OFFICIAL

Ref:	**NR/L3/SIG/10663**
Issue:	17
Date:	02 December 2023
Compliance date:	02 March 2024

Level 3

Work Instruction

Signal Maintenance Specifications

Technical Instruction

Issue date: 16th November 2023
Compliance date: 16th November 2023
Expiry date: 15th November 2024

Technical Instruction TI 182 is attached to this standard/control document.

This Technical Instruction mitigates an urgent safety/asset/equipment risk that cannot await a full review of this standard/control document.

This standard/control document will be reviewed and reissued before the emergency change expires on 15th November 2024.

Jerry Morling

Network Technical Head Signalling

Technical Instruction

Issue date: 4th September 2023
Compliance date: 29th September 2023
Expiry date: 29th September 2025

Technical Instruction TI 184 is attached to this standard/control document.

This Technical Instruction mitigates an urgent safety/asset/equipment risk that cannot await a full review of this standard/control document.

This standard/control document will be reviewed and reissued before the emergency change expires on 29th September 2025.

Jerry Morling

Network Technical Head Signalling

Approvals

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User information

This Network Rail document contains colour-coding according to the following Red–Amber–Green classification.

Red requirements – *no variations permitted*

- Red requirements are to be complied with and achieved at all times.
- Red requirements are presented in a red box.
- Red requirements are monitored for compliance.
- Non-compliances will be investigated and corrective actions enforced.

Amber requirements – *variations permitted subject to approved risk analysis and mitigation*

- Amber requirements are to be complied with unless an approved variation is in place.
- Amber requirements are presented with an amber sidebar.
- Amber requirements are monitored for compliance.
- Variations can only be approved through the national variations process.
- Non-approved variations will be investigated and corrective actions enforced.

Green guidance – *to be used unless alternative solutions are followed*

- Guidance should be followed unless an alternative solution produces a better result.
- Guidance is presented with a dotted green sidebar.
- Guidance is not monitored for compliance.
- Alternative solutions should be documented to demonstrate effective control.

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Compliance

This Network Rail standard/control document is mandatory and shall be complied with by Network Rail Infrastructure Limited and its contractors if applicable from 2nd March 2024.

Where it is considered not reasonably practicable[1] to comply with the requirements in this standard/control document, permission to comply with a specified alternative should be sought in accordance with the Network Rail standards and controls process, or with the Railway Group Standards Code if applicable.

If this standard/control document contains requirements that are designed to demonstrate compliance with legislation they shall be complied with irrespective of a project's Project Acceleration in a Controlled Environment (PACE) phase or equivalent governance framework. In all other circumstances, projects that have formally completed PACE strategic development & project selection phase may continue to comply with any relevant Network Rail standards/control documents that were current when PACE phase 1 was completed.

NOTE 1: *Legislation includes National Technical Specification Notices (NTSNs)*

NOTE 2: *The relationship of this standard/control document with legislation and/or external standards is described in the purpose of this standard.*

NOTE 3: *For more information on PACE see NR/L2/P3M/201.*

Disclaimer

In issuing this standard/control document for its stated purpose, Network Rail Infrastructure Limited makes no warranties, expressed or implied, that compliance with all or any standards/control documents it issues is sufficient on its own to provide safety or compliance with legislation. Users are reminded of their own duties under legislation.

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[1] *This can include gross proportionate project costs with the agreement of the Network Rail Assurance Panel (NRAP).*

Issue record

Issue	Date	Comments
9	September 2018	Update for new and updated SMS
10	June 2019	Update for new and updated SMS
11	Mar 2020	Update for new and updated SMS
12	December 2020	Update for new and updated SMS
13	September 2021	Update for new and updated SMS
14	December 2021	Updated for new and amended SMS's following PMR Project.
15	June 2022	Update for new and updated SMS
16	March 2023	Update for new and updated SMS
17	December 2023	Update for new and updated SMS

Legislation

No legislation has been identified that is applicable to the content of this standard/control document.

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Contents

Index's

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1 Purpose

This document contains the index to the Signal Maintenance Specifications (NR/SMS) for signalling equipment on Network Rail Managed Infrastructure (NRMI).

2 Scope

This document applies to all staff who carry out corrective or preventative maintenance to signalling equipment on NRMI.

3 Index for NR/SMS

The indexes show the latest (current) issues of the individual NR/SMS documents.

Heading	Title	Iss No.	Issue Date	Compliance Date
Part A				
Index	Index - General	16	04/03/2023	03/06/2023
A01	Introduction	8	05/12/2020	05/06/2021
A02	Preventative & Corrective Maintenance	2	04/03/2017	31/05/2017
A03	Definitions	7	04/03/2017	31/05/2017
A04	Method Statement Summary	8	04/03/2017	31/05/2017
A05	Plant, Tools & Calibration	4	04/03/2017	31/05/2017
A06	Materials	5	04/06/2022	03/09/2022
A07	Security of Equipment	3	04/09/2021	04/12/2021
A08	Items for Renewal	4	04/06/2022	03/09/2022
A09	Lubrication	4	04/06/2022	03/09/2022
A10	Painting & Surface Treatments	4	04/09/2021	04/12/2021
A11	Maintenance Diagrams	3	04/06/2022	03/09/2022
A13	Reinstating Flooded or Water Affected Equipment	5	04/06/2022	03/09/2022
A14	Environmental Issues	4	04/06/2022	03/09/2022
A15	Out of Use Assets	4	04/09/2021	04/12/2021
A16	Reference Documents	4	04/06/2022	03/09/2022
A17	Signalling Definitions	5	04/03/2023	03/06/2023

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Part B				
Index	Index – Specific Tests	19	02/12/2023	02/03/2024
Test 001	Facing Point Lock Tests (Machine)	4	04/06/2022	03/09/2022
Test 002	Facing Point Lock Tests (Mechanical)	5	04/06/2022	03/09/2022
Test 003	Facing Point Lock Tests (Clamp lock)	9	04/06/2022	03/09/2022
Test 004	Facing Point Lock Tests (HPSS)	8	04/06/2022	03/09/2022
Test 005	Facing Point Lock Tests (T72 with VCC Lock)	4	04/06/2022	03/09/2022
Test 006	Wheel Stop Detection Test	1	01/09/2018	01/12/2018
Test 007	Detection Test (T72 with VCC Detector)	4	04/03/2023	03/06/2023
Test 008	HPSS Tests	4	04/03/2023	03/06/2023

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Test 009	Detection Test (SO Hydraulic Supplementary Point)	3	04/03/2023	03/06/2023
Test 010	BR998 Detector Tests	4	04/03/2023	03/06/2023
Test 011	Detector Tests (Electrical Detectors)	5	04/03/2023	03/06/2023
Test 012	Detector Tests (Mechanical Detectors)	4	04/03/2023	03/06/2023
Test 013	Detection Test (Clamplock)	5	04/03/2023	03/06/2023
Test 014	Lock and Detector Full Test (Clamp lock)	4	01/06/2019	07/09/2019
Test 015	Clamp Lock: Test for air in the system	3	01/06/2019	07/09/2019
Test 016	Detection Test (Supplementary Detectors)	9	07/03/2020	06/06/2020
Test 017	Mk1 Clamp Locks Test For Cracking	2	04/03/2017	31/05/2017
Test 018	Train Operated Points Detection Test	2	04/03/2017	31/05/2017
Test 019	Detection Loop Test	3	04/03/2017	31/05/2017
Test 020	Hydraulic Derailer (Type BRB 817) Tests	2	04/03/2017	31/05/2017
Test 021	Filament Signal Lamp Tests	7	04/03/2017	31/05/2017
Test 022	Signal Lamp and Light Module Proving Tests	8	04/03/2023	03/06/2023
Test 023	Other Signal Tests	4	04/03/2023	03/06/2023
Test 024	AWS Tests	7	05/12/2020	05/06/2021
Test 025	Vehicle Identification Loops (VIS) Loop Tuning Setup	1	04/06/2022	03/09/2022
Test 026	Trainstop Calibration Test	3	04/03/2017	31/05/2017
Test 027	JE Style TrainStop Detection Test	1	03/03/2018	31/05/2018
Test 028	JE Style TrainStop Positioning Check	1	03/03/2018	31/05/2018
Test 029	ATP Equipment (Chilterns) Loop Test	4	05/12/2020	05/06/2021
Test 030	AzL Axle Counter Isolate, reset and restore procedures	1	03/03/2018	31/05/2018
Test 031	Thales Axle Counter Reference Direction Function Test	2	02/12/2023	02/03/2024
Test 037	Frauscher: RSR123 Wheel Sensor Occupancy Detection Capability Test	2	02/12/2023	02/03/2024
Test 038	Siemens ACM 100 - Calibration of Wheel Detector	4	03/03/2018	31/05/2018
Test 039	Siemens ACM 100 – In Service Functional Test of Wheel Detector	3	03/03/2018	31/05/2018
Test 040	Frauscher: RSR123 Wheel sensor adjustment – associated with AEB Boards	6	05/12/2020	05/06/2021
Test 041	Insulated Rail Joint (IRJ) Tests	4	04/09/2021	04/12/2021
Test 042	Axle Counters Dummy Wheel Test - AzL 70, 70/30, 70/30S	2	05/12/2020	05/06/2021
Test 043	TCAID Test	4	04/06/2022	03/09/2022
Test 044	Mechanical Treadle Timing and Adjustment Test	2	01/06/2019	07/09/2019
Test 045	Thales Axle Counter Dummy Wheel Test (AzLM)	6	02/12/2023	02/03/2024
Test 046	Level Crossing CCTV Camera Test	2	04/03/2017	31/05/2017

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Test 047	CCTV Tx System Tests	4	03/03/2018	31/05/2018
Test 048	Tail Lamp CCTV Tests	2	03/03/2018	31/05/2018
Test 049	Ultra Circuit Contact Box Set-up procedure	1	01/09/2018	01/12/2018
Test 051	Busbar Earth Tests	5	07/03/2020	06/06/2020
Test 052	Dynamic Earth Tests	5	05/12/2020	05/06/2021
Test 053	Earth Leakage Detector (ELD): Testing and Calibration	7	04/09/2021	04/12/2021
Test 054	Cable Insulation Tests	9	04/09/2021	04/12/2021
Test 055	Secondary Cell Test	7	05/12/2020	05/06/2021
Test 056	Avel-Lindberg Static Inverter Tests	5	05/12/2020	05/06/2021
Test 057	Uninterruptible Power Supplies (UPS) Tests	5	04/03/2023	03/06/2023
Test 058	Primary Cell Test	4	03/03/2018	31/05/2018
Test 059	Emergency Pull Cable System Tests	3	04/06/2022	03/09/2022
Test 060	Emergency Signals on Control (ESOC) Test	3	01/06/2019	07/09/2019
Test 061	Relay Timer Test	2	03/03/2018	31/05/2018
Test 062	Line Protection Unit Test	3	03/03/2018	31/05/2018
Test 063	(RETB) Radio System Tests	6	07/03/2020	06/06/2020
Test 064	(RETB) Fixed Site Power Supply Test	6	07/03/2020	06/06/2020
Test 065	(RETB) Fixed Site Antenna Systems Test	6	07/03/2020	06/06/2020
Test 066	Fixed Site Radio and Site Interface Equipment	6	07/03/2020	06/06/2020
Test 069	SELC Digital Timer – Set-up Procedure	2	04/09/2021	04/12/2021
Test 070	AHBC Operational Sequence Test	3	07/03/2020	06/06/2020
Test 071	ABCL Operational Sequence Test	2	01/06/2019	07/09/2019
Test 072	AOCL Operational Sequence Test	2	03/03/2018	31/05/2018
Test 073	AOCR Operational Sequence Test	2	03/03/2018	31/05/2018
Test 074	MSL Operational Sequence Test	3	01/09/2018	01/12/2018
Test 075	MCB Operational Sequence Test	4	04/03/2023	03/06/2023
Test 076	OCB Operational Sequence Test	2	03/03/2018	31/05/2018
Test 077	Barrow Crossing Operational Sequence Test	2	03/03/2018	31/05/2018
Test 078	Level Crossing Gates Operational Sequence Test	3	01/06/2019	07/09/2019
Test 079	Interrogation of the EBI Gate 200 SD Card	3	04/03/2023	03/06/2023
Test 080	AHBC with Predictor Operational Sequence Test	4	03/03/2018	31/05/2018
Test 081	MSL with Predictor Operational Sequence Test	2	03/03/2018	31/05/2018
Test 082	Frauscher : RSR 123 Wheel Sensor Adjustment - associated with IMC & ACB Boards	6	05/12/2020	05/06/2021
Test 083	AOCL+B Operational Sequence Test	2	01/06/2019	07/09/2019
Test 084	Power Operated Gate Opener Adjustment / Test	3	07/03/2020	06/06/2020
Test 085	HABD Servo System Tests	2	01/06/2019	07/09/2019

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Test 086	HABD Servo Alignment Tests	2	01/06/2019	07/09/2019
Test 087	HABD GETS FÜES Functions Test	2	01/06/2019	07/09/2019
Test 089	SSI Datalink Test	5	04/09/2021	04/12/2021
Test 099	GEC Override System Test	4	03/03/2018	31/05/2018
Test 149	Electronic Route Selection Equipment (ERSE) Test	5	05/12/2020	05/06/2021
Test 151	Harmon Crossing Processor (HXP-3) Tests	2	01/06/2019	07/09/2019
Test 152	Vital Harmon Logic Controller Tests	3	01/09/2018	01/12/2018
Test 155	WRSL Level Crossing Predictor (GCP3000) Tests	3	01/06/2019	07/09/2019
Test 156	Westrace MK2 Hot Standby PM Changeover Test	2	01/06/2019	07/09/2019
Test 157	Frauscher : RSR 123 Wheel Sensor Adjustment - associated with IMC Boards	4	04/06/2022	03/09/2022
Test 158	Interrogation of the Vamos Crossing System SD Card	2	04/06/2022	03/09/2022
Test 159	VAMOS: Sequence Tests	2	04/06/2022	03/09/2022
Test 160	AFBCL Operational Sequence Test	1	07/03/2020	06/06/2020
Test 161	Flex - Operational Sequence Tests	1	04/06/2022	03/09/2022
Test 170	Point Machine T72 Heater & Thermostat Test	2	01/06/2019	07/09/2019
Test 171	Earth Monitoring Integrity Test	2	01/06/2019	07/09/2019
Test 173	GraphXMaster Projection AC Leakage Test	2	01/06/2019	07/09/2019
Test 174	Patrolman's Lockout Device Test	2	01/06/2019	07/09/2019
Test 175	Remote Condition Monitoring (RCM) Alarms and Insulation Values Test	2	01/06/2019	07/09/2019
Test 176	Lockout Device Test	2	01/06/2019	07/09/2019
Test 177	Treadle - Gauge Test	3	04/09/2021	04/12/2021
Test 180	EPOS - Manual Post Calibration Test	1	04/09/2021	04/12/2021
Test 181	EPOS - Wheel Sensor Occupancy Detection Capability Test	1	04/09/2021	04/12/2021
Test 182	EPOS - Verification of Measurement Accuracy	1	04/09/2021	04/12/2021
Test 183	EPOS - Basic Calibration	1	04/09/2021	04/12/2021
Test 184	EPOS - RSR123 Wheel Sensor Voltage Adjustment	1	04/09/2021	04/12/2021
Test 201	Siemens Point Module Correspondence Test	2	01/06/2019	07/09/2019
Test 202	Siemens Point Detection Module Test	2	01/06/2019	07/09/2019
Test 203	Siemens Point Module Running Current Test	2	01/06/2019	07/09/2019
Test 209	KVB Balise Test	1	01/09/2018	01/12/2018
Test 210	Electromagnetic Lock Test	2	05/12/2020	05/06/2021
Test 211	Phoenix MD Full Calibration Test	1	03/03/2018	31/05/2018
Test 212	Phoenix MD Accuracy Test	1	03/03/2018	31/05/2018

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Test 230	Train Protection and Warning System (TPWS) Tests	4	04/03/2023	03/06/2023
Test 231	TPWS Module or Transmitter Loop Test (following failure)	2	05/12/2020	05/06/2021
Test 232	TPWS Module or Transmitter Loop Test (following Pway Work)	2	05/12/2020	05/06/2021
Test 233	TPWS Self-Powered OSS (SPOSS) Trackside Equipment Test	1	01/06/2019	07/09/2019
Test 234	TPWS Failure Indication Unit (FIU) Test	1	01/06/2019	07/09/2019
Test 235	TPWS Buffer Stop Test	1	07/03/2020	06/06/2020
Test 251	DC Track Circuit Test	6	04/09/2021	04/12/2021
Test 253	EBI Track 200 (Audio Frequency) Track Circuit Test	5	01/09/2018	01/12/2018
Test 254	Track Circuit: SF15 / U Type Aster	4	05/12/2020	05/06/2021
Test 255	HVI (High Voltage Impulse) Track Circuit Test	4	04/09/2021	04/12/2021
Test 256	BR-WR Quick Release TC Test	2	03/03/2018	31/05/2018
Test 257	Reed Type RT Track Circuit Test	3	01/06/2019	07/09/2019
Test 258	Rectified AC TC Test	2	03/03/2018	31/05/2018
Test 259	FS 2600 Track Circuit Test	3	04/06/2022	03/09/2022
Test 260	50Hz AC Track Circuit Test	5	04/09/2021	04/12/2021
Test 261	Overlay Rail Circuit Test	3	03/03/2018	31/05/2018
Test 262	DC Coded Track Circuit Test	2	03/03/2018	31/05/2018
Test 263	EBI Track 400 Audio Frequency Track Circuit Test	4	01/09/2018	01/12/2018
Test 270	Facing Point Lock Tests (Unistar HR)	1	02/12/2023	02/03/2024
Test 271	Detection Test (Unistar HR)	1	02/12/2023	02/03/2024
Test 300	Testing Requirements Following Flooding	4	04/09/2021	04/12/2021
Test 301	WR E10K Token System Test	2	01/06/2019	07/09/2019
Test 302	Signal Visibility Check	3	01/06/2019	07/09/2019

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	Part C			
Index	Index - Tasks	22	02/12/2023	02/03/2024
AP11	ATP Equipment (GWML)	2	03/03/2018	31/05/2018
AP12	ATP Equipment (Chilterns)	4	05/12/2020	05/06/2021
AW11	Automatic Warning System (AWS)	8	05/12/2020	05/06/2021
AW15	Depot Test Magnets	2	05/12/2020	05/06/2021
AX00	Axle Counters General	7	04/09/2021	04/12/2021
AX11	Axle Counter AzL70	3	04/09/2021	04/12/2021
AX12	Axle Counter AzL70/30 and 70/30S	7	04/09/2021	04/12/2021
AX15	Axle Counter Thales AzLM	9	02/12/2023	02/03/2024
AX28	Siemens AzS ZP 43 D Wheel Detector Equipment	3	02/12/2023	02/03/2024

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AX29	Siemens AzS ZP 43 V Wheel Detector Equipment	4	02/12/2023	02/03/2024
AX30	Siemens AzSM (E) Axle Counter Evaluator	3	03/03/2018	31/03/2018
AX31	Siemens AzS 350U Axle Counter Evaluator	4	02/12/2023	02/03/2024
AX40	Frauscher Advanced Axle Counter	8	04/09/2021	04/12/2021
AX41	Frauscher : RSR123 Wheel Sensors	9	04/06/2022	03/09/2022
AX42	Frauscher Advanced Counter: Check on the IO-EXB	3	07/03/2020	06/06/2020
AX51	Siemens Axle Counter ACM 100 (ACM Module and WSD Wheel Detector)	3	03/03/2018	31/05/2018
AX99	Trains Entering Terminal Stations System (TETS)	1	03/03/2018	31/05/2018
BA11	TASS Balise	4	07/03/2020	06/06/2020
BA13	Cambrian ERTMS - Ansaldo Balise	4	07/03/2020	06/06/2020
BA16	KVB Balise	2	04/09/2021	04/12/2021
BR11	Swing Bridges	5	04/06/2022	03/09/2022
BR12	Swing Bridges - Banavie	2	04/06/2022	03/09/2022
BR20	Bridge Navigation Lights (Keadby - King George IV Bridge)	1	02/12/2023	02/03/2024
CA02	Air Main System	2	05/12/2020	05/06/2021
CE03	Battery Maintenance	2	04/06/2022	03/09/2022
CS02	Control System - TEML41	1	05/12/2020	05/06/2021
CS03	Control System - DM11	1	05/12/2020	05/06/2021
CS04	Control System - Delphin 1024/256	1	05/12/2020	05/06/2021
CS05	Control System - Sapphire T48	1	05/12/2020	05/06/2021
CS06	Control System - Modular Control System	1	05/12/2020	05/06/2021
DE11	Detonator Placer	3	05/12/2020	05/06/2021
EL00	Electrical Equipment - General	5	07/03/2020	06/06/2020
EL12	Platform Plungers and Pull Wires	4	04/09/2021	04/12/2021
EL13	Dispatch Interface Unit LED Indicators	1	04/09/2021	04/12/2021
EL21	Trackside Apparatus Case	15	04/03/2023	03/06/2023
EL31	Equipment and Relay Rooms	12	04/09/2021	04/12/2021
EL32	Electronic Equipment Cabinet	1	04/06/2022	03/09/2022
EL33	Ansaldo Interlocking - Equipment Rooms & Peripheral Locations	3	05/12/2020	05/06/2021
EL34	Siemens - Modular Signalling Equipment	3	04/09/2021	04/12/2021
EL37	Location Case - Temperature Controlled Location (TCL)	1	03/03/2018	31/05/2018
ER00	Logging Systems - General	4	04/03/2023	03/06/2023
ER11	Instead Signalling Event Recorder	4	05/12/2020	05/06/2021
ER12	Westrix Signalling Event Recorder	1	03/03/2018	31/05/2018
ER15	ACIC Signalling Event Recorder	3	04/03/2017	31/05/2017
ER16	ADT Signalling Event Recorder	2	04/03/2017	31/05/2017
ER17	SA380 Signalling Event Recorder	3	04/09/2021	04/12/2021

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		Part C		
ER21	DOS Based Trackwatch Data Logging System	3	04/03/2017	31/05/2017
ER22	Atlas Data Logging System	4	04/06/2022	03/09/2022
ER23	Relay ALERT Data Logging System	1	04/03/2017	31/05/2017
GF01	Ground Frames	5	04/09/2021	04/12/2021
IC00	VDU Based Control Equipment - General	8	04/09/2021	04/12/2021
IC11	Integrated Electronic Control Centre (IECC)	5	05/12/2020	05/06/2021
IC12	IECC Scalable	4	05/12/2020	05/06/2021
IC14	WestCad Control System	5	04/09/2021	04/12/2021
IC15	Siemens VICOS VDU Control System	2	05/12/2020	05/06/2021
IC16	WESTCAD - MCR	4	04/09/2021	04/12/2021
IC17	Signallers Assistant (TREsa)	5	04/03/2017	31/05/2017
IC18	ElectroLogIXS - Vital Logic Controller (VLC)	2	01/06/2019	07/09/2019
IC20	Westcad Level Crossing Touch Screen Device	1	01/09/2018	01/12/2018
IC51	Logger & Archiving System (Formerly GETS)	2	05/12/2020	05/06/2021
IC52	GE Standalone FTN unit	1	04/03/2017	31/05/2017
IC53	GE Leicester Keyboard/Trackerball unit	1	04/03/2017	31/05/2017
IC61	Rugby Whole Route Display System	2	05/12/2020	05/06/2021
IE00	Cambrian ERTMS - General	4	07/03/2020	06/06/2020
IE21	Cambrian ERTMS: Remote Object Controller Cabinet	3	04/06/2022	03/09/2022
IE22	Cambrian ERTMS: Radio Block Centre (RBC) Cabinet	3	04/06/2022	03/09/2022
IE23	Cambrian: Route Control Centre System (RCCS)	3	05/12/2020	05/06/2021
IE24	Cambrian ERTMS: Maintenance Aid Equipment (SAM)	3	04/06/2022	03/09/2022
IE25	Cambrian ERTMS: Interlocking Train Control System (SEI Cabinet)	3	04/06/2022	03/09/2022
IE26	Cambrian: Workstations	3	05/12/2020	05/06/2021
IE27	Cambrian: Ancillary Equipment	3	05/12/2020	05/06/2021
IE28	Cambrian ERTMS: Cambrian Applicative Training Simulator (CATS)	3	04/06/2022	03/09/2022
IE29	Ansaldo-STS Interlocking	3	07/03/2020	06/06/2020
IF01	Atlas 200 ETCS Radio Block Centre (RBC) and Maintenance Supervision System (MSS)	3	02/12/2023	02/03/2024
IF02	Atlas 200 ETCS - Enclosure and Balise	4	02/12/2023	02/03/2024
IF03	Atlas 200 ETCS Network Transmission Gateway	2	04/09/2021	04/12/2021
IG01	Thameslink Radio Block Centre (RBC) System	2	01/09/2018	01/12/2018
IG02	NCL Radio Block Centre (RBC) System	1	02/12/2023	02/03/2024
IK01	ARAMIS System Maintenance	2	07/03/2020	06/06/2020

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IS00	Electronic Interlocking General	4	03/03/2018	31/05/2018
IS11	Solid State Interlocking (SSI)	4	05/12/2020	05/06/2021
IS12	Westrace Electronic Interlockings	4	04/06/2022	03/09/2022
IS13	Westlock Electronic Interlocking	5	04/06/2022	03/09/2022
IS14	Smartlock Electronic Interlockings	3	04/09/2021	04/12/2021
IS15	Vital Harmon Logic Controller (VHLC)	3	01/09/2018	01/12/2018
IS20	Siemens SIMIS-W Interlocking	2	05/12/2020	05/06/2021
IS30	Harmon LX Predictor (HXP-3)	3	04/03/2023	03/06/2023
IS35	WRSL Level Crossing Predictor (GCP3000)	2	05/12/2020	05/06/2021
JA10	Signalling Network Switches	2	04/09/2021	04/12/2021
LC00	Level Crossings: General	6	07/03/2020	06/06/2020
LC09	Level Crossings with Obstacle Detection Equipment	5	05/12/2020	05/06/2021
LC10	Level Crossings Operational Sequences	5	07/03/2020	06/06/2020
LC11	Road Lights and Audible Warnings	9	07/03/2020	06/06/2020
LC14	Crossing Plungers, Control Units, and Pull Cords	2	07/03/2020	06/06/2020
LC15	Miniature Stop Light (MSL) & Warning Light (MWL) Units	7	05/12/2020	05/06/2021
LC16	DCI Signals and Crossing Headlight Units	4	07/03/2020	06/06/2020
LC17	Barrow Crossing Light Units	3	05/12/2020	05/06/2021
LC20	Level Crossing – Automatic Half Barrier (Reliability – Centered Maintenance)	5	07/03/2020	06/06/2020
LC21	Barrier Machine BR Spec 843	8	07/03/2020	06/06/2020
LC22	EBI Gate 630 Barrier Machine	1	03/03/2018	31/05/2018
LC23	Rural Barrier - Machine Operated	3	05/12/2020	05/06/2021
LC24	Barrier Machine GWE	5	05/12/2020	05/06/2021
LC26	Barrier Machine WBS Style C	3	03/03/2018	31/05/2018
LC27	Barrier Machine NER Mechanical	3	03/03/2018	31/05/2018
LC29	Barrier Machine WR Style	6	01/06/2019	07/09/2019
LC30	Barrier Machine – S60	3	05/12/2020	05/06/2021
LC31	Barrier Machine: AHB Mk.1 (Penguin)	4	04/06/2022	03/09/2022
LC32	Barrier Machine: Newgate	1	01/06/2019	07/09/2019
LC50	Power Operated Gate Opener (POGO): Crossing Equipment	3	07/03/2020	06/06/2020
LC70	EBI Gate 200 Level Crossing System	5	05/12/2020	05/06/2021
LC71	Vamos Crossing System	4	04/06/2022	03/09/2022
LC72	EBI Gate 2000 Level Crossing System	1	03/03/2018	31/05/2018
LC73	Flex Crossing System	1	04/06/2022	03/09/2022
LC81	Level Crossing Gates	4	04/06/2022	03/09/2022
LC84	Automatic Gate Closer	1	03/03/2018	31/05/2018
LC85	Electromagnetic Locks	5	03/03/2018	31/05/2018
LC86	Fortress Key Locks	2	05/12/2020	05/06/2021

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LV00	Lever Frames, Lever Locks, & Circuit Controllers: General	5	05/12/2020	05/06/2021
LV11	Lever Frames – Non Specific	3	05/12/2020	05/06/2021
LV12	Lever Frame – Direct Locking	4	04/03/2023	03/06/2023
LV13	Lever Frame – Midland Railway Tumbler	4	05/12/2020	05/06/2021
LV14	Lever Frames – Tappet Locking	3	05/12/2020	05/06/2021
LV15	Lever Frames – LNWR Tumbler	4	05/12/2020	05/06/2021
LV16	Lever Frame – LNWR Tappet	4	05/12/2020	05/06/2021
LV17	Lever Frame: GWR Five Bar Vertical Tappet	3	05/12/2020	05/06/2021
LV21	Electric Locks	3	05/12/2020	05/06/2021
LV31	Circuit Controllers	5	05/12/2020	05/06/2021
LV41	Combined Lock & Circuit Controller	4	05/12/2020	05/06/2021
LV51	Key Release and Token Instruments	3	05/12/2020	05/06/2021
LV52	Single Line Staffs and Tokens	2	05/12/2020	05/06/2021
LV53	Token Instrument WR E10K	3	05/12/2020	05/06/2021
LV99	Lever Frame Overhaul	3	04/03/2017	31/05/2017
MP01	Panel Multiplexer - TEML41 (AN)	1	05/12/2020	05/06/2021
MP02	Panel Multiplexer - WBS Type S2	1	05/12/2020	05/06/2021
MP03	Panel Multiplexer - Vaughan Harmon	1	05/12/2020	05/06/2021
MP04	Panel Multiplexer - GEC Type RM	1	05/12/2020	05/06/2021
MP05	Panel Multiplexer - GE	1	05/12/2020	05/06/2021
OD01	MCB-OD Radar Scanner	2	03/03/2018	31/05/2018
OD02	Redscan RLS-3060 LIDAR Scanner	5	04/03/2023	03/06/2023
PA00	Point Equipment General	5	04/03/2017	31/05/2017
PA01	Mechanical Points	6	04/09/2021	04/12/2021
PA21	Siemens Point Modules	2	05/12/2020	05/06/2021
PB00	Clamp Lock - General	2	07/03/2020	06/06/2020
PB11	Clamp Lock Hydraulic Points	11	04/06/2022	03/09/2022
PB15	Yard Points	4	05/12/2020	05/06/2021
PB16	Chairlock Points	4	05/12/2020	05/06/2021
PB17	JOSS Lock Points	3	04/03/2023	03/06/2023
PB18	Hydraulic Derailer: Type BRB 817	2	04/06/2022	03/09/2022
PB19	Mechanically Operated Derailer (Cambois, Keithley and Whitby)	1	02/12/2023	02/03/2024
PB21	Train Operated (Hydro-Pneumatic) Points	2	05/12/2020	05/06/2021
PC05	Point Machine HW Style	11	02/12/2023	02/03/2024
PC22	Point Machine MV-GRS Model 5 Style	5	05/12/2020	05/06/2021
PC31	Point Machine SGE Style HB	4	05/12/2020	05/06/2021
PC33	Point Machine SGE Style HA	6	05/12/2020	05/06/2021
PC41	Point Machine WRSL Style 63	6	05/12/2020	05/06/2021
PC42	Point Machine WRSL Styles M3 & M3A	6	05/12/2020	05/06/2021
PC49	WRSL AC Point Controllers	2	07/03/2020	06/06/2020

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PC51	High Performance Switch System (HPSS)	7	01/06/2019	07/09/2019
PC61	Point Machine T72 with VCC Lock & Detection	2	05/12/2020	05/06/2021
PC81	Unistar HR Points	1	02/12/2023	02/03/2024
PC91	Point Machine WRSL Style CP & D Pneumatic	2	05/12/2020	05/06/2021
PC92	WRSL Hand and Air Points	2	05/12/2020	05/06/2021
PC95	Point Machine SGE Style VB Pneumatic	2	05/12/2020	05/06/2021
PD01	BR998 Detector	6	04/06/2022	03/09/2022
PD02	Electrical Point Detectors	5	05/12/2020	05/06/2021
PD03	Mechanical Detectors	2	05/12/2020	05/06/2021
PF01	Point Fittings	11	04/03/2023	03/06/2023
PF02	Mechanical Supplementary Drives	8	07/03/2020	06/06/2020
PF03	Point Fittings Switch Rollers	4	03/03/2018	31/05/2018
PF04	SO Hydraulic Supplementary point Drive System	2	04/03/2017	31/05/2017
PF05	Hydraulic Assist Drives	1	04/03/2017	31/05/2017
PF07	Torsion Operated Supplementary Drive	1	07/03/2020	06/06/2020
RC01	Remote Control System - Type R Reed FDM	1	05/12/2020	05/06/2021
RC02	Remote Control System - Type RR Reed FDM	1	05/12/2020	05/06/2021
RC03	Remote Control System - Westone FDM	1	05/12/2020	05/06/2021
RC04	Remote Control System - FDM69-NV	1	05/12/2020	05/06/2021
RC05	Remote Control System - Westplex	1	05/12/2020	05/06/2021
RC07	Remote Control System - GEC Type RM TDM	1	05/12/2020	05/06/2021
RC08	Remote Control System - WRSL Type TDM69	1	05/12/2020	05/06/2021
RC09	Remote Control System - WRSL Type S2	1	05/12/2020	05/06/2021
RC10	Remote Control System - Westronic F1 TDM	1	05/12/2020	05/06/2021
RC11	Remote Control System - Vaughan Harmon DM11	1	05/12/2020	05/06/2021
RC12	Remote Control System - Telecode TDM	1	05/12/2020	05/06/2021
RC13	Remote Control System - AP Datalink TDM	1	05/12/2020	05/06/2021
RC14	Remote Control System - Transmitton TDM	1	05/12/2020	05/06/2021
RC15	Remote Control System - DAM TDM	1	05/12/2020	05/06/2021
RC16	Remote Control System - Westronic 1024 TDM	1	05/12/2020	05/06/2021
RE01	Off Grid Power Supply - Photovoltaic (PV) Cells (Solar Panels)	1	05/12/2020	05/06/2021
RE02	Off Grid Power Supply – Miniature Wind Turbine Generator	1	05/12/2020	05/06/2021
RE20	Off Grid Power Supply - Direct Methanol Fuel Cell System	2	05/12/2020	05/06/2021

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SB00	Signal Box Control & Operating Systems - General	2	05/12/2020	05/06/2021
SB11	Signallers Control & Indication Panels or Displays	6	05/12/2020	05/06/2021
SB12	Signal Box Operating Floor and Block Shelf	4	01/09/2018	01/12/2018
SB21	GraphXMaster CX50-100U Back Projection Unit	2	05/12/2020	05/06/2021
SG00	Signals: General	9	05/12/2020	05/06/2021
SG01	Signal Structures	1	04/09/2021	04/12/2021
SG02	Signal Post and Signal Box Replacement Switches	2	04/06/2022	03/09/2022
SG03	Signal Sighting - Cab Rides	3	04/06/2022	03/09/2022
SG05	Counter-Balanced Signal Support Posts	2	01/06/2019	07/09/2019
SG07	Main Colour Light Signals – Dorman Lite	5	04/06/2022	03/09/2022
SG08	LED Main Colour Light Signals - VMS	3	07/03/2020	06/06/2020
SG09	Main Colour Light Signal - Integrated Lightweight Signal (iLS)	5	04/06/2022	03/09/2022
SG10	Main Colour Light Signals - LED	5	07/03/2020	06/06/2020
SG11	Main Colour Light Signal - Filament Type Head	11	04/06/2022	03/09/2022
SG12	Semaphore Signals	8	05/12/2020	05/06/2021
SG13	Electro-Mechanical Banner Repeater Signal	7	07/03/2020	06/06/2020
SG14	Position Light Signal	7	04/06/2022	03/09/2022
SG15	Position Light Junction Indicator	7	05/12/2020	05/06/2021
SG16	Alphanumeric Route Indicators – SARI & MARI (Filament & Fibre Optic)	6	04/03/2023	03/06/2023
SG17	Alphanumeric Route Indicators – LED SARI & MARI	4	04/03/2023	03/06/2023
SG18	Indicators Signals	3	07/03/2020	06/06/2020
SG19	Banner Repeater Signal - Filament Type Head	3	07/03/2020	06/06/2020
SG20	Reflective Boards & Signs	7	04/03/2017	31/05/2017
SG21	Signal Lens - Clean	3	02/12/2023	02/03/2024
SG22	Banner Repeater Signal - LED	3	05/12/2020	05/06/2021
SG90	Rock Fall Detection Apparatus - Pass of Brander	2	04/06/2022	03/09/2022
SG95	Semaphore Signal Machine (BP, GRS, & SGE)	2	05/12/2020	05/06/2021
SG96	Semaphore Signal Machine (WRSL)	2	05/12/2020	05/06/2021
SW01	Signalling Lockout (Staff Protection) System	4	04/09/2021	04/12/2021
SW02	Staff Annunciator / Warning system	3	03/03/2018	31/05/2018
SW03	Patrolman's Lockout Device	3	04/09/2021	04/12/2021
SW20	Emergency Pull Cable System	2	07/03/2020	06/06/2020
TC00	Track Circuits: General	5	05/12/2020	05/06/2021
TC02	Track Circuits: Overlay Track	4	05/12/2020	05/06/2021

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TC03	Track Circuits: DC Low Voltage	5	04/06/2022	03/09/2022
TC04	Track Circuits: DC Medium Voltage	5	04/06/2022	03/09/2022
TC05	Track Circuits: DC Coded	2	05/12/2020	05/06/2021
TC06	Track Circuits: Reed Type RT	2	05/12/2020	05/06/2021
TC08	Track Circuits: 50Hz AC	3	04/09/2021	04/12/2021
TC09	Track Circuit: FS2600	1	04/03/2017	31/05/2017
TC10	Track Circuits: Aster SF15 / U Type	4	04/09/2021	04/12/2021
TC12	Track Circuits: HVI (High Voltage Impulse)	6	04/06/2022	03/09/2022
TC14	Track Circuits: Western Region Quick Release	2	05/12/2020	05/06/2021
TC15	Track Circuits: AC Rectified (Diode)	2	05/12/2020	05/06/2021
TC16	Track Circuits: EBI Track 200	6	02/12/2023	02/03/2024
TC17	Track Circuits: EBI Track 400	3	05/12/2020	05/06/2021
TC30	Track Circuits: Additional Bonding Check	3	04/12/2021	05/03/2022
TC91	Track Circuit Assister Interference Detector (TCAID)	7	04/06/2022	03/09/2022
TD00	Train Describers - General	2	05/12/2020	05/06/2021
TD11	Train Describer Electro-Mechanical	2	05/12/2020	05/06/2021
TD21	Train Describer Hewlett Packard 21MX Series	2	05/12/2020	05/06/2021
TD31	Train Describer Vaughan Type 4M	3	04/03/2017	31/05/2017
TD32	Train Describer Vaughan Small	3	05/12/2020	05/06/2021
TD33	Train Describer – Scottish Type	2	04/06/2022	03/09/2022
TD35	Train Describer WRSL VME Bus Based	3	04/09/2021	04/12/2021
TD36	Train Describer WRSL Small Bus Based (STD)	2	05/12/2020	05/06/2021
TD37	Train Describer GEC/GS Micro Processor Based	2	01/09/2018	01/12/2018
TD38	GE PC based Small Train Describer	1	04/03/2017	31/05/2017
TD40	Train Describer GETS Dual	2	05/12/2020	05/06/2021
TD42	GE Automatic Code Insertion (ACI) Terminal	3	05/12/2020	05/06/2021
TP00	Train Protection & Warning System (TPWS) General	11	04/09/2021	04/12/2021
TP11	Train Protection & Warning System (TPWS)	9	01/06/2019	07/09/2019
TP22	TPWS Trackside Radio Control Unit (TRCU)	2	05/12/2020	05/06/2021
TP23	TPWS Lineside Status Indicator (LSI)	3	03/03/2018	31/05/2018
TQ00	Treadles - General	6	05/12/2020	05/06/2021
TQ01	Treadles – Mechanical	5	05/12/2020	05/06/2021
TQ11	FREDDY Sensor (Electronic Treadle)	2	05/12/2020	05/06/2021
TQ12	SEL/AzL Electronic Treadle	2	05/12/2020	05/06/2021
TQ13	Siemens Wheel Sensor	2	05/12/2020	05/06/2021
TQ14	GET's Treadle Replacement Unit	3	07/03/2020	06/06/2020
TS01	Electro-Hydraulic Trainstop	2	05/12/2020	05/06/2021

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TS02	Tripcock Tester	3	05/12/2020	05/06/2021
TS03	Electro-Pneumatic Trainstops and Associated Air Valves	4	05/12/2020	05/06/2021
TS20	Indusi Trainstops (Tyne-Wear Metro)	2	05/12/2020	05/06/2021
TS21	JE Style Trainstop	1	03/03/2018	31/05/2018
TS22	Train Stops (Manchester Metro)	2	07/03/2020	06/06/2020
TS23	Wheel Stop	1	01/09/2018	01/12/2018
TV01	Level Crossing CCTV Analogue Systems	5	05/12/2020	05/06/2021
TV02	Level Crossing CCTV Digital Systems	2	05/12/2020	05/06/2021
TV03	Tail Lamp CCTV Digital Systems	2	05/12/2020	05/06/2021
TW01	Airport Trip Wires	3	07/03/2020	06/06/2020
TW02	Airport Trip Wires – Scotland	2	04/06/2022	03/09/2022
VS30	Vehicle Identification System	1	04/06/2022	03/09/2022

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Part D				
Index	Index - Level Crossing Annual Tests	15	04/06/2022	03/09/2022
LX70	Automatic Half Barrier Crossing (AHBC)	7	05/12/2020	05/06/2021
LX70-1	Automatic Half Barrier (AHBC) - RCM	4	04/06/2022	03/09/2022
LX71	Automatic Barrier Crossing Locally Monitored (ABCL) and Automatic Full Barrier Crossing Locally Monitored (AFBCL)	8	05/12/2020	05/06/2021
LX72	Automatic Open Crossing Locally Monitored (AOCL)	6	07/03/2020	06/06/2020
LX73	Automatic Open Crossing Remotely Monitored (AOCR)	6	07/03/2020	06/06/2020
LX74	Miniature Stop Light Crossing (MSL)	6	07/03/2020	06/06/2020
LX75	Manually Controlled Barriers (MCB)	8	05/12/2020	05/06/2021
LX76	On Call Barriers (OCB)	5	07/03/2020	06/06/2020
LX77	EBI Gate 200 Level Crossing System	3	07/03/2020	06/06/2020
LX78	VAMOS Level Crossing System	3	04/06/2022	03/09/2022
LX79	Flex Level Crossing System	1	04/06/2022	03/09/2022
LX80	Automatic Half Barrier (AHBC) - With Level Crossing Predictor	6	05/12/2020	05/06/2021
LX81	Miniature Stop Light Crossing (MSL) - Using A Level Crossing Predictor	3	07/03/2020	06/06/2020
LX83	Automatic Open Crossing Locally Monitored + Barriers	4	04/09/2021	04/12/2021
LX94	Miniature Stop Light Crossing (MSL) - (RCM)	5	04/06/2022	03/09/2022

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	Part E			
Index	Index - Assets other than Signalling	12	04/06/2022	03/09/2022
BA12	Platform Identification Beacon System (PIBS)	3	04/03/2017	31/05/2017
HO00	HABD General	2	04/03/2017	31/05/2017
HO11	HABD Equipment - FÜES Mark 1	3	05/12/2020	05/06/2021
HO12	HABD Phoenix MB	3	03/03/2018	31/05/2018
HO13	Hot Axle Box Detector - EPOS	1	04/09/2021	04/12/2021
HO14	Hot Axle Box Detector - Wheel Sensor	2	04/06/2022	03/09/2022

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	Part L			
Index	Index - Local Instructions	11	02/12/2023	02/03/2024
LP100	Ipswich	6	04/09/2021	04/12/2021
LP101	Tottenham	5	04/09/2021	04/12/2021
LP102	Romford	5	04/09/2021	04/12/2021
LP201	Sussex	7	02/12/2023	02/03/2024
LP202	Kent	7	02/12/2023	02/03/2024
LP251	Preston	8	04/09/2021	04/12/2021
LP252	Warrington	6	04/09/2021	04/12/2021
LP253	Carlisle	11	04/09/2021	04/12/2021
LP254	Liverpool	6	04/09/2021	04/12/2021
LP255	Manchester	5	04/09/2021	04/12/2021
LP300	Birmingham	5	04/09/2021	04/12/2021
LP350	LNE and EM	9	04/09/2021	04/12/2021
LP351	Middlesbrough, Sheffield, Leeds and York	1	02/12/2023	02/03/2024
LP400	Cardiff	13	04/09/2021	04/12/2021
LP401	Shrewsbury	6	04/09/2021	04/12/2021
LP450	Wessex	7	02/12/2023	02/03/2024
LP500	Reading	5	04/09/2021	04/12/2021
LP501	Swindon	2	02/12/2023	02/03/2024
LP502	Bristol	8	04/09/2021	04/12/2021
LP503	Plymouth	14	04/09/2021	04/12/2021
LP550	Scotland	7	04/09/2021	04/12/2021

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	Part R			
Index	Index - Maintenance Record Cards	15	02/12/2023	02/03/2024
AP11	ATP Equipment (GWML)	1	01/12/2009	01/06/2010
AW11 RC01	AWS Test - Electro / Permanent	3	01/09/2018	01/12/2018
AW11 RC02	AWS Test - Electro / Suppressor	3	01/09/2018	01/12/2018
AW11 RC03	AWS Test - Permanent Magnet Only	2	01/09/2018	01/12/2018

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AX28 RC01	Siemens Axle Counter: AzS ZPD 43 Wheel Detector Equipment	2	02/12/2023	02/03/2024
AX29 RC01	Siemens Axle Counter: AzS ZP 43 V Wheel Detector Equipment	3	02/12/2023	02/03/2024
AX30 RC01	Siemens Axle Counter – AzSM (E) Evaluator	3	04/06/2022	03/09/2022
AX31 RC01	Siemens Axle Counter: AzS 350U Evaluator	2	02/12/2023	02/03/2024
AX40-41 RC01	Wheel Sensor – RSR 123	1	05/12/2020	05/06/2021
AX51 RC01	Siemens Axle Counter ACM 100, WSD Wheel Detector	1	03/03/2018	31/05/2018
AX99 RC01	TETS Record Card	1	03/03/2018	31/05/2018
CS02 RC01	Control System: TEML41	1	05/12/2020	05/06/2021
CS03 RC01	Control System: GETS DM11	1	05/12/2020	05/06/2021
CS04 RC01	Control & Interface System: GETS Delphin 1024	1	05/12/2020	05/06/2021
CS05 RC01	Control & Interface System: GETS Sapphire T48	1	05/12/2020	05/06/2021
EL21 - EL31 RC01	Wiring Degradation Record Card	1	01/08/2004	30/06/2005
EL21 - EL31 RC02	Relay Plugboard Checks	1	01/08/2004	30/06/2005
EL21 RC01	Site Attendance Record Card - Location Case	2	01/09/2018	01/12/2018
EL31 RC01	Site Attendance Record Card - Site Equipment Room	3	01/09/2018	01/12/2018
ER11 RC01	Instead Signalling Event Recorder	1	01/08/2004	30/06/2005
HO11 RC01	HABD Equipment: GETS FÜES	1	01/04/2006	31/12/2006
HO12 RC01	HABD Equipment: Phoenix MB Sensor Temperature	1	03/03/2018	31/05/2018
IE29 RC01	Ansaldo-STS Interlocking System Colour Light Signalling System (SEI-CLSS)	1	03/03/2018	31/05/2018
IR11 RC01	RETB Fixed Station	1	01/08/2004	30/06/2005
IS15 RC01	Vital Harmon Logic Control	2	01/09/2018	01/12/2018
IS30 RC01	Harmon Crossing Processor (HXP-3)	1	05/12/2020	05/06/2021
IS35 RC01	WESTeX LCP3000 Crossing Predictor	1	01/12/2016	01/12/2016
LC09 RC01	Optex Redscan RLS3060 series LIDAR Record Card	3	07/03/2020	06/06/2020
LC50 T084 RC01	Power Operated Gate Opener (POGO)	1	06/09/2014	07/03/2015
LV11 - LV17 RC01	Lever Frame	1	01/08/2004	30/06/2005
MP01 RC01	SSI Panel Multiplexer: TEML41 (AN)	1	05/12/2020	05/06/2021
MP02 RC01	SSI Panel Multiplexer: WBS Type S2	1	05/12/2020	05/06/2021
MP03 RC01	SSI Panel Multiplexer: Vaughan Harmon	1	05/12/2020	05/06/2021
MP04 RC01	SSI Panel Multiplexer: GEC Type RM	1	05/12/2020	05/06/2021
PB18 RC01	Hydraulic Derailer	2	06/09/2014	07/03/2015

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Part R				
PF01 RC01	Point Fittings	3	05/12/2020	05/06/2021
PTS RC01	Point System (Hydraulic Pneumatic)	3	01/09/2018	01/12/2018
PTS RC02	Point System (Machine)	3	04/09/2021	04/12/2021
PTS RC03	Point System (Mechanical)	2	01/09/2018	01/12/2018
PTS RC04	Point System (HPSS)	3	01/09/2018	01/12/2018
PTS RC05	Point System Operating Current	2	01/09/2018	01/12/2018
PTS RC06	Point System Unistar HR	1	02/12/2023	02/03/2024
RC01 RC01	RC System: Type ‘R’ Reed FDM Test	1	05/12/2020	05/06/2021
RC01 RC02	Reed Point Detection (Transmitter)	1	05/12/2020	05/06/2021
RC01 RC03	Reed Point Detection (Receiver)	1	05/12/2020	05/06/2021
RC02 RC01	RC System: GEC Type ‘RR’ Reed FDM Test	1	05/12/2020	05/06/2021
RC03 RC01	RC System: Westone Non-Vital FDM Test	1	05/12/2020	05/06/2021
RC04 RC01	RC System: FDM69-NV Test	1	05/12/2020	05/06/2021
RC05 RC01	Siemens Westplex	1	05/12/2020	05/06/2021
RC07 RC01	RC System: GEC Type RM TDM Test	1	05/12/2020	05/06/2021
RC08 RC01	RC System: WBS Type TDM 69 Test	1	05/12/2020	05/06/2021
RC09 RC01	RC System: WBS Type S2 TDM Test	1	05/12/2020	05/06/2021
RC10 RC01	RC System: Westronic F1 TDM Test	1	05/12/2020	05/06/2021
RC11 RC01	RC System: Vaughan Harmon Type DM11 Test	1	05/12/2020	05/06/2021
RC12 RC01	RC System: Telecode 80 Test	1	05/12/2020	05/06/2021
RC13 RC01	RC System: AP Datalink TDM Test	1	05/12/2020	05/06/2021
RC16 RC01	RC System: Westronic 1024 TDM Test	1	05/12/2020	05/06/2021
SW20 T059 RC01	Severn Tunnel Pull Wire	2	01/04/2006	31/12/2006
T021 RC01	Junction Indicator and Position Light Signal - All Types	2	01/09/2018	01/12/2018
T021 RC02	Route Indicator - non LED	2	01/09/2018	01/12/2018
T021 RC03	Route Indicator - LED	2	01/09/2018	01/12/2018
T021 RC04	Signal - (Filament / Light Engine)	5	01/06/2019	07/09/2019
T021 RC05	Signal - LED	3	01/06/2019	07/09/2019
T021 RC06	Signal SMIS type	2	01/09/2018	01/12/2018
T026 RC01	Trainstop (Electro-Hydraulic) Calibration	1	01/08/2004	30/06/2005
T029 RC01	ATP (Chilterns)	3	01/06/2019	07/09/2019
T041 RC01	IRJ - DC & BR-WR Quick Release TC	2	01/09/2018	01/12/2018
T041 RC02	IRJ - DC & BR-WR Quick Release TC	2	01/09/2018	01/12/2018
T042 RC01	Axle Counter AzL70 Evaluator Single Rail Contacts	2	03/03/2018	31/05/2018
T042 RC02	Axle Counter AzL70 Evaluator Double Rail Contacts	1	03/03/2018	31/05/2018
T042 RC03	Axle Counter AzL70/30 Evaluator EAK30 Junction Box	1	03/03/2018	31/05/2018
T043 RC01	Track Circuit Aid (TCAID)	1	01/08/2004	30/06/2005

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Part R				
T044 RC01	Treadle Timing & Adjustment	4	01/06/2019	07/09/2019
T045 RC01	AzLM & AzLE Axle Counters	5	01/09/2018	01/12/2018
T046 RC01	Level Crossing CCTV Camera	1	01/08/2004	30/06/2005
T047 RC01	CCTV HF Tx System (Marconi/GEC 14.5MHz AM)	2	01/09/2018	01/12/2018
T047 RC02	CCTV HF Tx System (Philips FM)	2	01/09/2018	01/12/2018
T051 RC01	AC Busbar & Earth Test	2	01/09/2018	01/12/2018
T051 RC02	DC Busbar & Earth Test	2	01/09/2018	01/12/2018
T052 RC01	Dynamic Earth Test (Power Worked Points)	2	01/09/2018	01/12/2018
T052 RC02	Dynamic Earth Test (Level Crossing Barriers)	2	01/09/2018	01/12/2018
T053 RC01	Earth Leakage Detector Tests	2	01/06/2019	07/09/2019
T053 RC02	IR425 Record Card	1	07/03/2020	06/06/2020
T054 RC01	Cable Insulation Test	3	03/03/2018	31/05/2018
T054 RC02	Non-Intrusive Earth Test for FDM systems (method A)	3	01/09/2018	01/12/2018
T054 RC03	Non-Intrusive Earth Test for FDM systems (method B)	2	01/09/2018	01/12/2018
T055 RC01	Secondary Cell Test ALCAD - Vantage	2	01/09/2018	01/12/2018
T055 RC02	Secondary Cell Test - Cyclon	3	01/09/2018	01/12/2018
T055 RC03	Secondary Cell Test Lead Acid / Alkaline	3	01/09/2018	01/12/2018
T055 RC04	Secondary Cell Test Power Box - Modular	1	01/09/2018	01/12/2018
T056 RC01	Avel-Lindberg Static Inverter	1	01/08/2004	30/06/2005
T057 RC01	Uninterruptible Power Supply (Not TPWS UPS)	2	01/09/2018	01/12/2018
T057 RC02	Uninterruptible Power Supply (For TPWS Only)	2	01/09/2018	01/12/2018
T058 RC01	Primary Cells	1	01/08/2004	30/06/2005
T060 RC01	Emergency Signals On Control (ESOC)	1	01/08/2004	30/06/2005
T061 RC01	Relay Timers	2	01/09/2018	01/12/2018
T062 RC01	Line Protection Units	1	01/08/2004	30/06/2005
T063 RC01	RETB Radio Systems – Regular Tasks	2	03/03/2018	31/05/2018
T063 RC02	RETB Radio Systems – Service A	2	03/03/2018	31/05/2018
T063 RC03	RETB System (Six Monthly)	1	01/08/2004	30/06/2005
T064 RC01	RETB Fixed Site Power Supply Test – Service A	2	03/03/2018	31/05/2018
T064 RC02	RETB Fixed Site Power Supply Test – Service B	2	03/03/2018	31/05/2018
T065 RC01	RETB Fixed Site Antenna Systems – Service A	2	03/03/2018	31/05/2018
T065 RC02	RETB Fixed Site Antenna Systems – Service B	2	03/03/2018	31/05/2018
T066 RC01	RETB Fixed Site Radio and Interface Equipment (Pre-Site Visit)	2	03/03/2018	31/05/2018

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	Part R			
T066 RC02	RETB Fixed Site Radio and Interface Equipment– Service A	2	03/03/2018	31/05/2018
T066 RC03	RETB Fixed Site Radio and Interface Equipment– Service B	2	03/03/2018	31/05/2018
T089 RC01	SSI Datalinks Health Check	1	01/08/2004	30/06/2005
T089 RC02	SSI Datalinks Baseband / LDT	1	01/08/2004	30/06/2005
T251 RC01	Track Circuit Tests - DC Track	4	01/09/2018	01/12/2018
T253 RC01	Track Circuit Tests - ET200 (M)	6	01/09/2018	01/12/2018
T253 RC02	Track Circuit Tests - ET200 (F)	6	01/09/2018	01/12/2018
T254 RC01	Track Circuit Tests - SF15 / Aster U	5	07/03/2020	06/06/2020
T255 RC01	Track Circuit Tests - HVI	4	01/09/2018	01/12/2018
T256 RC01	Track Circuit Tests - BR-WR Quick Release	4	01/09/2018	01/12/2018
T257 RC01	Track Circuit Tests - Reed Type RT	4	01/09/2018	01/12/2018
T258 RC01	Track Circuit Tests - Rectified AC (Diode)	4	01/09/2018	01/12/2018
T259 RC01	Track Circuit Tests - FS2600	4	01/09/2018	01/12/2018
T260 RC01	Track Circuit Tests - 50Hz AC	5	04/06/2022	03/09/2022
T261 RC01	Track Circuit Tests - Rail Circuit	4	01/09/2018	01/12/2018
T262 RC01	Track Circuit Test - DC Coded	3	01/09/2018	01/12/2018
T263 RC01	Track Circuit Tests - EBI Track 400 (M)	6	01/09/2018	01/12/2018
T263 RC02	Track Circuit Tests - EBI Track 400 (OL)	6	01/09/2018	01/12/2018
T263 RC03	Track Circuit Tests - EBI Track 400 (SA)	6	01/09/2018	01/12/2018
T302 RC01	Signal Visibility Check	2	01/09/2018	01/12/2018
TD11 RC01	Train Describer - Electro Mechanical	1	01/08/2004	30/06/2005
TD21 RC01	Train Describer - HP21MX 2100 Series	1	01/08/2004	30/06/2005
TD21 RC02	Train Describer - HP21MX 2108 Series	1	01/08/2004	30/06/2005
TD31 RC01	Train Describer - Vaughan Type 4M	1	01/08/2004	30/06/2005
TD32 RC01	Train Describer - Vaughan Type Small (Ex BR-WR)	1	01/08/2004	30/06/2005
TD37 RC01	Train Describer - GEC/GE Micro Processor Based	1	01/08/2004	30/06/2005
TD40 RC01	Train Describer - GETS Dual (NS)	1	01/08/2004	30/06/2005
TP11 RC01	Equipment Associated with Signals	2	01/12/2009	01/06/2010
TP11 RC02	Equipment Associated with PSR's & Buffer Stop	1	01/08/2004	30/06/2005
TP11 RC03	Self Powered OSS (SPOSS)	1	01/08/2004	30/06/2005
TP11 RC04	OSS+ Loops at TPWS+ Installations	2	07/03/2020	06/06/2020
TS20 RC01	Indusi Train Stops Magnetic Train Stop Associated with Stop Signals	1	01/12/2009	01/06/2010
TS20 RC02	Indusi Train Stops Magnetic Train Stop Associated with Speed Control	1	01/12/2009	01/06/2010
TS22 RC01	Trainstop - Manchester Metro	1	03/03/2018	31/05/2018

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		Part T		
Index	Index - Telecoms Assets	9	04/06/2022	03/09/2022
CA11	Pole Routes	2	04/09/2021	04/12/2021
IR00	Radio Electronic Token Block (RETB) - General	5	03/03/2018	31/05/2018
IR11	RETB Signal Box	5	03/03/2018	31/05/2018
IR12	RETB Fixed Station	5	03/03/2018	31/05/2018
TE01	Operational Telephones	1	04/06/2022	03/09/2022
TE02	Inspection and Minor Maintenance of Lineside S&T Cable Routes	1	04/06/2022	03/09/2022

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		Part Z		
Index	Index – Reference Values	16	02/12/2023	02/03/2024
Z01	Signal - Reference Values	12	02/12/2023	02/03/2024
Z02	Point - Reference Values	11	02/12/2023	02/03/2024
Z03	Train Detection - Reference Values	9	04/09/2021	04/12/2021
Z04	Level Crossing - Reference Values	5	07/03/2020	06/06/2020
Z05	Cable - Reference Values	5	07/03/2020	06/06/2020
Z06	Cell - Reference Values	2	07/03/2020	06/06/2020
Z07	Earth Leakage - Reference Values	3	05/12/2020	05/06/2021
Z08	Train Protection - Reference Values	1	07/03/2020	06/06/2020

Heading	Title	Iss No.	Issue Date	Compliance Date
		Part - Appendix		
Index	Index - SMS Appendixes	13	02/12/2023	02/03/2024
Appendix 01	General Information on the Siemens Axle Counter Systems	5	03/03/2018	31/05/2018
Appendix 02	General Information on Ansaldo Signalling Equipment	2	05/03/2016	04/06/2016
Appendix 03	General Information on Level Crossing Equipment	3	07/03/2020	06/06/2020
Appendix 04	How to Set up Schwihag Rollers	3	03/03/2018	31/05/2018
Appendix 05	General information on Mil Spec 5015 Plug Couplers	2	04/06/2022	03/09/2022
Appendix 06	Unipart : Plug & Play “Break Out Box” Guidance Notes	2	04/06/2022	03/09/2022
Appendix 07	General information on Frauscher advanced Axle Counter	3	05/12/2020	05/06/2021
Appendix 08	General information on EBI 200 Audio Frequency Track Circuit Equipment	4	01/06/2019	07/09/2019
Appendix 09	General Information on EBI Gate 200 Level Crossing System	3	07/03/2020	06/06/2020

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Compliance date:	02 March 2024

Heading	Title	Iss No.	Issue Date	Compliance Date
Part - Appendix				
Appendix 10	General information on EBI Track 400 Audio Frequency Track Circuit Equipment	4	02/12/2023	02/03/2024
Appendix 11	General information on Siemens Westlock interlocking and zone controller	3	04/06/2022	03/09/2022
Appendix 12	General information on DC Coded Tracks	2	04/06/2022	03/09/2022
Appendix 13	General information on Siemens ACM100 System	2	03/03/2018	31/05/2018
Appendix 15	General Information on the Thales Axle Counter Systems	2	02/12/2023	02/03/2024
Appendix 16	General information on HXP-3	1	03/03/2018	31/05/2018
Appendix 17	General Information relating to the Thameslink Radio Block Centre	2	01/09/2018	01/12/2018
Appendix 18	General Information on the JE Style Trainstop	1	03/03/2018	31/05/2018
Appendix 19	General Information on the ARAMIS System	2	07/03/2020	06/06/2020
Appendix 20	General Information on EBI Gate 2000 Level Crossing System	1	03/03/2018	31/05/2018
Appendix 21	Ansaldo-STS Interlocking System Colour Light Signalling System (SEI-CLSS)	2	01/06/2019	07/09/2019
Appendix 22	General Information on the ElectrologIXS System	1	01/09/2018	01/12/2018
Appendix 23	General Information on the KVB Test Set	1	01/09/2018	01/12/2018
Appendix 24	General Information on the Newgate Barrier System	1	01/06/2019	07/09/2019
Appendix 25	General Information on the Cambrian Balises	1	07/03/2020	06/06/2020
Appendix 26	General Information on the Direct Methanol Fuel Cell System	1	07/03/2020	06/06/2020
Appendix 27	General Information on the Siemens WSD Wheel Detector	1	07/03/2020	06/06/2020
Appendix 28	General Information on Programming Balises	1	07/03/2020	06/06/2020
Appendix 30	General information on Instead Data Loggers	1	04/09/2021	04/12/2021
Appendix 31	General Information on the FUES – EPOS Hot Axle Box Detector	1	04/09/2021	04/12/2021
Appendix 32	Style 63 Point Machine Circuit Controller Replacement	1	04/09/2021	04/12/2021
Appendix 36	General Information on the NCL Radio Block Centre (RBC) System	1	02/12/2023	02/03/2024

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What's new, what's changed and why:

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Briefings are given to those who have specific responsibilities within, or are directly affected by, this standard/control document.

A copy of briefings may be available from the Standards & Controls site.

Requirements to cascade briefings are described within any implementation plans.

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NOTE: *Contractors are responsible for arranging and undertaking their own Detailed and Overview Briefings in accordance with their own processes and procedures.*

Signal Works Testing Handbook NR/L2/SIG/30014/D115

Note: All other activities can be safely undertaken unless disturbing paper gaskets and rope seals for which non-licenced asbestos work rules are to be followed. HW & Style 63 machines do not have paper gaskets or rope seals and the full range of asbestos-containing materials are captured in the archetypal reports for point machines.

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Stephen Dapre

Stephen Dapre
I am approving this document as Regional Head of Eng (S&T) Southern Region
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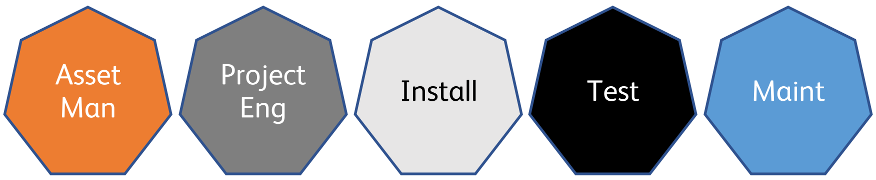

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NOTE: *The IMC040/IMC040A boards are used to process the information received from the strike-out wheel sensors. The Vamos crossing system uses the output from these boards to determine when to start displaying a green aspect to level crossing users.*

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NOTE: *When the IMC040A boards have been accepted for use by NR, there will be separate communications regarding the arrangements for rolling these out to existing Vamos crossing systems and provision of them for use with new Vamos crossing systems.*

[illegible]

[illegible]	[illegible]
[illegible] Modul[illegible]	[illegible] ***NOTE:*** *Clause 3 of Appendix A sets out an additional process to support Routes in determining whether it is appropriate to bring a new Vamos crossing system into service at a particular level crossing in advance of the modified components being available.* *Clause 4 of Appendix A contains additional controls which apply should it be decided to bring a new Vamos crossing system into service at a particular level crossing in advance of the modified components being available.* *These controls align with current good practice as implemented on existing Vamos crossing systems in response to NR/SIN/211 and NR/SIN/212.*
[illegible]	[illegible]

[illegible]	[illegible]
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[illegible]	[illegible] R M r 1 [illegible] NOTE: *There is no change to the Service B frequency for LC71.*
R L [illegible]	dd [illegible] R M r 1 [illegible] [illegible] R M r 1 [illegible] NOTE: *There are no changes to the tasks within Service B of LC71.*

R M R [illegible]	[illegible]	[illegible]	M [illegible]
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[illegible]	[illegible]

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[illegible]

[illegible] – *no variations permitted*

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- [illegible]
- [illegible]
- [illegible]

[illegible] – *variations permitted subject to approved risk analysis and mitigation*

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- [illegible]
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- [illegible]
- [illegible]

[illegible] – *to be used unless alternative solutions are followed*

- [illegible]
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[illegible]	[illegible]

[illegible]

[illegible]

Rationale: To provide an audit trail of decision making.

[illegible]	[illegible]
[illegible]	1
[illegible]	[illegible]
[illegible]	[illegible]

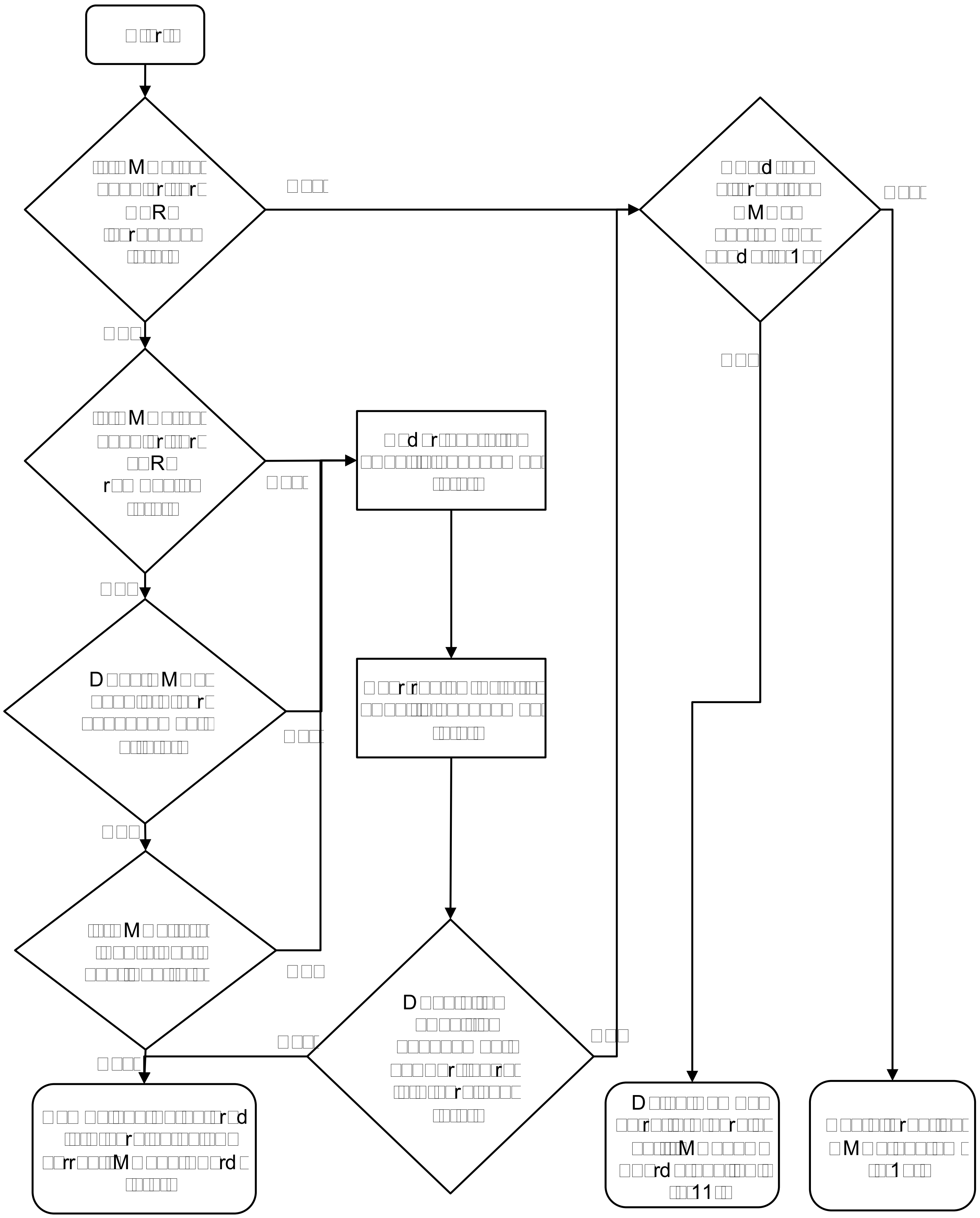
[illegible]

[illegible]

Rationale: To confirm that key accountable roles for asset and risk management at the level crossing are supportive of the intended actions.

[illegible]

[illegible]



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[illegible]	[illegible]

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Rationale: To avoid introducing a wrong side failure risk in situations where there is no existing safety hazard to be mitigated. Hazard review by a group of subject matter experts from across the Regions has concluded that it is not appropriate to bring a Vamos crossing system into service with the current IMC040 boards in situations where the provision of an OMSL solution is driven by a need to mitigate elevated hazards arising from a proposed increase in PSR.

Note: For the purposes of this process the current IMC040 boards are those referenced on product acceptance certificate PA05/05850 issue 8 (or earlier).

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Rationale: To allow a more detailed consideration of the risks and benefits associated with the potential introduction of a Vamos crossing system.

[illegible] crossing users' [illegible]

[illegible]

[illegible]

Note: The circumstances described in sections 3.4 and 3.5 may also be relevant at a particular level crossing. Where this is the case, these circumstances are also considered as part of the site-specific assessment.

[illegible]

Rationale: To allow a more detailed consideration of the risks and benefits associated with the potential introduction of a Vamos crossing system.

Note: The circumstances described in sections 3.3 and 3.5 may also be relevant at a particular level crossing. Where this is the case, these circumstances are also considered as part of the site-specific assessment.

Rationale: To allow a more detailed consideration of the risks and benefits associated with the potential introduction of a Vamos crossing system.

Note: The circumstances described in sections 3.3 and 3.4 may also be relevant at a particular level crossing. Where this is the case, these circumstances are also considered as part of the site-specific assessment.

Note: It is possible for more than one of the above circumstances to apply at a level crossing. The site-specific assessment undertaken for such a level crossing should consider all relevant circumstances and the factors which are applicable to them.

Rationale: To reduce the risk of the site-specific assessment failing to consider factors which influence hazards at the level crossing.

“window of opportunity” for the wrong side

Rationale: To reduce the risk of the site-specific assessment failing to consider factors which influence hazards at the level crossing.

Note: For guidance on items c) and d) in this requirement, refer to sections 3.6.5 and 3.6.6.

Rationale: To reduce the risk of the site-specific assessment failing to consider factors which influence hazards at the level crossing.

Note: For guidance on items c) and d) in this requirement, refer to sections 3.6.5 and 3.6.6.

The signaller's workload,

Rationale: To provide an audit trail of decision making.

Rationale: To achieve a consistent approach to the judgements which underpin the site-specific assessment activity and share good practice across NR.

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[illegible]	1
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]

Rationale: To provide a record of the discussion, any recommendations identified and the support (or otherwise) of the panel for audit purposes and to inform the Route's subsequent decisions on how to proceed.

[illegible]

Rationale: To confirm that the key accountable roles for asset and risk management at the level crossing are satisfied with the outcome of the site-specific assessment activities.

[illegible]

Note: Signage changes associated with the introduction of the Vamos crossing system cannot be implemented until the Vamos crossing system itself is brought into service. Covering over visual and audible warning devices avoids their presence misleading crossing users to expect a visual or audible warning.

[illegible]	[illegible]
[illegible]	1[illegible]
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[illegible]

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[illegible]

Rationale: These requirements are to mitigate the risk of a wheel sensor becoming loose on the rail, which is a known precursor to a wrong side failure mode. They also contribute to an installation which is consistent with the existing Vamos crossing systems as modified through the actions specified in Special Inspection Notices (SINs) NR/SIN/211 and NR/SIN/212 and the good practice set out in Notice Board 215.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Rationale: To support future visual inspections of the security of the rail claw fastenings. This also contributes to an installation which is consistent with the existing Vamos crossing systems as modified through the actions specified in NR/SIN/211 and NR/SIN/212.

[illegible]

[illegible]

Rationale: To mitigate the risk of a damaged or insecure cable being brought into service as these may be precursors to a wrong side failure mode.

[illegible]

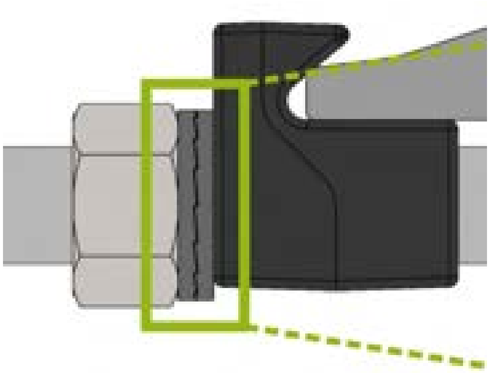
[illegible]

[illegible]

Rationale: The temporary Service A inspection regime is a mitigation for the hazard of the wrong side failure mode of the IMC040 boards.

Rationale: The regular monitoring of remote monitoring information from the Vamos crossing system by appropriate personnel is a mitigation for the hazard of the wrong side failure mode of the current IMC040 boards.

***NOTE:** Washers are considered to be damaged if the inner cam faces or outer serrations are rusted, partially damaged or significantly worn.*



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INDEX

END

General

These systems have one type (DEK43) of rail mounted wheel detectors (heads). Wheel detection is provided by two different types of systems: ZP 43V Analogue (the original type) and ZPD 43 Digital.

The differences are limited to the components and method of operation of the equipment within the trackside connection box.

The voltages and frequencies transmitted between an axle counter evaluator and the ZP 43V and the ZPD 43 wheel detection systems are essentially the same

Currently two different AzS axle counter evaluator systems are in use on Network Rail infrastructure; these are the AzSM (E) and the AzS 350U.

Overview - Siemens (AzS series) Axle Counters

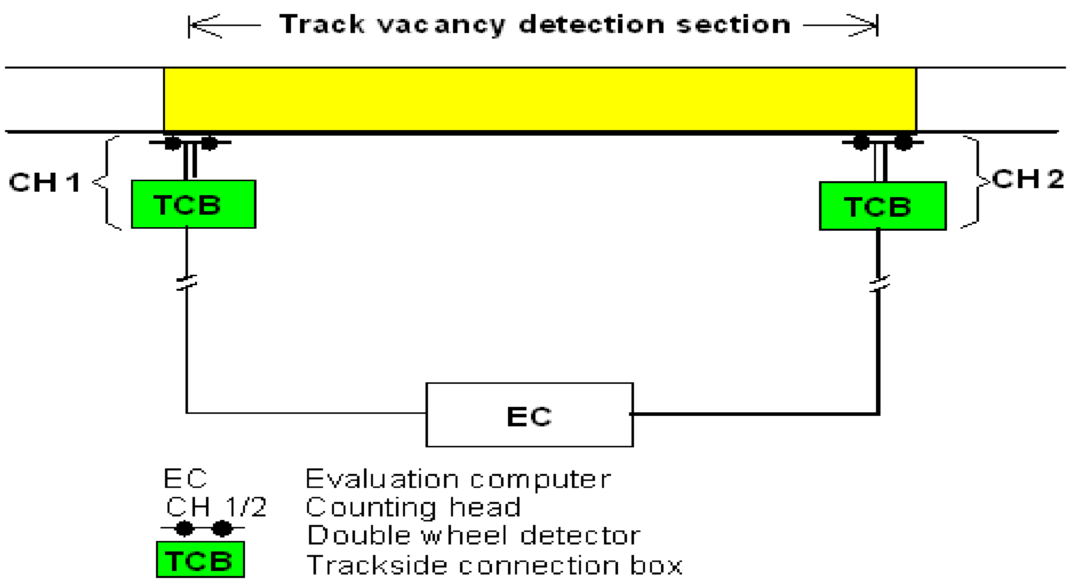


Figure 1 - Layout of Wheel Detection Equipment and associated components

The Wheel Detection Equipment consists of a rail mounted double wheel sensor and equipment within the trackside connection box that provides an output to the axle counter evaluator.

The DEK 43 consists of two detectors mounted in one unit on one rail that detects the passing wheels of the vehicles. As they pass, the wheels influence the electromagnetic field between the transmitter and the receiver of each detector; this alters the voltage induced in the receiving coil of the detector.

This voltage is converted by the trackside connection box to frequency/amplitude–modulated signals, which are transmitted to the evaluation computer.

The Evaluation Computer used can be either a AzSM (E) or a AzS 350U system. The ZAN card (in the AzSM (E)) or the VESBA card (in the AzS 350U) converts the signals from wheel detection equipment into a series of logic pulses so that the microprocessor in the evaluation computer can determine the train's direction of travel & the number of axles.

The Evaluation Computer interprets the signals transmitted by the counting heads. It then compares the numbers of axles, which have entered and left a track vacancy detection section to determine whether that track vacancy detection section is clear or occupied.

In the case of the AzS 350U evaluator the clear/occupied state of each track vacancy detection section determines whether the corresponding TR (track relay) is energised or de-energised, while the AzSM (E)) transmits the states of the track sections directly to the interlocking via the IL bus.

Up to 16 counting heads (ZP 43 V units) can be connected per evaluation computer in the AzSM (E) system. The AzS350U can have up to 5 counting heads (ZP 43 V units) connected per evaluation computer

DEK 43 Double Wheel Detector

The DEK 43 Double Wheel Detector consists of two electronic sensors. Each sensor (detector) has a transmitter and a receiver section.

The transmitter housing is located on the outer side of the rail, the receiver housing being on the gauge side of the rail.

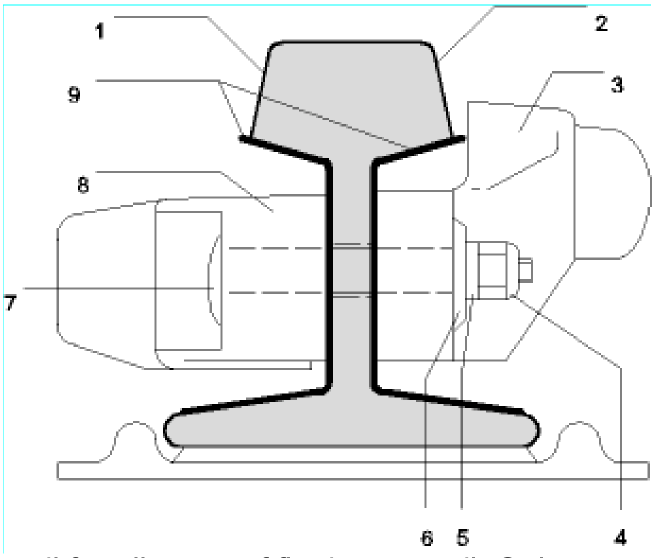
To prevent interference from the rail (due to track return currents), a reducing plate is fitted to both the transmitter & receiver.

The reducing plate is mounted on the side facing the rail. It is matched to the rail profile and reaches from the rail base across the web to below the railhead.

The double wheel detector is attached to the neutral zone of the rail web by two bolts.

DEK 43 Components

1. Gauge side of rail.
2. Outer side of rail.
3. Transmitter.
4. M12 prevailing-torque hexagon nut.
5. Spring washer.
6. Square washer.
7. Mushroom-head bolt.
8. Receiver.
9. Reducing plates.



Reduction plates are fitted to both sides of the rail for all types of flat bottom rail. Only one reduction plate is fitted on the receiver side for all types of Bull head rail.

ZP 43V Wheel Detection Equipment

This is used on the AzSM (E) and AzS 350U systems.

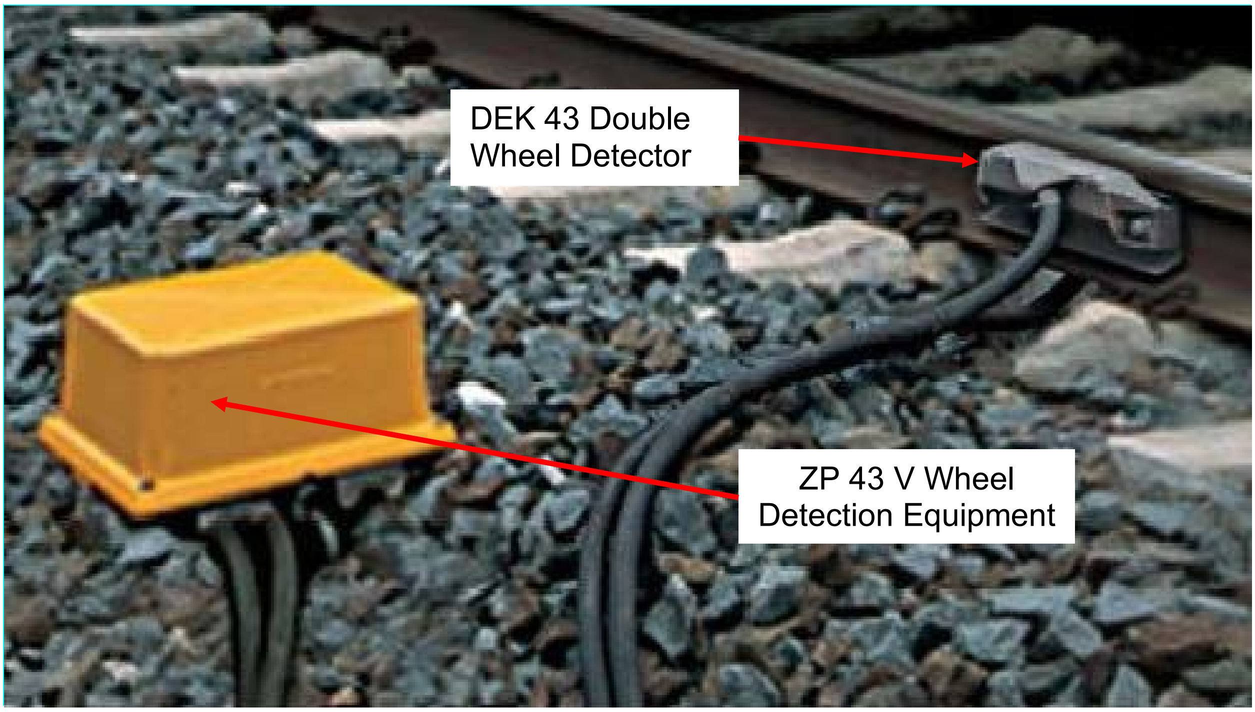


Figure 2 - ZP 43 V Wheel Detector Equipment

This equipment consists of a double wheel sensor (two detectors mounted in one unit on one rail) that detects the passing wheels of the vehicles. As they pass, the wheels influence the electromagnetic field between the transmitter and the receiver of each detector; this alters the voltage induced in the receiving coil of the detector.

This voltage is converted by the trackside connection box to frequency/amplitude–modulated signals, which are transmitted to the evaluation computer.

The ZAN card (in the AzSM (E)) or the VESBA card (in the AzS 350U) then converts these signals in to a series of logic pulses so that the microprocessor can determine the train's direction of travel & number of axles.

The equipment within the trackside connection box consists of vertical backplane with connectors where all incoming wires are terminated.

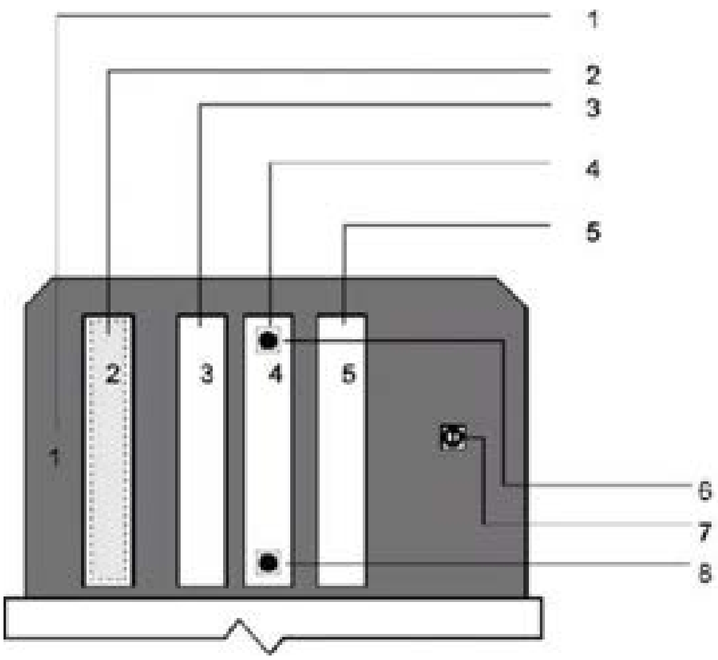
The backplane provides four circuit board connectors into which circuit boards can be plugged. Connector 3 is used for the Band Pass Filter board and connector 4 is used for the Generator board.

When it is necessary to take measurements, the PEGA 1121 test set is plugged into connector 2 (on the left hand side).

When adjustments have to be made during set-up and maintenance, this is done using potentiometers on the cards and on the backplane.

ZP 43 V Internal Layout

1 Wiring backplane.
2 Connection for WDE service equipment.
3 Band-pass filter board.
4 Generator board with adjusting control for signal frequencies.
5 Double-usage board.
6 Adjusting control for signal frequency f2(6.52 kHz)
7 Rotary switch for transmitting frequency (43 kHz)
8 Adjusting control for signal frequency f1(3.60 kHz)



Test Equipment

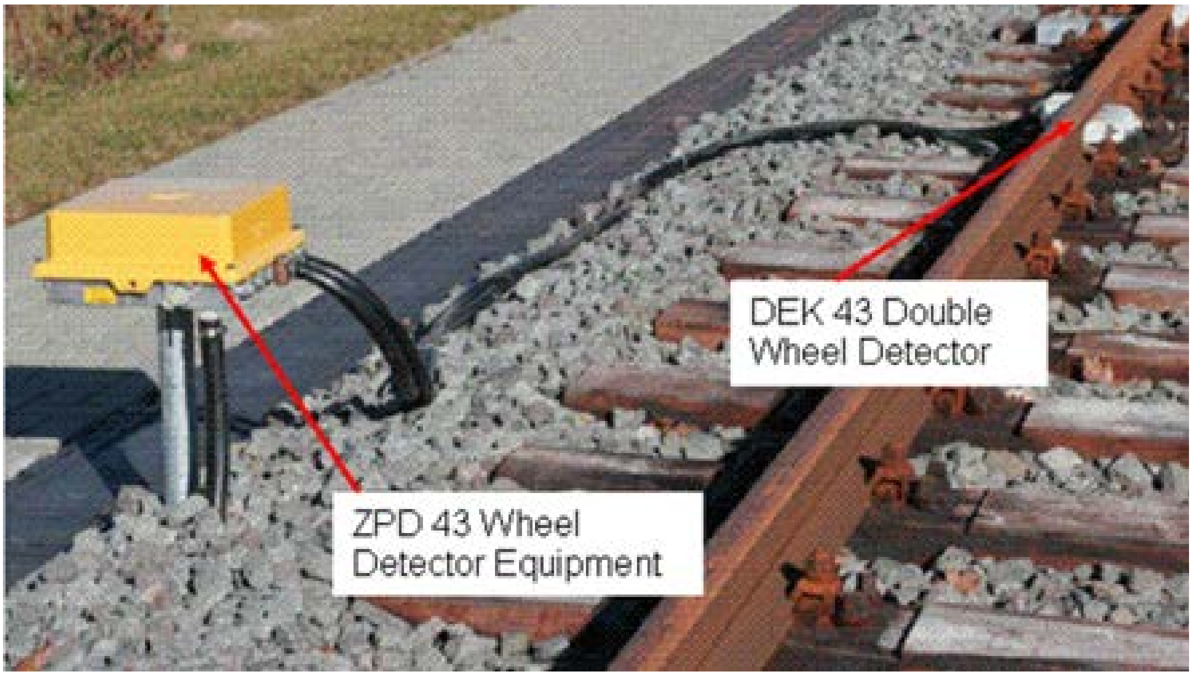
The PEGA 1121 test set is used for testing the ZP 43V.

1 Display
2 Test socket, positive input
3 Test socket, negative input
4 Round socket for WDE adaptor (WDE = Wheel Detector Equipment)
5 Display illumination, on/off
6 Operating mode/function indicator
7 Operating mode selector
8 Confirmation
9 Previous function/next-lower frequency
10 Next function/next-higher frequency

Check that the “ZP43” mode has been selected on the PEGA 1121 test set Check that the switch on the plug-in module has been set to “ZP43” (down) (The setting of the rotary switch is immaterial)

ZPD 43 Wheel Detection Equipment

This is used on the AzSM (E) and AzS 350U systems.



ZPD 43 Wheel Detection Equipment

This equipment consists of a double wheel sensor (two detectors mounted in one unit on one rail) that detects the passing wheels of the vehicles.

As they pass, the wheels influence the electromagnetic field between the transmitter and the receiver of each detector; this alters the voltage induced in the receiving coil of the detector.

This voltage is converted by the trackside connection box to frequency/amplitude–modulated signals, which are transmitted to the evaluation computer.

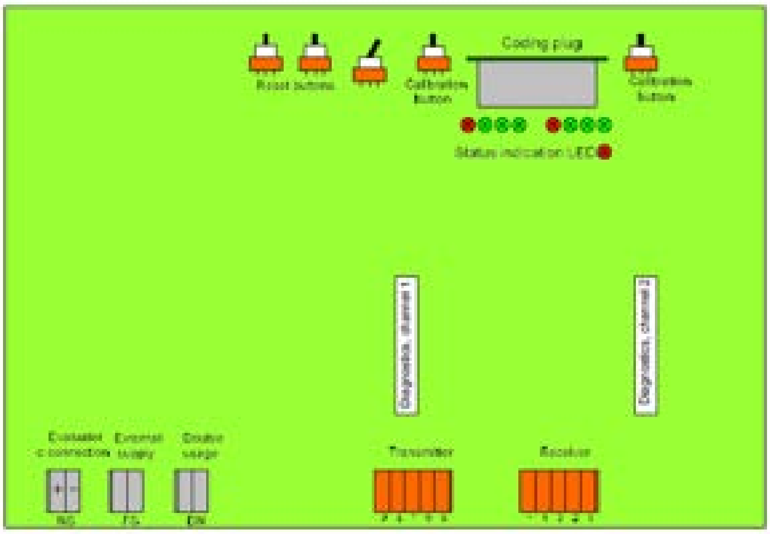
The ZAN card (in the AzSM (E)) or the VESBA card (in the AzS 350U) then converts these signals in to a series logic pulses so that the microprocessor can determine the train's direction of travel & number of axles.

The equipment within the trackside connection box consists of a single horizontal circuit board with connectors where all incoming wires are terminated, and on which the coding (identity) plug is located.

When it is necessary to take measurements, these are taken at the connector terminals, using an approved meter (Fluke 187 or similar).

When adjustments have to be made during set-up and maintenance, this is done using the pushbuttons this circuit board. The process is automated with no manual adjustments required.

ZPD 43 Internal Layout



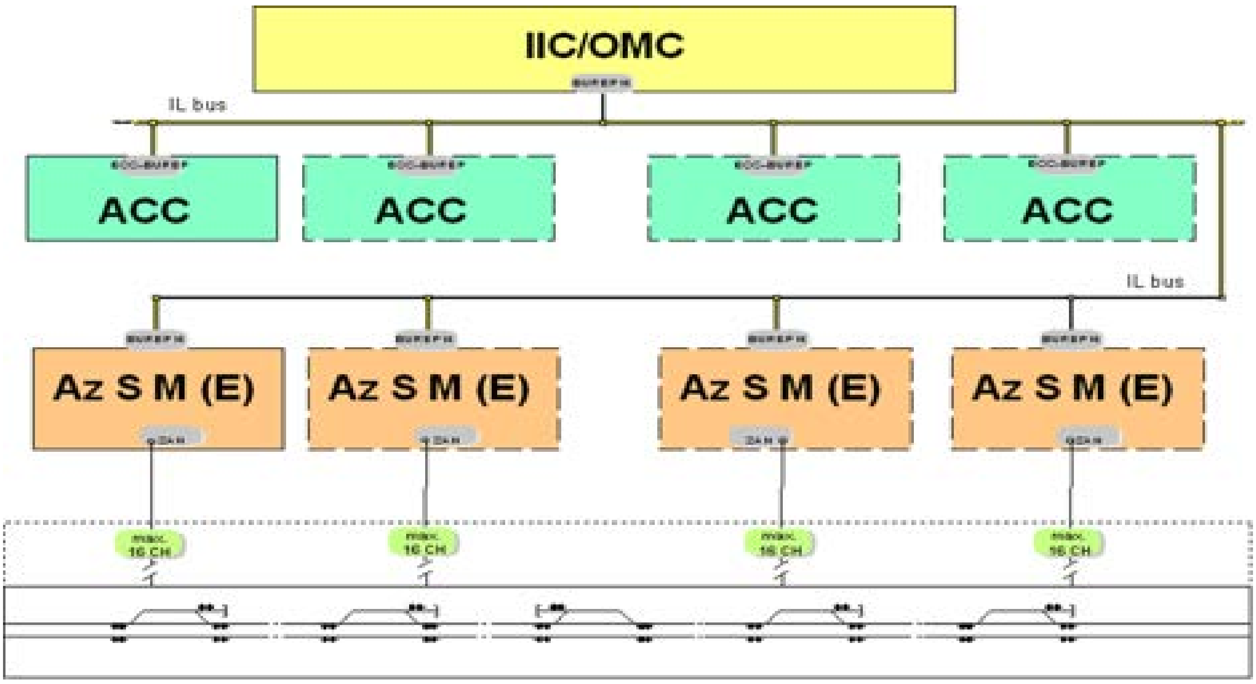
Test Equipment

All measurements are to be taken using an approved true RMS meter with frequency scale and with an internal resistance ≥ 50 kΩ (e.g. Fluke 187).

AzSM (E) Systems

The AzSM axle counter is a microcomputer based system with a multiple section evaluation computer for the track vacancy detection of track sections. The AzSM (E) variant is designed to interface with the Siemens SIMIS-W interlocking:

AzSM (E) System Architecture



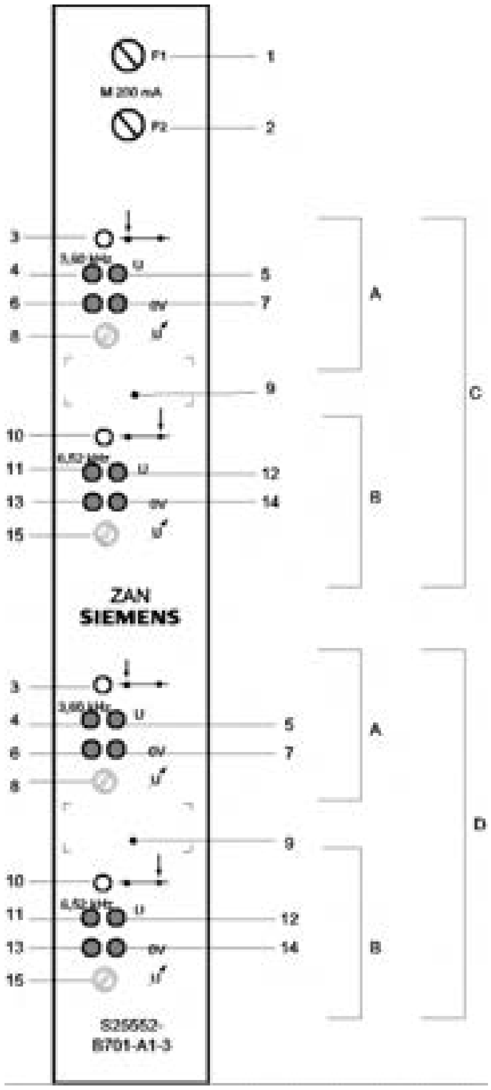
Abbreviation	Meaning
IIC/OMC	Overhead computer
ECC-BUREP	Element Control Computer interface board between computer & bus
BUREP	Interface board between computer bus
IL Bus	Interlocking Bus
ACC	Area Control Component (computer)
AzSM (E)	Axle counting system for multiple sections

Structure/Function

The AzSM (E) Axle Counting System consists of two main components:

a) Indoor system: evaluation computer (EC). The hardware is based on the SIMIS 3216 computer, connected to the ACC via the IL bus.
b) Outdoor system: ZP 43V Wheel Detection Equipment.

Evaluation Computer Test Points & Indications



Key to Test Points & Indications		
No.	**Item**	**Comment**
A	System 1	
B	System 2	
C	Counting Head 1	(System 1 & 2 of double wheel detector)
D	Counting Head 2	(System 1 & 2 of double wheel detector)
1	M 200mA	Fuse, counting head1
2	M 200mA	Fuse, counting head 2
3	LED Yellow	System 1 of double wheel detector being traversed.
4	Test Socket	F1 = 3.60khz +/- 0.05 KHz (frequency adjustment at
5	Test Socket	Voltage U1 = 3.0V DC +/- 0.10v
6 & 7	Test Socket	0v sockets for both systems.
8	Potentiometer	Voltage adjustment to 3.0 V DC +/- 0.10V
9	Space for Label with CH	
10	LED Yellow	System 2 of double wheel detector being traversed
11	Test Socket	f2 = 6.52khz +/- 0.10 KHz (frequency adjustment at counting head)
12	Test Socket	Voltage U2 = 3.0v +/- 0.10v
13 & 14	Test Socket	0V socket for both systems
15	Potentiometer	Voltage adjustment to 3.0 V DC +/- 0.10V

AzSM (E) - Reset & Restore Procedures

The re-set and restore of the Siemens AzSM (E) axle counter is performed by the signaller.

The reset & restore procedure can be performed only when:

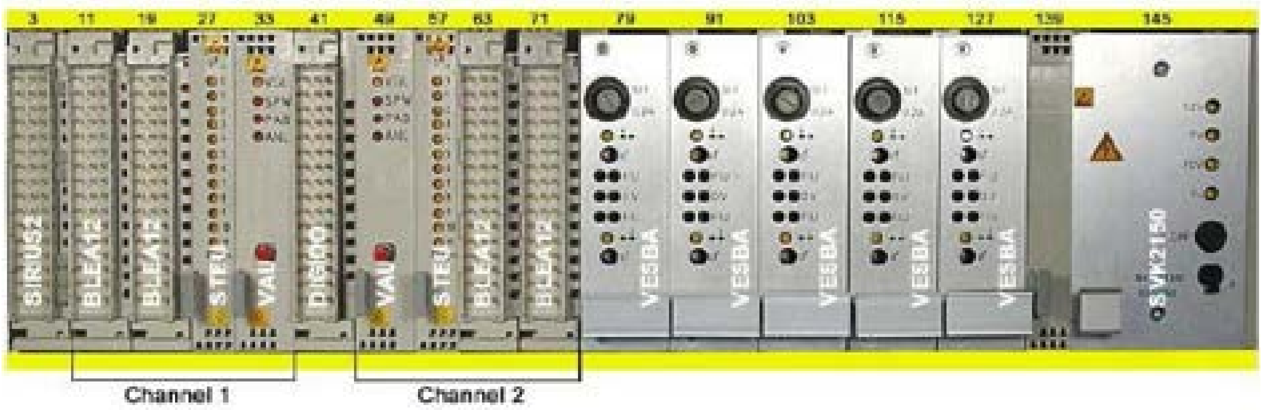
a) An axle counter section remains occupied after the passage of a train when the track section is “clear” or
b) Requested by the technician if the elements are indicated as being occupied when the axle counter section (s) is ‘clear’ (e.g. after the restart of an evaluation computer (EC) due to failure or maintenance work or after other faults)

The axle counter reset & restore procedure is split into the following stages:

a) Applying protection
b) Resetting the section
c) Restoration to normal working

AzS 350U Systems

AzS 350U ACE rack



The system can evaluate up to four track sections.

Structure/Function

The AzS 350U Axle Counting System consists of two main components:

a) Indoor system: evaluation computer (EC). The hardware is based on the 8085 microprocessor VAU board microcomputer system.
b) Outdoor system: ZP 43 Wheel Detection Equipment.

Evaluator Computer

This interprets the signals transmitted by the ZP 43 wheel detection equipment. It can connect to five ZP 43s directly and a further six remotely via two other evaluator computers. It compares the number of axles entering and leaving a tack section and outputs the track section state via voltage free contact relays. The evaluator computer can also be used as a transmission system for vital signal functions.

Before removing any board reference should be made to the Siemens maintenance manual. Following the correct removal/re-fitment procedures is critical to the operation of the axle counter.

AzS 350U - Reset, & Restore Procedures

The re-set and restore of the Siemens AzS 350U axle counter is performed by the signaller.

The reset & restore procedure can be performed only when:

a) An axle counter section remains occupied after the passage of a train when the track section is "clear" or
b) Requested by the technician if the elements are indicated as being occupied when the axle counter section (s) is 'clear' (e.g. after the restart of an evaluation computer (EC) due to failure or maintenance work or after other faults)

The axle counter reset & restore procedure is split into the following stages:

a) Applying protection
b) Resetting the section
c) Restoration to normal working

End

Contents

1 T72 POINT MACHINE

1.1 General Information

Any deficiency or failure, which could affect the safe running of trains or the integrity of the signalling system, shall be reported to the signaller immediately.

Before working on points:

- Set up possession and protection arrangements with the signaller.
- Check that a route cannot be set over the points being worked on (staff and safety of trains). This requires the implementation of a safe system of work which may include:
- Provision of a point operator at the controlling point.
- Verify the point end by asking the signaller to swing the points prior to starting work.
- A locally documented procedure.

1.1.1 Defects

Defects that could affect the safe operation of trains shall be advised to the signaller immediately.

Defects should be repaired as soon as possible. Where not rectified at the time, inform your SM (S).

If the point identification number is displayed on the detachable lid instead of on the machine body, check that when working on adjacent machines the lids are not inadvertently swapped. Incorrect point identification may result.

1.2 Mechanical Information

The Ansaldo Signal (CSEE Transport) type T72 point machine has a cast iron body which houses the control module, motor, and gear train with integral clutch. A lip is incorporated along each side of the machine body to enable it to be carried ‘stretcher style’ with two crowbars.

The separate steel lid is normally secured with four quick release clips, two of which can be secured with padlocks. However, to provide a more robust means of securing the machine against unauthorised access, the lid has been fitted with two lugs which engage the slotted blocks fitted to the machine body. A hasp and staple has also been fitted and is secured with an RKB221 padlock. A second RKB221 may be fitted to one of the quick release clips.

An RKB222 padlock is fitted to the crank handle access lever bracket.

In addition to the RKB222 padlock, the crank handle access lever is also secured by a fixed lock operated by a barrel type key. The fixed lock shall also be unlocked to allow the lever to be moved to the '*Hand'* position. The key is captive in the lock until the lever is restored and locked in the '*Motor'* position.

When the lid is removed, put it in a place of safety, preferably under cover or face down to prevent accumulation of rain, dust, grit, or foreign bodies in the cover being inadvertently transferred to the machine.

The first version of the point machine supplied to the UK had a 4.7 kN clutch setting, an internal diode, a thermostat plate that restricted the access to the fourth motor brush and a wiring anomaly. These machines have been superseded by machines with a 6 kN setting to meet the requirements for operating RT60 layouts and have been modified to remove the diode, provide an alternative thermostat mounting plate which allows access to the fourth motor brush and corrects the wiring anomaly. 6 kN machines are identified by means of the identification plate on the outside of the machine as follows:

Point machine label showing version E and 6 kN

Only machines with labels as shown above bearing the version E and 6 kN markings can be used. Any machines found without these labels or with other than version E and 6 kN shall NOT be used and your SM (S) shall be informed immediately so the machine may be placed in quarantine until it can be returned to the servicing agent or manufacturer.

1.2.1 Fixing

Four lugs each with a 20 mm diameter hole.

1.2.2 Size

750 mm (L) x 620 mm (W) x 215 mm (H)

1.2.3 Weight

150 kg

1.2.4 Throw

The throw of the machine can be adjusted between 105 mm and 260 mm by loosening the drive arm clamp and shortening or lengthening the drive arm as required. See Ansaldo Signal – T72 Point Motor DC Permanent Magnet Type - Manual 2 - Installation and Use – section 6.5 - Setting and Adjusting the Throw.

The drive arm clamp is secured with two hexagonal head screws locked with tabs on a common tab washer plate.

The tab washer plate shall be renewed every time the tabs are bent away to permit loosening / removal of the hexagonal headed screws (i.e. the tab(s) shall not be re-used).

The required drive rod varies according to the point layout on which it is being used. The drawings detail the components required for each layout.

1.2.5 Balance

The balance of the throw can be adjusted by shortening or lengthening the drive rod, such adjustment is necessary, in conjunction with the adjustment of the throw of the machines, to check that the correct switch openings are achieved.

1.2.6 Mid stroke indication

The point machine is in the mid stroke position when the line or groove on the output shaft is aligned with the pointer on the machine nose. Some machines may have spots of red paint as alignment indicators.

1.2.7 Drainage

A water drain device is fitted adjacent to the gear wheel assembly. A screw driver is required to open it. The device should be closed when drainage is complete.

If the machine has been flooded or is suspected of having been flooded, then the complete machine shall be replaced and the ‘flooded machine’ returned for refurbishing.

1.3 Electrical Information

1.3.1 External connection

Either a single 3 m or 5 m length of CMA 24 cable terminated with plug couplers connects the machine to the junction box. The threaded connector ring at the point machine end is tightened with a hook spanner. Provision is made for fitting locking wire. The armour cable sheath is secured to the plug coupler body with a worm drive clip.

During transit the plug coupler sockets are fitted with protective caps.

Before connection, especially if replacing a machine check that the plug coupler is free of any debris and contamination.

1.3.2 Internal connection

The internal cable connections are secured with ‘Faston’ clips. However, no internal connections are required to be made during installation or removal of the machine.

1.3.3 Motor

DC permanent magnet type motor operating between 90 volts dc to 170 volts dc. The control module restricts the current delivered to the machine to 7A, so that the 7A rating of the motor contacts is not exceeded.

The control module cuts off the power supply to the motor when the current falls to zero as a result of the internal control contact in the T72 opening when it nears the end of its travel. The control circuit includes a timer that cuts the current after between 6 - 9 seconds if the contacts have not opened in this time.

The T72 clutch protects the motor between encountering an obstruction and the timer becoming effective.

The motor cannot be replaced on site.

1.3.4 Motor brushes

The motor is fitted with four brushes. Each spring loaded brush assembly is retained by a threaded plug slotted to accept a wide blade screwdriver or coin. The brush cap may require assistance to ‘pop-up’ if the side arms bind in the brush guide slots.

When a brush has worn to the minimum permitted length (8 mm), renew it.

1.3.5 Heater

A thermostatically controlled 100 W (at 110 V) heating resistor is fitted to the gear train cover plate.

1.3.6 Clutch

A friction type clutch, mounted in the reduction gear assembly, absorbs the inertia of the motor and gears as the motor starts and stops or in the event of an obstruction preventing closure.

The clutch cannot be adjusted or serviced on site.

1.3.7 Isolation

Moving the selector lever from *‘Motor’* to *‘Hand’* causes an internal isolation switch to operate and permits access for the point crank handle.

1.3.8 Manual operation

Manual operation is via a spring loaded shaft fitted with a small gear wheel. The spring checks that the gear wheel is disengaged from the motor driven gear train when not required. Consequently, the crank handle should be pushed in during manual operation to keep the small gear wheel engaged with the main gear.

Non-UK versions of the T72 are manually operated by a long lever which is normally secured flat to the ground by a padlock. The crank handle is provided for the UK version of the T72, but the claw type clutch / bevel gear assembly for manual operation by lever remains. This is engaged and operates during manual operation.

1.3.9 Heater or Thermostat - replacement

If the heater and / or thermostat are replaced their correct operation shall be checked (NR/SMS/Test/170).

1.4 Spares and Replacements for the T72 Point Machine)

The following components can be replaced on site:

Component	CSEE Transport Part Number
Motor brushes	6520403-00 (electric motor reference)
Drive arm	6520354-01
Lid	2012491
Heater kit	6522389-10
Thermostat	6004122-00
Crank handle	2010063

Other components may be specific to the particular layout on which it is used. The drawings detail the replacement components required for specific layouts.

1.5 Tools

Open-ended spanner – 27 mm.

Hexagonal sockets – 24 mm and 27 mm.

‘Hook’ spanner (plug coupler) ‘FACOM’ – number 125 – 120.

Grease gun with Tecalmit type fitting

Other tools required include hammer, small drift (for securing washer tabs), combination pliers, insulated metre rule, and screwdriver (water drainage screw).

1.6 Torque Values

Component	Torque Values
Bolt and castellated nut connecting each crank control arm to coupling rod	15 Nm (maximum)#
T72 point machine fixing bolts	110 ± 10 Nm

#: If, when the nut has been tightened to 15 Nm, the security split pin cannot be fitted, the nut should be carefully slackened to align the first available slot with the hole in the bolt.

1.7 Lubricants

Lubricant	CSEE Transport part number
'SHELL' Rimula C oil for diesel engine Viscosity SAE 20W-40	6004075-00
'SHELL' Retinax HD Grade 2 grease – Multipurpose grease (blue)	6004075-00

The named lubricants shown above are recommended by the equipment manufacturer. Equivalent lubricants may be used.

2 COGIFER VCC LOCK & DETECTION MECHANISM

2.1 VCC Lock

2.1.1 Lock Mechanism

The VCC lock mechanism for the Network Rail applications are supplied to fit 113lb FB, UIC54, and RT60 rail sections. These three types are identified as follows:

The P80 version is used on full depth switch rails (113lb).

The M89 version is used on shallow depth switch rails (UIC54).

The M80 version is used for RT60/NR60 layouts.

The version of the VCC is stamped on the C-arm and adjacent to the entry hole for the "hammer head bolt" on the inside of the body of the VCC itself.

They differ in the switch rail fittings, the design of the switch rail bracket being the most obvious difference. The M80 and M89 bodies are similar but the RT60 version is for inclined rail and the UIC54 for vertical.

Check that the correct components for the particular configuration are available to suit the particular site requirements before starting work.

A left and right hand assembly is required for each installation. The handing is embossed on the lock body casting adjacent to the hole in the web that fits to the rail. 'G' Gauche - Left hand or 'D' Droite - Right hand. (The 'handing' is determined by facing the point toe).

The upper surface of the bearer on which the VCC lock and detection assembly is mounted shall be lower than the adjacent bearers to accommodate the VCC base plate which is an integral part of the VCC assembly. This bearer is usually a hollow steel bearer which is thinner than the surrounding concrete bearers.

2.1.2 Required Switch Opening

The required switch opening is greater than that normally provided on UK point layouts. The locking arrangement not only locks the switch rail to the stock rail but also locks the open switch open.

If the switch opening is insufficient, the crank arm is unable to complete its travel and lock the switch rail open. Failure to lock may therefore be due to the lock being tight on the closed switch side or inadequate switch opening on the open switch side.

The required switch opening for a 113A full depth layout is 115mm. 110 mm is the required switch opening on a shallow depth (UIC54) and RT60 switches.

2.1.3 VCC Exterior Cover

The crank head, locking piece and detector are protected by a cast iron cover retained by two spring hooks and secured against unauthorised access with an RKB221 padlock.

2.1.4 Lock Arm Stroke Balance

The crank head of a lock arm shall fully engage its respective locking piece when the switch rail is closed and locked in either normal or reverse position.

The amount of engagement for either lie of points should be as near the same as possible. To achieve this condition the coupling rod that operates the lock arms shall be adjusted so that the stroke of both lock arms is the same (in balance).

2.1.5 Checking the Lock Arm Stroke Balance

When the points are correctly set, the lock arms should both cover the locking surfaces fully and equally. If the stroke balance is incorrect – i.e. one lock arm travels further than the other, then the drive rod length is incorrect. If both lock arms travel the same distance but either travel too far or not far enough, then the drive arm of the T72 is the incorrect length.

The stroke balance can be checked by manually operating the points and noting the position of the crank head relative to its locking piece (distance of crank head from inner face of the casting) when the relevant switch rail is closed and locked. Repeat the procedure for the opposite lie of points and compare the amount of engagement (distance of crank head from inner face of the casting) with that previously observed.

For either lie of points, the amount of engagement should be approximately the same ± 3mm.

If the amount of engagement is not within the permitted tolerance then the cause shall be investigated and remedial action taken.

For further details refer to Cogifer VCC Clamp Lock Maintenance Manual 1010-100-005 or VCC Clamp Lock Installation Manual 1010-100-004

2.2 Detector

2.2.1 Detector Mechanism

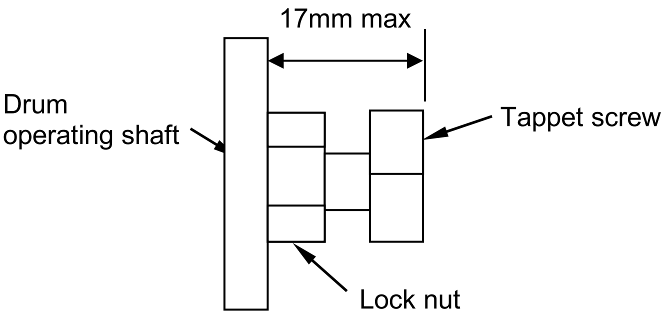
The detector drum and contacts are protected by an internal metal cover incorporating an insulation strip secured with rivets. The cover is a push fit and there is a risk that the wire insulation may be damaged by the sharp edge of the cover especially when the cover is refitted. Take care when fitting these covers as it is possible that, in extreme circumstances, damage to two of the wires insulation could result in false detection. If the wire insulation has been damaged arrange remedial action as appropriate.

2.2.2 Replacing a detector

If it is necessary to replace a detector, take care as it is very easy to bend the detector finger and/or damage the contacts.

It is very important that the following procedure for changing a detector is followed.

- Check that the detector is in switch open position (finger in pre-engagement notch).
- Check that the points are in the switch open position.
- Insert the plunger gauge through the hole in the stock rail.
- Fix the detector in place – 2 screws (cross-corners) will suffice at this stage.
- Set the tappet screw on the detector so that it is one to two turns out.
- Lever the finger open so that 6 mm gauge can be inserted — don’t lever against plunger gauge.
- Close and lock the switch (do this slowly, checking that the finger engages with the slot in the lock arm).
- Unscrew plunger gauge until it makes contact with tappet screw head.
- Unlock and open the points.
- Remove the 6 mm gauge checking that the finger is in the detector’s pre-engagement notch.
- Remove the detector.
- Remove plunger gauge without adjusting it.
- Cut the new plunger to the gauge length.
- Insert the plunger through the stock rail.
- Fix the detector using all four screws.
- Close and lock the points – watch the movement to check that it operates properly.
- Adjust the tappet screw (max. 17 mm) until the gauge is a sliding fit.



Detector adjustment showing maximum screw extension

- Repeat for the other detector.

2.2.3 Detector Electrical Connections

The terminal connectors used on the VCC are standard M6 ring tongue crimps with a black sleeve.

2.2.4 Cable Clamps

The cable clamps supplied with the equipment do not always adequately clamp the cables. Consequently the standard tail cable may not be sufficiently secured by the cable clamp. An additional sleeve may be required.

An alternative clamp has been supplied so that the cable is secured correctly; these should be recovered from units being replaced and re-used on the new units.

2.3 VCC Lock and Detector Spares and Replacements

2.3.1 VCC Lock and Detector

The following components can be replaced on site. However, due to the dismantling required to replace the lock crank wear pads, it is recommended that the complete lock crank assembly is replaced.

The oblong plastic sleeve on which the lock crank assembly slides should also be replaced to avoid unnecessary dismantling.

When replacing a lock crank assembly you cannot assume that the previous settings, packing and gauging of the associated components are still valid. The lock crank assembly may appear like for like but the replacement shall be treated as a new installation and the full installation procedure shall be applied.

See the relevant sections in Cogifer VCC Lock and Detector Mechanism manual.

When replacing the detector, check that the finger correctly engages the notch in the crank head. Otherwise the lock contact fingers, beneath the white plastic cover hinge, will be twisted and the contact gap reduced. A false circuit may be created.

If the VCC lock frame assembly requires replacement because of a ‘run through’ or suspected ‘run through’ then both VCC assemblies shall be replaced.

Component	COGIFER part number
Plastic sleeve	Specify VCC type
Wear pad kit: 1 x crank head pad 1 x fixing screw 1 x crank support pad 2 x fixing screws	871920025
Locking piece kit: 1 x locking piece 1 x castellated screw 1 x securing screw	871920009
Adjusting Shim Set (various thicknesses) (different material)	Specify VCC type Specify :stainless steel
Stabilising device: 1 x roller stabiliser 1 x spring 1 x stopping plate 1 x stopping ring	871920056
VCC cover retaining spring (2 required for each cover)	314040003
Hollow bolt kit: 1 x Ø27mm hollow bolt 1 x spring washer 1 x nut	Specify VCC type
Hammer head bolt kit: 1 x hammer head bolt 2 x spring washers 2 x flat washers 1 x slotted nut 1 x split pin	Specify VCC type
Lock crank assembly: 1 x lock crank 1 x lock crank bracket 2 x hammer head bolt kits 1 x stabilising device 1 x crank head pad 1 x control arm support pad	Specify VCC type

Component	COGIFER part number
VCC Detector kit: 1 x detector 1 x brass plunger 1 x terminal bag* *Note: Only the flat washers and nuts are required. The wires are terminated with black ring tongue crimps. Dispose of the remaining Paulvé terminal components in accordance with local instructions.	872220002 (Left hand model P80 - C9470)
	872120002 (Right hand model P80 - C9470)
	872220001 (Left hand model M80 & M89)
	872120001 (Right hand model M80 & M89)
Brass plunger (VCC Lock) (length 135 mm)	333050001

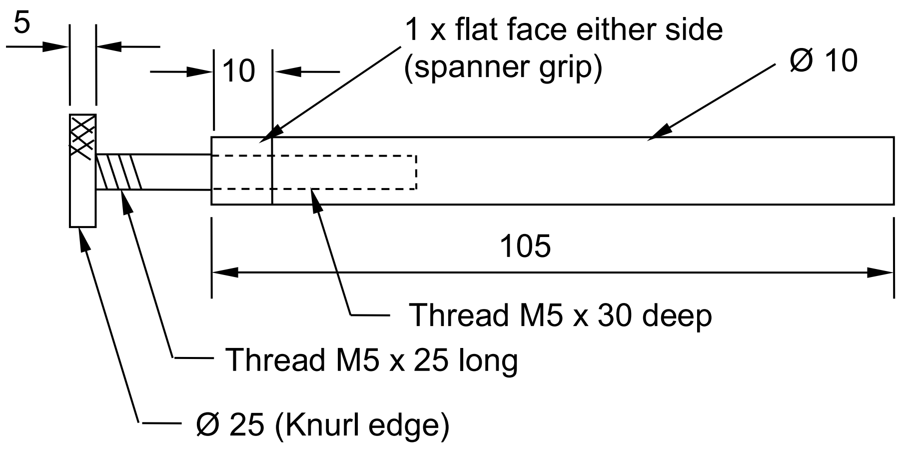
2.3.2 Wire Termination

Description	NRS part number
Terminal, crimp, ring tongue, M6, black sleeve	0054/119568

2.3.3 Gauges

Description	COGIFER part number
13/26mm	377001002
6mm ('U' shaped)	377001000

2.3.4 Special Gauge (Plunger Length Assessment)



Material: Silver steel or similar non rusting material (remove burrs and sharp edges)
Dimensions are in mm

The gauge may provide an alternative means of assessing the length of a replacement plunger

An alternative method for determining the plunger length is detailed in the manufacturer's installation manuals making use of callipers, a ruler and marking device if the above 'Gauge' is not available.

2.3.5 VCC Lock and Detector Lubrication

Description	Type
Lubricant	BP Energrease LS EP

The named lubricant shown above is recommended by the equipment manufacturer. An equivalent lubricant may be used.

2.3.6 VCC Lock and Detector Tools

Open-ended spanner – 13mm (2 required)

Hexagonal socket – 10mm

Torque wrench – range up to 400Nm

Other tools required include: feeler gauges, file, hacksaw, rule, screwdriver, and drill.

A small pair of inside callipers may be useful when:

- Measuring the projection of the brass plunger.
  (7.3).
- Measuring the gap between the hollow bolt and the top face of the tappet screw.
  (7.3).
- Measuring the length of the tappet / lock nut assembly.
  (7.3).

Ø 4mm drill – drilling hammer head bolt for split pin to secure castellated nut.

2.3.7 VCC Lock and Detector Torque Values

Component	Torque Values
VCC lock body to stock rail (Ø27mm hollow bolt)	40 Nm (maximum) *(Initial assembly to mate lock body with rail web) Shall be loosened before finally tightening to value below*
VCC lock body to stock rail (Ø27 mm hollow bolt)	300 ± 20 Nm
Bolts [3 off] securing VCC body to concrete bearer	300 ± 20 Nm
‘T’ head bolt with rail foot clamp securing rail to VCC body (steel or concrete bearer)	160 ± 15 Nm
Bolt with rail foot clamp securing rail foot to VCC body through to concrete bearer	160 ± 15 Nm
M12 x 35 hex. head screw either side of lock body	50 ± 5 Nm
Coupling rod / control arm connecting bolts	15 Nm (maximum) *(Slacken nut if necessary to insert split pin)*
Drive rod / coupling rod connecting bolt	15 Nm (maximum) *(Slacken nut if necessary to insert split pin)*

2.4 Fault Finding on the Detection Circuit

Typical faults on the detection circuit are likely to be:

- **Open Circuit:** Contact open because detection should not be made or broken wire;
- **Short Circuit:** Cable damage;
- **High Resistance:** Defective contact.

The conventional means of testing for the presence of a voltage is difficult with this circuit and so an alternative method is available. The circuit is terminated in a capacitor which is part of a tuned circuit. There is a 33 kΩ resistor across this capacitor which can be used for testing purposes.

The circuit should be first disconnected at the Junction Box by slipping the incoming detection feed links T1 1, T1 3 and T3 3. A meter on resistance setting is then put across the detection circuit T1 1 (right hand) or T1 3 (right hand) to T3 3 (right hand).

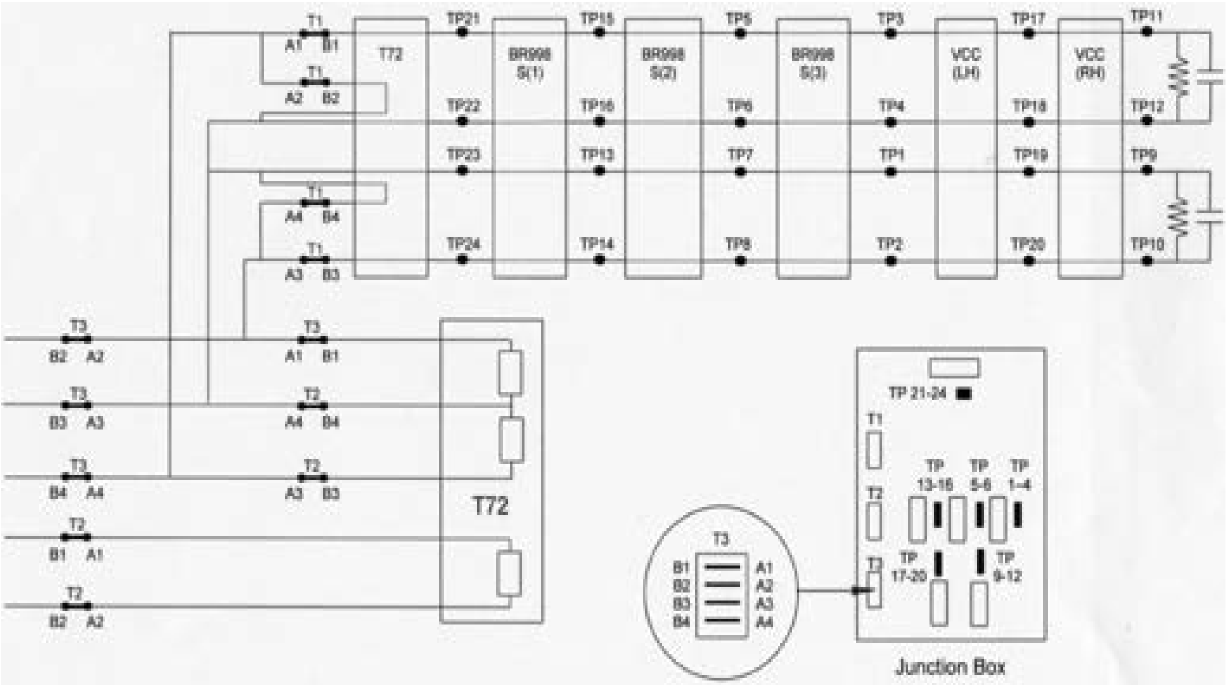
If the meter reads much greater than 33 kΩ, then it is likely that there is an **open circuit**. The test should be carried out on other sections of the circuit to localise the fault.

If it reads only a few ohms then this indicates a **short circuit**. Further testing is then required to localise the fault.

If the meter reads about 33 kΩ but the detection circuit does not operate, the n **high contact resistance** should be suspected. Test points are provided to test most contacts in the circuit (see simplified diagram for details of the test points). Test each contact in turn to determine its contribution to the total circuit resistance. The total series resistance of all the detection contacts measured at the junction box should be less than 1 Ohm. Cable resistance should be 5 Ohms or less. The total detection circuit resistance measured at the DEV card input should not be more than about 5 Ohms. If the total resistance exceeds 45 Ohms the DEV card will not operate correctly.

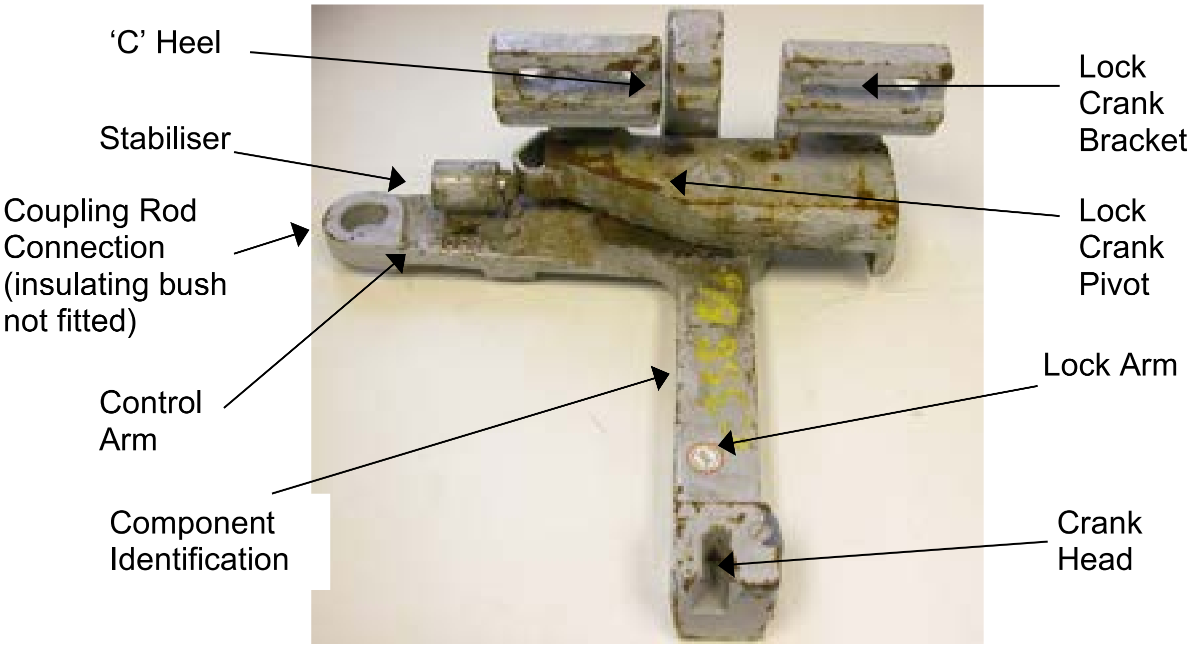
Simplified Point Circuit – New Junction Box

NOTE   Only the Test Points and principal components are shown in the diagram, i.e. contacts within the equipment are not shown.



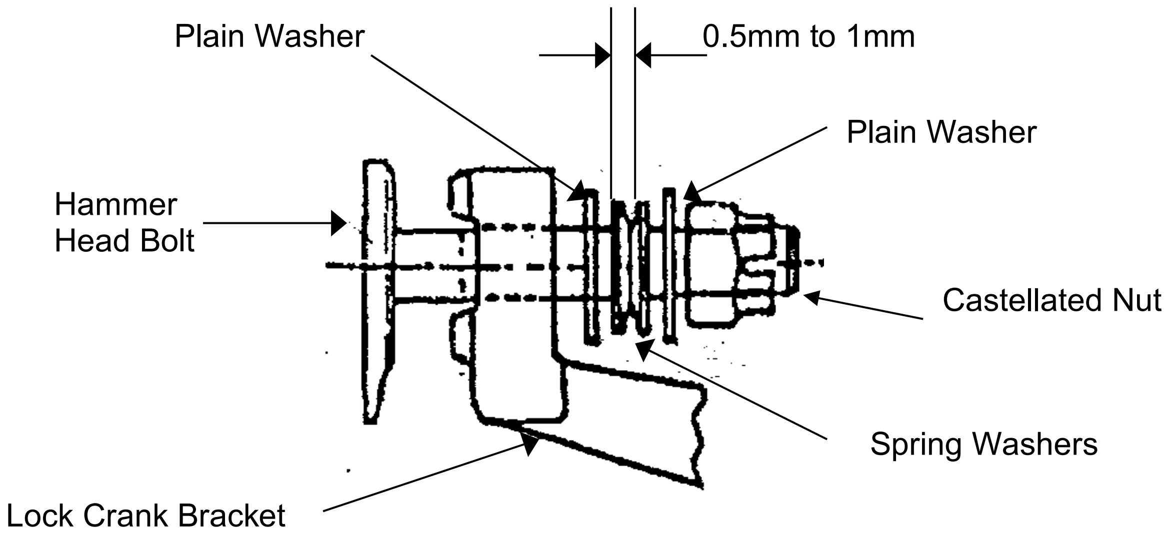
2.5 Component Details

2.5.1 Lock Crank Bracket ('C' arm) Assembly



Lock crank bracket ('C' arm) assembly for RT60 type rail. (Assemblies for UIC54 and 113A rail types are similar)

2.5.2 Detail (Hammer head bolt assembly)



3 CORRECTIVE & PREVENATIVE MAINTENANCE DETAILS FOR THE T72 POINT MACHINE AND VCC LOCK AND DETECTOR

3.1 Method of performing the Detection Test on the VCC Detector

Use the double ended 13/26 mm gauge to determine the operation of the lock contacts relative to the crank head position as it engages the locking piece during manual operation.

Figure 1

To check that the point detection is not ‘light’, the optimum moment of detection should occur midway between the 13 mm and 26 mm gauge positions. (Figures 2 and 3).

In Figure 2 and Figure 3 the crank head is shown moving towards the locked position (manual operation).
(The detector body has been removed for clarity).

Figure 2

The 13 mm gauge shall NOT overlap the locking piece.
If the gauge distance is less than 13 mm then the contacts are making late.

Figure 3

The 26 mm gauge shall overlap the locking piece.
If the gauge distance is greater than 26 mm then the contacts are making early.

3.2 Adjustment of the Detector Cam Stroke Tappet Screw

1. Open the switch blade.
2. Release the tappet screw lock nut.
   (Two 13 mm spanners are required)
3. Close and lock the switch blade.
4. Adjust the tappet screw until the 6 mm 'U' shaped gauge is a sliding fit.
5. Remove the gauge.
6. Open the switch blade.
7. Tighten the tappet screw lock nut.
   Check that the tappet screw does not move.
8. Close and lock the switch blade.
9. *Gauge* the stroke of the detector cam shaft.
   If correct proceed to clause 10 otherwise remove gauge and return to clause 1.
10. Remove gauge.
11. Open the switch blade.
12. *Measure* the overall length of the tappet screw and lock nut assembly (*7.3, Figure 4*).
    If greater than 17 mm, the cause shall be investigated and rectified. Possible causes may include a worn stock rail or damaged / worn brass plunger.

    NOTE If the tappet screw is unscrewed more than the 17 mm maximum to compensate for worn components it may become detached from the cam shaft.
    Renewal of the brass plunger is described in the next section.
    Return to DETECTION TEST VCC DETECTOR TEST (NR/SMS/Test/007).

3.3 Renewing the Brass Plunger

1. Disconnect CMA 24 cable connector in junction box. *(If applicable).*
2. Set the point machine selector lever to *'Hand'*.
3. Remove the VCC cover.
4. Remove the detector cover.
5. Manually operate the points to open the switch blade on the side to be fitted *(if applicable).*
6. Check detector finger is in pre-engagement notch. *(Switch open position, Figure 3).*

Figure 3

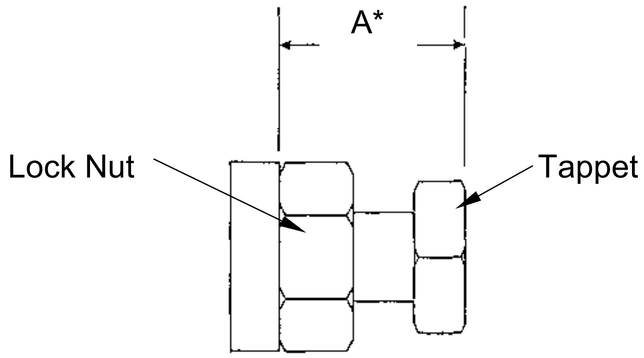
7. Remove detector from VCC lock body.
8. Remove plunger.
   (Dispose of in accordance with local instructions).
9. Insert plunger gauge into hollow bolt.
10. Re-fit detector.
    (2 screws in opposite corners sufficient).
11. Set tappet screw one to two turns out.
    *(Do **NOT** tighten lock nut).*
12. Lever the finger open and insert 6 mm gauge.
    *(Do **NOT** lever against plunger gauge adjusting screw. Insert screw driver behind finger pointing downwards towards pre-engagement notch with blade against base of terminal block to prevent damaging the plastic body, Figure 4).*

Figure 4

13. Slowly close and lock the switch.
    (Checking that the finger engages with the slot in the crank head).
14. Unscrew plunger gauge adjusting screw until it makes contact with head of tappet screw.
15. Unlock and open the switch.
16. Insert screwdriver to prevent finger springing back. *(Figure 4).*
17. Remove the 6 mm gauge whilst easing the finger into the pre-engagement notch.
18. Remove detector.
19. Remove plunger gauge without adjusting it.
20. Mark gauged length onto new plunger. Figure 5.

Figure 5

21. Cut plunger to plunger gauge length.
22. Insert plunger.
23. Re-fit and secure detector *(4 screws).*
24. Close and lock points.
    (Checking finger engages with slot in crank head).
25. Adjust detection tappet screw until 6 mm gauge is a sliding fit.
26. Open switch and tighten tappet screw lock nut.
27. Close and lock points. Re-check detector operation with 6 mm gauge.
28. *Measure* the overall length of the tappet screw and lock nut assembly.
    (dimension 'A' – Figure 6).



*Note: Maximum permitted length 17mm.

Figure 6

29. *Check* all fixings are secure.
30. *Lubricate* cam shaft. (NR/SMS/PC61).
31. Manually operate the points (over and back).
32. *Check* that the detector and lock operate correctly.
33. Refit the detector cover.
34. Refit the VCC cover and secure with the spring clips and RKB221 padlock.
35. Re-connect CMA 24 cable connector in junction box. *(If applicable).*
36. *FACING POINT LOCK TEST (NR/SMS/Test/005).*
    DETECTION TEST VCC DETECTOR TEST (NR/SMS/Test/007).

3.4 Procedure Following a 'Run-through'

To prevent damage to the VCC lock assembly in the event of a run through the crank lock arm has been designed to fail. The mode of failure will be by bowing, either concave or convex according to whether the associated switch rail was open or closed.

If a run through is suspected, examine the 'C' portion of the crank lock arm for each lie of points. An obvious gap between the 'C' heel and the switch rail shim pack when the associated switch rail is closed and locked will indicate a run through has probably occurred. In addition to the probable deformation of the 'C' arm, it is likely the detector contacts and "finger" will have become distorted – see Detector Mechanism section of this document if a run through has occurred.

To confirm the occurrence of a run through the crank lock assembly should be removed and the lock arm checked for distortion by placing it on a flat surface.

If the lock arm is found to be distorted, either concave or convex, then a run through has occurred and **both** lock crank assemblies shall be replaced along with a thorough examination and possible replacement of the detector mechanism.

The damaged lock crank assemblies and any elements of damaged detectors shall be destroyed to prevent accidental re-use.

If a run through has occurred the coupling and / or drive rods may have been distorted and other point equipment and fittings damaged.

Inform your SM (S) so that the necessary inspection and remedial action can be arranged.

3.5 Replacement of the Printed Circuit Board (PCB) in an Ansaldo T72 Point Machine Junction Box

- Isolate point machine *(disconnect CMA 24 cable plug coupler from junction box PCB).*
- Isolate junction box PCB, point machine heater supply cable (2 core), point control/detection cable (3 core).
- Note wire number and corresponding terminal block identity for the point machine heater supply also point control and detection.
- Unplug plug couplers and dummy plug coupler(s) if fitted.
- Disconnect point heater supply also point control and detection wires from respective terminal blocks.
- Carefully remove PCB assembly from junction box (retain fixings).
- Carefully install new PCB assembly in junction box and secure. *(Retain packaging for salvaged PCB).*
- Re-connect CMA 24 cable plug coupler.
- Re-connect plug couplers and dummy plug coupler(s) if applicable.
- Refit point heater supply and point control and detection wires in respective terminal block connections.
- Protect salvaged PCB with suitable packaging and return to the MSSCC for refurbishment.

3.6 Sources of Additional Information

The information contained within the maintenance specifications was sourced from the following documents. They may be used as a source of additional information.

Manufacturer's design changes may supersede the information contained within the documents listed below.

3.6.1 Ansaldo Signal: T72 Point Motor DC Permanent Magnet Type:

- Manual 2 Installation and Use
  Document No. 103 00 T 6520619-03 Rev. C
  2nd December 2002

3.6.2 Ansaldo Signal: T72 Point Motor DC Permanent Magnet Type:

- Manual 3 Preventative and Corrective Maintenance On-site
  Document No. 103 00 T 6520654-03 Rev. C
  2nd December 2002

3.6.3 Cogifer VCC Clamp Lock:

- Installation Manual
  Document No. 1010-100-004-A
  (1st October 2001 Edition)
- Maintenance Manual
  Document No. 1010-100-005-A
  (1st October 2001 Edition)

3.6.4 Cogifer VCC Detector:

- Maintenance Manual
  Document No. 1010-200-001-A
  (1st October 2001 Edition)

4 SD321 COLOUR LIGHT SIGNAL

The last function of maintenance is to test and observe that the equipment operates correctly from the controlling point.

Signal lamp voltage and proving tests shall not be carried out if a train is approaching as this may cause the displayed aspect to change from the lower to the upper unit.

4.1 SD321 Signal Details

4.1.1 Development

The SD 321 signal used with the Ansaldo ACC system has three aspects displayed from a single aperture which are operated and proved alight over a single pair of wires.

A signal head consists of two light units, each consisting of an optical assembly and an electrical filter unit. They are connected by a plug coupler and short cable.

The optical assembly contains 3 halogen lamps, one for the red aspect, one for the yellow and one for the green. Each lamp is mounted in a removable lamp holder. The optical assembly is sealed. It contains three filters, two dichroic mirrors and a lens. It is secured into the signal head by three bolts.

A dichroic mirror reflects light of one colour but allows light of other colours to pass through. The three light sources are mounted at right angles to each other.

The light from the red lamp passes straight though a red filter and then through the yellow and green dichroic mirrors.

The yellow light (from the top lamp) passes though a yellow filter and is reflected into the lens by the yellow dichroic mirror after passing through the green dichroic mirror.

The green light (from the bottom lamp) passes though a green filter and is reflected into the lens by the green dichroic mirror.

In the horizontal plane, the beam is slightly wider than a conventional signal but the beam is very narrow in the vertical plane. Correct adjustment of the signal head is therefore critical in the vertical plane.

4.1.2 Degraded modes

As each lamp is fitted with only a single filament, when a lamp fails, it cannot revert to an auxiliary filament. The failure of a lamp in one optical unit will cause a switch over to the other unit. The degraded mode 'corresponding auxiliary aspect' will be displayed.

If a train has passed the previous signal when a lamp failure occurs, then a more restrictive aspect may be displayed.

The normal aspects and degraded modes are shown below.

Aspect	Normal Aspect	Corresponding Auxiliary Aspect	Aspect Type
Red	Bottom red	Top red (previous signal at red)	2, 3 & 4
Yellow	Bottom yellow	Top yellow	2, 3 & 4
Double yellow	Top and bottom yellow	Top or bottom yellow (previous signal at double yellow)	4
Flashing yellow (single)	Bottom yellow	Top yellow (steady) **OR** Top yellow (flashing) see note below.	2, 3 & 4
Green	Top green	Bottom green	2, 3 & 4
Flashing yellow (double)	Top and bottom yellow	Top or bottom yellow (steady)	4

The flashing yellow auxiliary aspect is only available if the main flashing yellow aspect was already declared failed when a flashing yellow aspect is commanded to be displayed <u>and</u> there is no train approaching.

4.1.3 Failure of Corresponding Auxiliary Aspect

In the event that a corresponding auxiliary lamp should fail before the 'normally lit' lamp can be replaced then the next most restrictive aspect will be displayed.

4.1.4 Signal Lamp

The lamp is mounted in a holder which is secured to the optical unit with a bayonet type connection which also provides connection to the power supply.

The use of the correct lamp is vital to the performance of the signal. To produce light of the correct colour and intensity, the GE type M47 12 volt halogen lamp shall be used**.**

4.1.5 Signal Lamp Voltage

The signal lamp voltage shall be set to operate within the range **11.6** volts to **12.2** volts ac.

4.1.6 Maintaining the Specified Voltage Range

The lamp voltage cannot be adjusted at the signal head other than by means of adjusting the transformer in the lineside location case. However, this only provides a coarse form of adjustment. The lamp operating voltage is set up at installation and the control equipment maintains this voltage.

The set up voltage includes allowance for the length and type of cable feeding the signal. This is referred to as the ‘C – parameter’. If the cable is repaired or replaced, the lamp voltage shall be checked. If it is incorrect, the voltage parameters for the signal may need adjusting. This requires a data change, which currently has to be done by the manufacturer (Ansaldo), and a full re-test.

Conversely if the lamp voltage is found to be incorrect then the cable details, length, type, core size etc. shall be checked for compliance with the site drawings.

It is emphasised that any cable replacement shall be ‘like for like’.

Similarly cable repair shall not result in degradation of the original set up parameters.

On completion of the repair the lamp voltage shall be checked as follows:

(a) Check the lamp voltage of the most restrictive aspect is not less than 11.6V

then

(b) Check the lamp voltage of the normally lit aspect is not more than 12.2V (signals subject to the signallers extensive use of the auto-working facility should also be considered), i.e. predominant aspect displayed – green and not red.

The voltage is preset in the ACC and cannot be altered and should never require adjustment for maintenance purposes.

If the correct voltage cannot be maintained, report the problem to your SM(S) immediately.

4.1.7 Voltage on an Unlit Signal Lamp

If the voltage on any unlit lamp exceeds 0.8 volts report the situation to your SM(S) immediately.

A possible cause may be a faulty power supply unit. The unit cannot be serviced on site and should be replaced.

4.1.8 Signal Lamp Power Supply

All SDO signals are fed by POT / LAP circuits, with the exception of signals used to control the Cheadle Junction, Adswood Road, and the Macclesfield line. These signals are fed from PLS: 01, 51, 51A, 52, and 53 by POT / CLAM circuits.

4.1.9 Service Replacement

The GE type M47 12 volt halogen lamp is the only acceptable service replacement lamp.

Check that sufficient spare lamps are readily available.

If the lamp has recently been illuminated, the envelope and some metal components of the lamp holder will be very hot.

When changing the lamp take precautions to keep the lamp envelope clean, see *'Caution'* below.

The lamp shall be pushed completely into the lamp holder and shall be upright in the holder. Failure to do so may cause the beam to be out of alignment by up to 1.5° in the vertical plane.

Misalignment of the lamp can lead to the signal appearing dim when viewed from a train and in certain circumstances, when viewed off axis and close up; the signal may appear slightly discoloured.

It is therefore extremely important that after replacing a lamp, the colour of the particular aspect is checked from a position adjacent to where a train would normally stop.

If the signal appears discoloured re-check the lamp fitting and alignment and repeat the lineside check.

When replacing a lamp holder, the red notch on the lamp holder should align with the red notch on the optical assembly to check correct polarisation.

This lamp replacement procedure is described below:

- Turn the lamp holder counter-clockwise to release / remove the holder
- Remove the lamp
- Insert both pins of the new lamp into the sockets of the lamp holder
- Push the lamp firmly into its seat. Take care to avoid bending the pins
- Check the lamp is centred relative to the lamp holder. This is to check correct focusing of the optical system and the required visibility
- Align the red notches and re-insert the lamp holder

- Turn the lamp holder clockwise until locked
- Check that the lamp illuminates correctly

The glass envelope of a signal lamp, especially a halogen lamp, shall not be touched with bare hands because the skin's natural oils will cause the glass to blacken when the lamp gets hot. The light output will be reduced. Always use tissue paper or similar clean material when handling a signal lamp.

If the lamp becomes contaminated, clean it with methylated spirit.

4.1.10 Signal Lamp Failure Mode

An apparently 'healthy' lamp was found to be the cause of an intermittent signal failure. This incident has revealed that this type of lamp may fail intermittently prior to total failure. It is recommended that lamp substitution is considered as the first option when rectifying a similar fault. Recovered lamps shall be disposed of in accordance with local instructions to prevent accidental re-use which could result in a similar failure elsewhere and / or invalidate the lamp life monitoring data.

4.1.11 Replacement – Frequency

The GE type M47 12 volt halogen lamp has a rated life of 2000 hours when run at 12.0 volts as specified to check optimum luminance and aspect colour.

The lamp shall be changed when the aggregate operational hours are within 1750 and 1800 hours.

The actual period over which the hours are accrued will vary according to the typical daily operation of the signal and the usual aspect displayed.

To enable a robust and effective replacement schedule to be maintained, the operational life of each lamp in the signal head assembly is monitored. Therefore when a signal lamp is replaced, the MSSCC Box Technician shall be informed to enable the particular lamp life counter to be reset to zero ('no hours'). The ONLD PC at the Maintenance Desk in the MSSCC is used to extract and review this data. For further information refer to the Manchester South Signalling System O&M manuals.

4.1.12 Dispersing Lens

The dispersing lens (outer lens) spreads the light from the lens so as to provide the desired beam shape. There are three types of lens available for the SD 321 signal. Type 'A' (the 'standard') lens, type 'Bd' and type 'Bs'. The lens type is indicated by a small 'A' or 'Bd' or 'Bs' adjacent to the lens locating lug / nib on the rim at the bottom of the lens.

The type 'Bd' lens spreads the light to the right of the signal axis - 'd' (destro – right).

The type 'Bs' lens spreads the light to the left of the signal axis - 's' (sinistro – left).

The direction of the light spread is also indicated by a small arrow adjacent to the 'Bd' or 'Bs' identification. .

The majority of UK signals are fitted with the type 'A' lens.

It is important that the correct lens is fitted or the signal beam will not be aligned as specified on the signal head record card or sighting form. The beam produced by the lens will also be different.

The lens type and orientation marking is obscured by the lens retaining ring when mounted in the signal head.

4.1.13 Hot Strip

Unlike the lenses fitted to typical colour light signals the 'hot strip' is at the **top** of the lens and directs part of the beam downwards. The position of the lens is fixed by the small locating lug / nib engaging a slot in the lens retaining ring. The ring is secured by five screws arranged in a pattern to check correct orientation. Consequently the position of the 'hot strip' is not adjustable to operate at different angles.

4.1.14 Lens Replacement

Check that when replacing a dispersing lens that the small locating lug / nib on the rim at the bottom of the lens engages the **correct** slot in the lens retaining ring.

The centre slot is marked 'A' and is used for type 'A' lenses. The adjacent slots are marked 'Bd' and 'Bs' as appropriate. The locating lug / nib of the type 'Bd' lens shall be inserted in the slot marked 'Bd'. The locating lug / nib of the type 'Bs' lens shall be inserted in the slot marked 'Bs'.

Unless correctly seated, the lens will be mis-aligned reducing light output in the required direction.

4.1.15 Hood Replacement

There are three types of hood fitted to the SDO type signal. Each hood has been designed to check the optimum performance from the particular dispersing lens.

It is extremely important that the correct hood is fitted in conjunction with the particular lens type. For further details refer to 'Service Replacements (Signal Head Assembly)'.

4.1.16 Lens Cleaning

External
The external surface of the dispersing lens should be cleaned with a clean soft cloth dampened with water or similar non abrasive cleaning agent to remove dust and grime.

Internal
If it becomes necessary to clean the internal surface of the dispersing lens the optical unit will have to be removed. The method of cleaning is the same as for the external surface.

The reflectors and dichroic filters are sealed within the optical unit, and do not require any maintenance procedures.

To reduce the ingress of insects, dust, smoke or similar contaminants check that the door seal is in good condition. Arrange replacement if damaged or missing.

4.1.17 Signal Light Beam Alignment

Always refer to the signal head record card for the signal alignment details. If the details are not available or clarification is required, report it to your SM (S).

In the case of the 'Bd' and 'Bs' lens the alignment device does not align with the centre of the beam. The designated alignment point is specified at site and does not represent the point at which the signal will appear at its brightest.

The alignment procedure for the SD 321 signal is different to that used for other types of colour light signal.

The alignment device is a small portable telescope which is only fitted to the signal head for the duration of the alignment procedure. This permits use at other sites as necessary.

The signal head can be aligned by adjusting the nuts on the four M16 studs securing the signal head to the base plate. Four slotted holes in the base plate permit limited lateral rotation.

Because of the narrowness of the beam in the vertical plane, care should be taken to check that the signal head is correctly aligned.

The signal head is aligned as follows:

- Fit the small telescope to the two supports on the left side of the housing
- Raise the panel obscuring the corresponding hole in the background
- Adjust the signal head to align the centre of the cross on the alignment point
- Tighten the nuts and lock nuts on the four M16 base plate studs
- Tighten the nuts on the four M20 bolts securing the base plate to the post
- Check that the signal head is still aligned on the alignment point
- Remove the telescope
- Lower the obscuring panel
- Close and secure the access door

Check that the telescope is protected from damage during storage.

4.2 Item Replacement Procedures

4.2.1 Optical Unit

- Disconnect the plug coupler.
- Unscrew the M5 screw securing the lower lug of the unit.
- Unscrew the two M10 captive screws securing the side lugs of the unit.

- Remove the unit.
- Install the replacement unit into the aperture and firmly tighten the two M10 captive screws.
- Re-fit and tighten the M5 screw to check that optical unit is firmly locked in place.
- Reconnect the plug coupler.
- Confirm correct operation.

4.2.2 Filter / Power Supply Unit

- Remove the two ‘U’ links (power supply connection).
- Disconnect the earth connection.
- Disconnect the plug coupler.
- Unscrew the lower two knurled fixing nuts.
- Slide unit out of the signal head.
- Slide the replacement unit into position.
- Re-fit and tighten the lower two knurled fixing nuts.
- Reconnect the earth connection.
- Reconnect the plug coupler.
- Re-fit the two ‘U’ links (power supply connection).
- Confirm correct operation.

4.3 Construction Details

4.3.1 Signal Head Assembly Service Replacements

Component	Ansaldo Signal Part number
Housing assembly comprises: Housing Lower fixing / adjustment flange Cable terminal board Dispersing lenses type ‘A’ Hoods (compatible with lens) Background (1120 x 600mm)	P21B.000006
Housing assembly as above Dispersing lenses type ‘Bs’	P21B.000007
Housing assembly as above Dispersing lenses type ‘Bd’	P21B.000008

Hood (Signal fitted with a type 'A' lens)	109E.A29003
Hood *(Signal fitted with a type 'Bd' lens)*	109E.A29018
Hood (Signal fitted with a type 'Bs' lens)	109E.A29019
Dispersing lens (type 'A') (Standard lens)	2/993117
Dispersing lens (type 'Bs') (Where specified on site record card or sighting form)	2/993118
Dispersing lens (type 'Bd') (Where specified on site record card or sighting form)	2/993119
Optical unit	P21B.000003
Filter / Power supply unit	P31B.000001

4.3.2 Signal Lamp Service Replacement

Component	GEC Part number
12 volt halogen lamp	GE type M47

4.3.3 Fixings

Four slotted holes in flange (M20 bolts) – (typical signal head fixing / adjustment flange)

4.3.4 Weight

A complete signal assembly comprises of:

A housing unit: 58 Kg (approx.)

2 x Optical unit 7Kg (3.5 Kg each)*

2 x Filter unit 11Kg (5.5 Kg each)*

This makes a total weight of the signal assembly of approximately 76 Kg.

*The optical units and filter units are usually fitted after the housing unit has been fixed to the post or gantry.

4.3.5 Special Tools

Tools required in addition to the standard toolkit.

Component	Ansaldo Signal Part Number
Signal alignment telescope	109E.A29015

4.4 Ancillary Signals

These consist of the following:

- Position Light Junction Indicator (PLJI)
- Position Light Signal (PLS)
- Ground Position Light Signal (GPLS)
- Banner
- OFF Indicator

4.4.1 The Basic Lamp Driving Circuit

Each lamp (or pair of lamps for a PLJI) is driven directly by a POT (via a CLAM) over a 2-core cable, the maximum output of the POT being 60W. The POT provides the lamp feed and lamp proving.

The POT/CLAM combination produces a feed at 200 volts at a frequency of 250Hz. This is stepped down to 110 volts at an intermediate apparatus case. This then feeds to the transformer in the signal where it is transformed to 12 volts.

The POT provides a carefully regulated supply for the lamp and monitors that the current flowing is between pre-set limits. In the event of the lamp failing, its POT recognises that the current has fallen to nearly zero (a small amount of current still flows through the transformers). The POT then shuts down its output and provides an alarm to the signaller and MSSCC Box Technician.

The signal units and associated lamp details are shown below:

Unit	Lamps	Number of POTs	Rated Life (Hours)
PLJI	5 x 12V 24W SL35 2 pairs in parallel and 1 pivot	2 per route and 1 for pivot	Standard 2000 Long life 8000
GPL	3 x 10V 50W halogen (2 ON, 1 OFF)	3 (2 ON, 1 OFF)	6000
PLS	1 x 10V 50W halogen (1 OFF)	1 (1 OFF)	6000
Banner	3 x 12V 55W halogen (2 ON, 1 OFF)	3 (2 ON, 1 OFF)	1000

The rated life is dependant on the lamp being operated at the specified voltage.

4.4.2 Position Light Junction Indicator

The PLJI used in the Ansaldo ACC signalling system is optically similar with conventional PLJIs and uses the same SL35 lamps. The differences are in the internal wiring and the transformers provided.

To light a junction indicator requires three POTs, one for the pivot lamp and two POTs each driving two lamps wired in parallel. Lamps 1 and 3 are paired as are lamps 2 and 4.

The current sensing limits are set differently for the POT feeding the pivot to the other two POTs. Those feeding the junction arm lamps will detect the current falling below that required for two lamps but is more than that required to feed one lamp. It can thus detect a single lamp failure and shut down. The other lamp of the pair will be switched off. The POT feeding the pivot will detect when the current falls below that required to light one lamp and will switch off the feed to that lamp.

With a single POT shut down, there are at least 3 lamps lit so the signal is allowed to clear. If it is the pivot lamp that has failed, 4 lamps remain lit. Should a further lamp fail, this will shut down an additional POT. With 2 POTs shut down, the signal is prevented from clearing.

The PLJI transformers are of toroidal design. In the case of the single arm PLJI there is insufficient room for the three transformers and so theses are accommodated within a separate enclosure mounted within 5 metres of the PLJI with cabling between.

4.4.3 Position Light Signal

The PLS used in the Ansaldo ACC signalling system is optically and electrically similar to the fibre optic PLS and uses the same 10 volt 50 watt halogen lamps.

Normally a PLS is provided with a main and standby lamp, the auxiliary being switched in when the main lamp fails. Because of the relatively low usage of the OFF indication and the hours lit being monitored by the system, only a single lamp is provided. The lamp can be replaced after a specified number of hours before failure is likely.

The PLS unit is a standard fibre optic unit but with the auxiliary lamp and lamp proving relay omitted.

4.4.4 Ground Position Light Signal

The GPLS used in the Ansaldo ACC signalling system is optically similar to the fibre optic GPLS and uses the same 10 volt 50 watt halogen lamps. The differences are in the internal wiring and the transformers provided.

Normally a GPLS is provided with a main and standby lamp for both ON and OFF aspects, the auxiliary being switched in when the main lamp fails. Because of the low usage of the OFF indication and the hours lit being monitored by the system, only a single lamp is provided for the OFF indication. Main and auxiliary ON lamps are provided. The unit is wired differently to a standard unit. It is provided with three transformers (one per lamp) instead of the usual two.

The GPLS is directly fed by 3 POTs (via CLAMs). POTs are provided for the Main ON lamp, the Auxiliary ON lamp and the (Main) OFF lamp. Failure of the Main ON lamp will cause the Auxiliary ON lamp to light. Failure of the OFF lamp to light will cause an ON lamp to light so that the signal is not blacked out.

4.4.5 Banner Signal

The Banner Signal used in the Ansaldo ACC signalling system is optically and electrically similar to the fibre optic Banner and uses the same 12 volt 55 watt halogen lamps. Two ON lamps and one OFF lamp are provided.

4.4.6 OFF Indicator

The OFF Indicator used in the Ansaldo ACC signalling system is optically and electrically similar to the fibre optic OFF Indicator and uses the same 12 volt 55 watt halogen lamp.

4.4.7 Signal Lamp Replacement (PLJI)

The life of each signal lamp is monitored, consequently it is essential that if one of the non-pivot lamps is replaced then the other lamp fed from the same POT shall be replaced and the MSSCC Box Technician informed so that the lamp life counter for that particular circuit can be reset to zero (‘no hours’). Similarly, if the pivot lamp is replaced the MSSCC Box Technician shall be informed to enable that particular counter to be reset to zero. For further information refer to the O & M manuals.

4.4.8 Signal Lamp Replacement (PLS and GPLS)

When a lamp is replaced the MSSCC Box Technician shall be informed to enable that particular lamp life counter to be reset to zero. For further information refer to the O & M manuals.

5 CABLE MAINTENANCE

A safe system of work shall be agreed and implemented before any work is undertaken. The safe system of work may be by local directive.

Signal control cables, track circuit feed cables and apparatus case power supply cables operate at 230 volts. Before working on a cable, the cable shall be isolated at the Peripheral Location and steps taken to check that power cannot be re-connected before work is complete. (details can be found in NR/SMS/EL00).

Prior to working on any lineside circuit(s) check it is isolated and the MSSCC Box Technician made aware of the isolation.

Do not rely on the Field Device Controller disconnection switch alone to provide circuit isolation. Remove (and retain) the relevant ‘U’ link from the back of the unit or, where provided, slip the appropriate 2BA terminal link.

Do not rely on SW(2) or SW(3) disconnection switches alone to provide circuit isolation.

Isolate and lock S1 to isolate supplies to both SW(2) and SW(3).

5.1 Cables

Cables fall into one of five categories comprising: Monitored Cables, VIO Fed Cables, Non-Monitored Cables, Signal Control Tail Cables, and Other Tail Cables.

5.1.1 Monitored Cables

Signal Control Cables (ACC SIM PC monitored)

LAPS fed signals – Normally between the LAPS in the Peripheral Post and the filter in the signal head.

CLAM fed signals (only applies to signals fed from PLSs 01, 11, 51, 51A, 52 and 53) - Normally between the CLAM in the Peripheral Post and the step down transformer in the signal location.

In the rare cases where an isolation transformer is provided if the cable length exceeds 1300 metres, the monitored cable is between the CLAM in the Peripheral Post and the isolation transformer.

Point Control Cables (ACC SIM PC monitored)

All cables associated with point control and detection between the C-DEV in the Peripheral Post and the point junction box.

Track Circuit Cables (ACC SIM PC monitored)

The cables between the CTRC in the Peripheral Post and the step down transformer feeding the track feed unit (referred to as the Track Feed cables).

The detection and diagnostic cables between the track circuit relay/ICDR and the CTRC in the Peripheral Post (referred to as the Track Relay cables).

Power cables (SCADA Monitored)

Power cables connected to the SECAP 230 V power supplies between the Peripheral Location (PL) and apparatus cases, supplying the power for equipment such as AWS, TPWS, location heaters and lighting etc. are monitored by the in-built ELDs within the SECAP units. The alarms from these units are collected on the SCADA system and displayed on the SCADA terminal on the MSSCC Box Technicians desk.

5.1.2 Non-Monitored Cables

Indication cables

All VIO cables (control and indication) including:

Cables between the VIO or Terminal Board Rack in the Peripheral Post and the relay in the location case for equipment such as AWS and TPWS. The cables between the location case for equipment and the VIO or Terminal Board Rack in the Peripheral Post indicating the state of TPWS.

Multicore Cables

Multicore Cables between the Terminal Board Rack in the Peripheral Posts and the Fringe Boxes.

Signal Control Tail Cables

LAPS fed signals**;** not applicable.

CLAM fed signals (only applies to signals fed from PLS 01, 11, 51, 51A, 52 and 53),

The cables between the isolation transformer and step down transformer (where an isolation transformer is provided) and between the step down transformer and the filter unit in the signal head.

Track Circuit Tail Cables

The cables between the location case and lineside disconnection boxes and/or rails.

Other Tail Cables

The cables between the location case and equipment such as AWS, TPWS, etc.

5.2 Insulation Integrity Testing

5.2.1 Monitored Cables - ACC

These cables are continuously monitored by the ACC equipment. Should the leakage to earth exceed a pre-set level, an alarm is produced.

As set, the system will report the cable condition. If the cable resistance is greater than 5000kOhm, the Diagnostic Console will display **'Rd: > 5.0M'** with a status of **'Insulation OK'**.

If the resistance is between 5000kΩ and 1000kΩ, the actual value is displayed e.g. *1732K* with a status of **'Insulation OK'**.

If the resistance is less than 1000kOhm, the actual value is displayed, e.g. *135K* with a status of **'Insulation Error! <->'**.

Periodically, a record should be made of the actual values for earth leakage as measured by the monitoring equipment where these are less than 5000kΩ so that trends can be detected.

5.2.2 Monitored Cables - SCADA

Treat power cables as any other cable fitted with ELD.
High voltages are present on power cables, the appropriate precautions for working on high voltage equipment shall be implemented and observed (see NR/SMS/EL00).

5.3 Earth Monitoring Integrity Testing - ACC

This tests that the ACC's integral earth monitoring system is working correctly. The method of testing is described in NR/SMS/Test/171.

5.3.1 Equipment

The following equipment is required:

A calibrated resistance decade box with 'flying leads' that can be clipped to the Earth Bus-Bar (or similar suitable earth point) and inserted in to the 'test hole' on the 'U-Link' (see below).

Each 'U-Link' is provided with a 'test hole' in its insulation to enable the circuit to be tested without the need to partially withdraw the link thereby risking circuit interruption.

The actual circuits to be tested are detailed in the O&M manuals for the system.

5.3.2 Resources

Personnel will be required at the Peripheral Post and at the MSSCC as described below.

Peripheral Post: – to undertake the tests and to record the resistance shown on the CNT diagnostic screen section of the SIM PC (alternatively this can be viewed from the SIM PC on the "on-line" diagnostic terminal located on the Maintainers Operating Terminal in the MSSCC).

MSSCC: – to observe that the alarm is displayed on the Maintainers Operating Terminal.

5.3.3 Records

A list of the circuits tested, and a log of the test results shall be kept.

5.4 Monitored Cables – SECAP Insulation Monitor

The integrity of the signal power cable insulation is monitored by the Earth Leakage Detectors (ELDs) contained within the SECAP 230 volt power supply units fitted in the Peripheral Location. Each unit contains an integral audible alarm and LEDS which indicate the severity of the earth fault (local monitoring).
An alarm message will be displayed on the SCADA terminal on the MSSCC Box Technicians desk when the earth resistance drops below 5000k Ohm.
A typical message format is:
'North West Zone Manchester South – Middlewich South – REB 91 - PL 91 ELD FAILURE ALARM '

Earth alarms are to be investigated with on-site attendance at the earliest opportunity.

5.4.1 Non-Monitored Cables – Earth testing

V10 Fed Circuits:
These cables should be dealt with as any other tail cable connected to similar equipment, see NR/SMS/Test/051

Signal Control Tail Cables
These cables should be treated as any other tail cable and should be tested as specified in NR/SMS/Test/054

Track Circuit Tail Cables
These cables should be dealt with as any track circuit tail cable

Other Tail Cables
These cables should be dealt with as any other tail cable connected to similar equipment see NR/SMS/Test/051

5.5 Corrective Maintenance on Cables

5.5.1 Monitored, VIO Fed (Control), Signal Control Tail Cables and Power Cables

The cabling differs from conventional signalling in that most cables are two core rather than multicore and the distances between disconnection points are much greater. Different techniques are therefore required for fault location.

Earth faults on these types of cable shall be located and repaired promptly. The system can tolerate a single fault. Such a fault shall be removed before a second fault occurs at a different point on the cable. This allows, in normal circumstances, up to two weeks for remedial action.

As the monitoring system can cover groups of cables, the actual defective cable shall be localised.

Testing with the 1000 volt insulation tester will escalate the breakdown of defective cable insulation thereby reducing the time scale for remedial action.

Cables showing values between 5000kΩ and 1000kΩ

- The specific defective cable should be identified and tested within four weeks (maximum).
- The defective cable should be regularly monitored and remedial action agreed with the SM (S).

Monitored cables showing values between 1000kΩ and 100kΩ inclusive

- The S&TME shall authorise retention in service and manage the repair within two weeks (maximum).
- The Route Asset Manager (Signals) shall be advised of the situation as soon as practicable.
- All actions taken shall be recorded.
- The insulation resistance of any cable in this insulation range shall be re-checked every 24 hours.

- The insulation resistance values shall be recorded to enable the rate of degradation to be assessed.

If the rate of degradation increases rapidly the S&TME shall be informed and urgent remedial action taken.

The S&TME authority to retain in service is extended down to 100kΩ.

Cables showing values below 100kΩ (except track circuit feed circuits)

- The Route Asset Manager (Signals) has the discretion to retain in service.
- There will be no need to sign out of use in this range pending this permission.
- The defective cable should not be allowed to remain in service for more than two weeks (maximum).
- During this period the insulation resistance value of the affected circuit shall be checked and recorded on every shift to enable the rate of degradation to be assessed.

If the rate of degradation increases rapidly the S&TME shall be informed and urgent remedial action taken.

Track circuit feed cables showing values at or below 50kOhm

- The affected circuit shall be repaired within 2 days, if this is not possible:
- The signaller will invoke GE/RT8000 Rule Book Module TS2 'Track circuit block regulations' - Section 10 – 'Failure of signalling equipment' until such time as the failure is repaired.

With the proposed method of testing, there is a risk that an earth fault may be present and undiscovered for some time. Any earth fault discovered shall be promptly located and repaired.

The location of a fault might require the use of a Time Domain Reflectometer. Once localised it is necessary to identify at site which cable is the one in question.

Spare cables have not been provided so there is no easy means of cable diversion available. Any substitute cable used shall be of the same conductor size and length as the defective cable. Any cable inserted as part of a repair shall be of the same conductor size and length as the cable it replaces.

Cable jointing techniques are the same as for normal signalling cables.

Before re-commissioning a previously defective circuit, the requirements of SMTH shall be followed.

A particular hazard is that of cables being connected to the wrong function. A crossed cable may cause a wrong signal to show a proceed aspect. Where more than one cable is cut, it is essential that it is positively established that the correct cables are being rejoined.

Track Circuit Tail Cables

These are repaired, tested, and re-commissioned in the appropriate way for that type of conventional equipment.

Other Tail Cables

These are repaired, tested, and re-commissioned in the appropriate way for that type of conventional equipment.

Service Replacement

For details of replacement components refer to section 11.

6 CONTROL ROOM EQUIPMENT

6.1 Display System

6.1.1 Rear Projection Display System

The image displayed on the rear projection cube screens (wall display) is produced by a GraphXMaster Projector. To promote optimum performance of the projector the optical system shall be kept scrupulously clean, preferably by keeping invasive maintenance to the absolute minimum.

Personal protective equipment will be required when servicing this apparatus, especially when handling the lamp.

6.1.2 GraphXMaster Projector

High voltages are present in the projector.

When performing any service on this equipment, precautions for working on high voltage equipment shall be implemented and observed.

An AC leakage test shall be performed on completion of any service to check the equipment is safe to operate.

A 500 volt dc Insulation Tester is required; the test is detailed in NR/SMS/Test/173.

For further information see GraphXMaster Service Manual - 54-017145-02P - section 2.3 General Guidelines – AC Leakage Test – Cold Check.

6.1.3 Electro Static Sensitive Devices (ESSDs)

ESSDs are installed in this equipment. Electro Static Sensitive precautions shall be taken during all servicing of this equipment.

6.1.4 Projector Lamp

The lamp used in the ‘GraphXMaster’ projector is a 100W Ultra High Pressure (UHP) lamp which produces an intense source of light and heat. The lamp should be enclosed during operation and shall be treated with care.

Never look directly into the lens of the projector. The brilliant light emitted may cause permanent damage to your eyes.

The ultra-violet light generated by the lamp can have the same effect on the skin and the eyes as sunlight. Wear ultra-violet protective goggles with side guards when servicing the lamp.

6.1.5 Ventilation

To check that the lamp and projector do not overheat the ventilation slots shall not be obstructed.

6.2 Lamp Replacement in the GraphXMaster Projector

6.2.1 Aggregate Hours

The aggregate operational hours of the lamp are monitored by the system software and can be ascertained by pressing the 'Display' key on the keypad.

It is recommended that the lamp should be changed when its aggregate operational hours total 6000. If the lamp is used in excess of 6000 hours the risk of the lamp shattering is increased as a result of changes in the quartz glass.

Never remove the lamp from its housing immediately after it has been powered down. The lamp is under great pressure when hot and may explode causing personal injury and / or property damage.

6.2.2 Precautions

After turning off the projector wait at least 20 minutes before unplugging it to allow sufficient time for the internal fans to cool the lamp and for the projector to automatically turn off. The fans will shut off when the lamp has cooled sufficiently.

The lamp shall be allowed to cool for at least 1 hour before removing it from the lamp compartment.

When replacing the lamp, do not touch the sapphire (glass) surface of the lamp otherwise the output will be seriously degraded. Intense heat (hotspots) can occur where fingerprints are left and could cause the lamp to explode.

If the surface is accidentally touched it shall be cleaned with a lint-free cloth moistened with isopropyl alcohol.

Always wear clean cotton gloves and protective UV goggles with side protection when handling the lamp.

6.2.3 Procedure

- Press 'POWER OFF' on keypad to isolate the projector.
- Wait until the fans automatically shut off.
  Approximately 20 minutes.

- Remove the 2 small panels on the rear panel to gain access to the input panel and the lamp.
  4 screws per panel.
- Turn OFF the MAIN POWER SWITCH
  Located on the input pane).
- Unplug the projector and allow the lamp to cool
  Approximately 1 hour.
- Loosen the captive screws securing lamp module.
- Pull the lamp module from its compartment using the handle provided.
  Keep the module level as it is withdrawn by supporting it underneath with your other hand.
- Slide the new lamp module into position using the handle provided.
  Keep the module level as it is inserted by supporting it underneath with your other hand).
- Check that it is fully inserted into its compartment and secure in position with the captive screws.
- Plug in the projector.
- Turn ON the MAIN POWER SWITCH.
- Replace both access panels and secure in position.

  NOTE If the lamp module is not seated properly in the compartment or the captive screws are not tightened sufficiently the lamp module will not strike and the lamp error code '**4**' will appear on the status screen.

- Reset the lamp timer to record the aggregate operating hours of the new lamp.
  Service Menu.
- *Adjust the CSC (primary colour purity).
- (Adjust CSC)
  Highly recommended.
- *Align the lamp unit.
  6-Axis Adjuster.

*: For procedure refer to GraphXMaster CX50-100U Installation and Maintenance Manual - 54-017148-02P - section 2 - Installation and Setup.

6.2.4 CSC

The function of the CSC is to adjust the actual colour of the primary colours (red, blue, and green) to achieve optimum matching between cube screens in the video wall (wall display). Adjustment may be required when a lamp is renewed. Check that sufficient time has elapsed for the new lamp to warm up before proceeding.

The quality of the primary colours may deteriorate when a lamp is nearing its maximum permitted operational life (6000 hours).

6.2.5 6-Axis Adjuster

The 6 axis adjuster comprises 4 screws and a 2 position lever. Any distortion observed in the displayed image can be corrected by adjusting the screws using the 5mm and 2 mm Allen keys provided in the User's Kit.

6.2.6 Focus

Once set, adjustment of the image focus should not be necessary. Any subsequent adjustment to counteract distortion of the projected image may require the attention of a skilled technician. The focus can be manually adjusted by turning the thumb screws on the lens barrel but is not normally required.

6.3 Cleaning

The projector shall be unplugged before cleaning.

Generally, cleaning should not be necessary and should be avoided unless absolutely essential. This is to prevent accidental contamination of the optical surfaces and subsequent degradation of the projector output.

Maintaining the cleanliness of the projector and its components during servicing is essential to the continued optimum performance of the projector.

During servicing take every precaution to avoid contaminating the optical surfaces. Fingerprints on the optical components may cause a noticeable reduction in lamp output. Wear clean cotton gloves when handling internal components.

6.3.1 Projector Lens

To avoid the risk of scratching the lens it should only be cleaned when it is absolutely necessary, i.e. degradation of the image and / or foreign bodies appearing on the wall display.

A light coating of dust will not adversely affect the quality of the image.

If cleaning is required, use a clean DRY soft cotton cloth rubbing gently in a circular motion.

6.3.2 Projector Lamp

The lamp should not require cleaning during its lifetime.

However, if the sapphire (glass) surface is accidentally touched with bare hands it shall be cleaned with a lint-free cloth moistened with isopropyl alcohol.

Finger marks or similar contamination will reduce the output of the lamp and create 'hotspots' which may cause the lamp to explode.

6.3.3 Cube Screens (Low glare and High contrast type)

Clean with a clean soft damp cloth rubbing gently in a circular motion.

6.3.4 Cube Enclosure

Clean with a clean soft damp cloth. Do not use liquid or aerosol cleaners.

6.4 Keypad, IR, and Wired Type

6.4.1 Keypad Batteries

The keypad is powered by 4 AA size alkaline batteries.

6.4.2 Battery Replacement Procedure

- Remove cover on the underside of the keypad.
  Push the small tab in and up at the same time.
- Remove old batteries.
  Dispose of in accordance with local directive(s).
- Fit the new batteries.
  The battery orientation is marked in the battery compartment.
- Refit the battery cover.
  Check the bottom edge of the cover engages the rim of the compartment before closing. An audible 'click' will indicate that the cover has been refitted correctly.

6.5 Sources of Information

For further information refer to the relevant sections of:

GraphXMaster User Manual - 54-017144-02P (© 2001).

GraphXMaster Service Manual - 54-017145-02P (© 2001).

GraphXMaster CX50-100U Installation and Maintenance Manual - 54-017148-02P (© 2001).

6.6 Ordering Service Replacements

The equipment is covered by the ACC system product approval, projector lamps (and other components) can be ordered direct from Christie.

The following details are required:

- Christie Digital System part number (each item)
- Projector model number*
- Serial number*
- Date of manufacture*

*These details are on the projector license label.

The Christie Digital System part numbers are shown in the parts index list in section 5 (Parts and Module Replacement) of the GraphXMaster Service Manual - 54-017145-02P. Exploded views of the equipment to assist identification of the components are also included.

7 MSCC System Layout - Fibre Optic Configuration

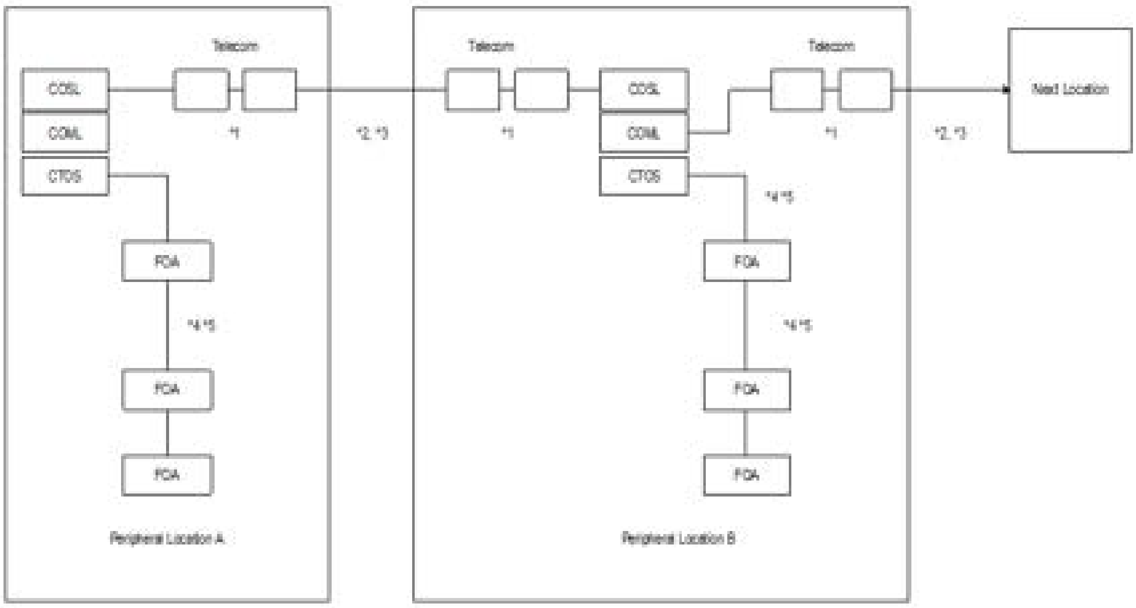
The infra-red light used for transmitting data in the fibre optic system is not visible but the intensity is sufficient to cause permanent eye damage. Do not look into the end of a fibre, nor directly into the open connectors of a fibre optic card while the card is plugged into a working system.

Module(s) shall only be changed with the co-operation of the maintenance desk operator. The signaller shall be informed of any likely effects.

Determine whether the fibre optic cable(s) to be tested are part of the primary or the secondary system. If the system on which tests are to be performed is active, check that the alternative system and its components are functioning correctly before commencing tests.

These tests require use of specialist test equipment that shall only be used by an ‘Instrument Engineer’ or a ‘Special User’ who has been suitably trained in their use.

7.1 MSCC System Layout - Fibre Optic Interconnection



Simplified Layout – Single Link

Transmission between peripheral locations is at 1310 nm over single mode fibre, with SC-AP end connectors.

Transmission within the peripheral location between CTOS and FOA, FOA - FOA is at 850 nm over multi mode fibre, with ST end connectors.

The entire transmission network duplicated with automatic changeover to check system availability.

Notes:

*1: SC-AP connectors

*2: 1310 nm transmission over single mode fibre

*3: Fibre in external telecomm cable

*4: Multi mode fibre with ST connectors

*5: 850 nm transmission

7.2 Values

Minimum bending radius **20 mm**

Transmission Level

Module	Input Sensitivity	Output Power
COML	-15 dBm	-31 dBm
COSL	-15 dBm	-31 dBm
CTOS	-15 dBm	-31 dBm
CTOM	-11.5 dBm	-24 dBm
COMX	-11.5 dBm	-24 dBm
FOA	-15 dBm	-31 dBm
PCDR	-11.5 dBm	-24 dBm

Maximum permissible loss

Component	Loss
Fibre optic patch cord	1 dB
Fibre optic cable section (Single mode, 1310 nm)	23 dB

For actual fibre optic cable section losses refer to loss budget records in local documentation.

Permissible attenuation for fibre optic components

Component	Loss
Connector (two connectors mated = one connection)	0.40 dB
Splice	0.05 dB
Fibre Loss (Single mode, 1550nm)	0.22 dB per km
Fibre Loss (Single mode, 1310nm)	0.22 dB per km

Calculated Attenuation for a Fibre Optic Cable Section

If the actual loss exceeds the budget records or the calculated section loss, investigation is required. Tables for calculation of expected section loss are given below.

Permissible attenuation for fibre optic cable section

Component	Quantity	Loss (dB)	Product
Connector		0.40 dB	
Splice		0.05 dB	
Fibre Loss		0.22 dB per km	
Total (Calculated loss for section)			dB

Typical Attenuation for Fibre Optic Components

Component	Loss
Connector (two connectors mated = one connection)	0.40 dB
Splice	0.05 dB
Fibre Loss (Single mode, 1550nm)	0.22 dB per km
Fibre Loss (Single mode, 1310nm)	0.22 dB per km

7.3 Connector types in use

	Lead connector	Card connector
COML/COSL	SC	SC
Telecoms interface	SC-APC	SC-APC
CTOS	ST	ST
FOA	ST	ST

8 SERVICE REPLACMENT COMPONENTS

8.1 Track Circuit Capacitor (TH)

The track circuit capacitor (TH) is fixed to a mounting plate that is secured to the rack with the plugboard’s lower fixing screw.

Description	Type
Track Circuit Capacitor (TH) 2.2µF	Capacitor (ASF) N9502700225

Description	NRS Part Number
Mounting Plate	NRS 0050/000694

8.2 Field Adaption Unit

The original units have been discontinued. Equivalent units providing the same functionality are available under the following part numbers:

Old Part Number	New Part Number
MSC/11/00/00	FF05-000-SG-DRG000001
MSC/11/00/01	FF05-000-SG-DRG000002
MSC/11/00/02	FF05-000-SG-DRG000003
MSC/11/00/03	FF05-000-SG-DRG000004

Old Part Number	New Part Number
MSC/11/00/04	FF05-000-SG-DRG000005
MSC/11/00/05	FF05-000-SG-DRG000006
MSC/11/00/06	FF05-000-SG-DRG000007
MSC/11/00/07	FF05-000-SG-DRG000008
MSC/11/00/08	FF05-000-SG-DRG000009

8.3 POT Field Device Controllers

The firmware installed on the original POTs that interface the BR867 Track Feed Units and SD321 Main Signals to the Ansaldo ACC interlocking has been updated. The new unit is available under the following part number:

Old Part Number	New Part Number
FM9088300400	FM90883000402

8.4 CDEV Board

The surge arrestor has been removed from the CDEV board and a new part number allocated. The new board is available under the following part number:

Old Part Number	New Part Number
FM9088300903	CDEV-06 B22B.0100150

8.5 CTRC

The CTRC has been modified in compliance with the SHWW redesign. The version has been incremented but the existing part number has been retained. Some of the earlier boards may have been modified and labelled accordingly. If an early type board is not labelled it shall not be used and should be returned to the store or to your SM(S) so that it can be returned to the manufacturer for modification.

Version	Part Number
See wiring diagram	B2GB.000021

End

1. Road Traffic Light Signals

1.1 General Description

Early type traffic lights were fitted with 36-watt filament lamps and can often be identified by the high visibility white border on the periphery of the lamp backboard.

The later filament type is fitted with 50-watt Quartz Halogen (QH) lamps and can be identified by the high visibility red and white border on the periphery of the lamp backboard.

A new LED unit is now approved. The three types shall not be mixed at the same crossing.

Many older installations have been converted to use the 50-watt QH lamps to comply with the improved performance for road traffic light signals specified by BS505. On early conversions the high visibility red and white border was clamped on to the existing backboard.

The modified assemblies were fitted with a GEC identification label on the underside of the lamp bowl unit. The red lamp unit should be labelled LL5101 and the amber lamp unit LL5102.

1.2 Lens Orientation

It is important that the plastic lens (Red or Amber) is installed correctly and that the beam is concentrated downwards.

The plastic lens comprises a large number of small lenses arranged in rows on the rear face of the lens. The lens shall be installed with the arch of the small lenses upper most. Some lenses might have the word “TOP” embossed on the inner or outer face near the edge of the lens to indicate the correct orientation. See Figure 1.

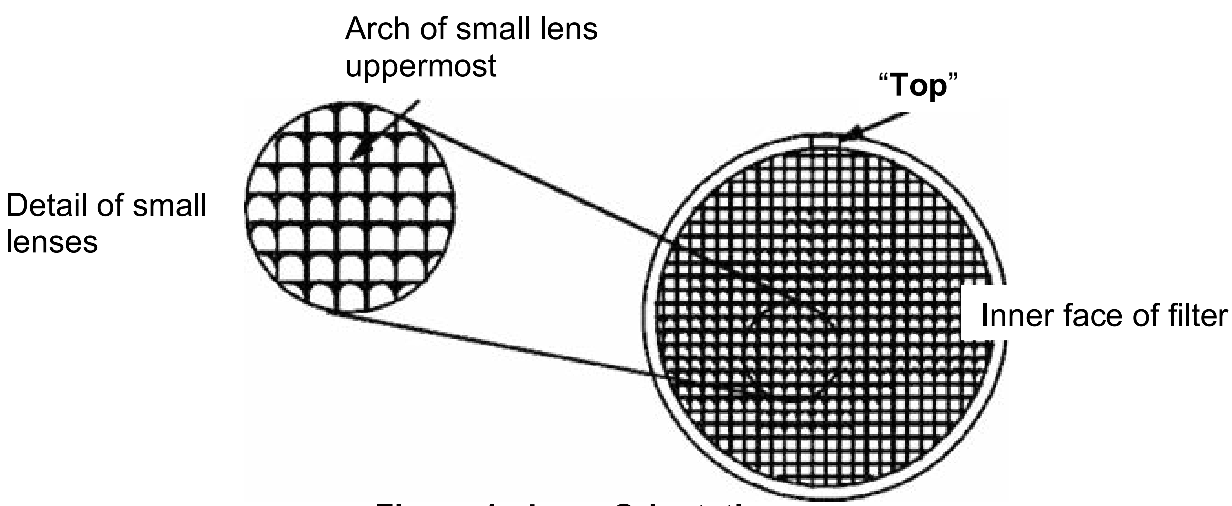


Figure 1 - Lens Orientation

The lens fitted to the QH type lamp assembly should have “TOP” moulded on a small raised block on the rim at the rear of the lens.

The latest type of traffic lights replacing the 50W QH lamps are LED based.

LED modules are NOT interchangeable with the current lamp assemblies and cannot be replaced individually, nor can they be mixed on the same crossing.

2. Booms

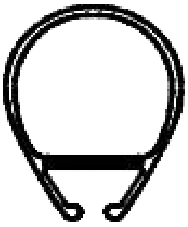
2.1 General Description

Booms may be constructed of wood, aluminium or glass reinforced plastic (GRP) e.g. Western Region type barrier.

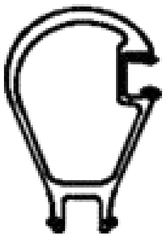
The method of construction can also vary. Timber booms may be laminated or jointed lengths of solid timber.

Other types, such as boom gates, are constructed of marine ply to form a box section approximately 300 mm x 200 mm. The addition of vertical timbers creates the “gate like” assembly.

Some barrier machines are similar in design but are fitted with booms of different cross section. When replacing a damaged boom, it is essential for the continued correct operation of the barrier equipment that the replacement boom is the correct length and that the boom cross section is correct for the machine. See Figure 3 also Barrier out of Balance (Tip) Force.



Used on G.W.E. Type Manually Controlled



Used on BR Spec. 843 machines manufactured by G.W.E. and Smiths Industries

Figure 2 - Cross section of typical metal booms

SPX style booms shall be measured from the centre bolt of the side arm, older GWE’s shall be from the end of the slot for the boom within the side arm, Penguins shall be from the centre pivot.

3. “Sangamo” or “Schlumberger” Time Switches

NOTE: *These time switches are no longer permitted and shall be replaced by the SELC electronic timer.*

3.1 Back-up Battery

The 110V supply cannot supply the peak pulse currents required by the time switch mechanism. These pulses are supplied from the internal back up battery which is also there to cover for power failures.

The backup battery is therefore essential to the correct operation of the time switch, such that a faulty battery can seriously affect the accuracy of the device.

As the purpose of the time switch is for controlling / muting the night time Yodalarm output, a slow time switch can eventually result in a muted Yodalarm during day time operation.

If a clock consistently loses time, arrangements shall be made to replace the time switch as soon as practicable.

Even if the time switch appears to be accurate the battery condition can be examined as follows:

- Remove the Cover
- Detach the timer dial by unscrewing the screw in the centre of the dial and easing it off. Do not turn the knurled Knob.

If the battery shows any sign of discharge or contamination, the complete unit should be considered as being defective and a replacement obtained.

The battery, which is incorporated in the printed circuit, cannot be replaced on site.

The battery should be examined when installing time switches as the battery condition can also deteriorate during storage.

NOTE: *The manufacturer recommends that the life expectancy of the backup battery with continuous use is approximately 10 years. However, prolonged storage in a discharged state may have an effect on the battery, limiting the life expectancy. It is recommended that the time switch is replaced at five-year intervals.*

3.2 Day Omit Device

The “Sangamo” or “Schlumberger” time switches may also incorporate a “Day Omit” option which is not required when they are used at level crossings. It is extremely important that this option is disabled. There are two methods by which this may be achieved.

The “Day Omit” option is controlled by seven arrows, one for each day. It is therefore extremely important that this option is disabled for each day of the week. Otherwise the volume of the “Yodalarm” will be muted during the daytime on those days not disabled.

Method 1

a) The position of the arrows on the “Day Omit” dial may be observed by carefully turning the “Day Omit” dial so that each arrow is just visible in turn at the edge of the main dial. The arrows on the face of the “Day Omit” dial shall be set to point towards the centre of the dial. See Figure 3. Take care not to rotate the timer dial.

b) To adjust the direction of an arrow, use a small flat bladed screw driver (blade approx. 3mm wide) and turn the arrow in an anti-clockwise direction until it points towards the centre of the “Day Omit” dial.

c) Check that the time setting is correct.

Method 2

Remove the central screw holding the timer dial and carefully lift it off. See Figure 3.

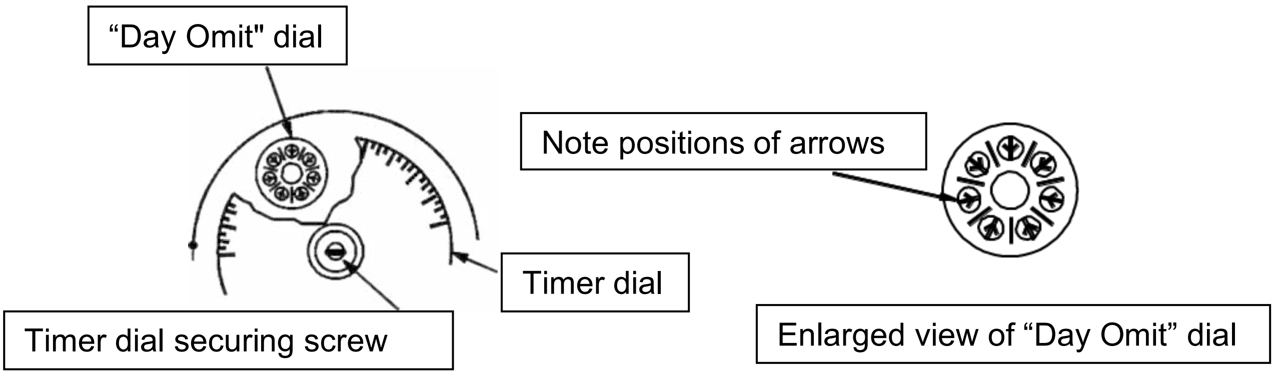


Figure 3 – Time Omit Device

Caution: Do not turn the knurled knob because the “ON” and “OFF” timing tappets will be loosened, and their relative time settings may be lost.

The arrows on the face of the “Day Omit” dial shall be set to point towards the centre of the dial.

To adjust the direction of an arrow, use a small flat bladed screw driver (blade approx. 3mm wide) and turn the arrow in an anti-clockwise direction until it points towards the centre of the “Day Omit” dial.

When all the arrows of the “Day Omit” device are set correctly, carefully replace the timer dial and secure with the centre screw.

Check that the time setting is correct.

3.3 Volume Control Adjustment

The times when the volume of the audible warning is to be reduced will be stipulated in the level crossing order or on the crossing layout drawing where an order does not exist. The timer “ON” and “OFF” tappets shall be set to correspond with these times.

The standard time clocks are supplied with pairs of “ON” and “OFF” tappets. The second tappet acting as a back-up for each type. The “ON” tappets switch the audible warning to the higher volume (Day setting) and the “OFF” tappets to the reduced volume (Night setting). i.e. “ON” days and “OFF” nights.

The first tappet of each type (“ON” or “OFF”) should be set to the time specified in the Order or layout drawing. The second (back-up) tappet of the pair should be set to follow approximately one hour later.

The latest type of time switch made by a firm called SELC. It is electronically based, and it carries out the change to and from British Summer Time (BST) automatically. In early 2008 each area was supplied with a sufficient quantity of SELC timers to replace the previous mechanical type. These should be replaced at the NEXT maintenance visit or failing that at the earliest opportunity.

4. British Railways Board Automatic Half Barrier Crossing - Machines

4.1 General Description

The British Railways Board (BRB) Mk I and Mk II Automatic Half Barrier Crossing (AHBC) machines are often referred to as the “Penguin” type because of the bulbous shape of the concrete column.

The column tapers towards the top and may carry the road traffic light signals. At many crossings the road traffic light signals have been removed from the column and the typical post mounted road traffic light signal assembly has been installed adjacent to the machine.

The barrier operating equipment is housed in a steel frame mounted to the rear of the column. Robust moulded ABS plastic covers protect the equipment. The ‘Y’ barrier machine, contained the telephone and local controls.

Two doors were provided in the side of the top cover, one for public access to the telephone and the other for operator access to the Local Control Unit.

The operator's door is fitted with a locking device activated by a magnet bonded to the inner face of the machine cover adjacent to the door lock.

When the door is closed and locked, the magnet lifts a gravity-operated pawl at the rear of the lock permitting the key to be withdrawn.

At some installations the telephone has been removed. A cover without a telephone access door has been fitted to the machine.

This modified cover is necessary to prevent unauthorised access to the local control buttons via the adjacent unlocked telephone door.

The telephone is usually relocated in a weatherproof housing mounted on a post adjacent to the barrier machine. Similar arrangements may also apply to the local control unit.

The timber boom is mounted on boom carriers on either side of the machine. The boom lengths range from 3.98 m (13ft 1in) to 6.02 m (19ft 9ins) pivot to tip.

Boom lengths of 3.35 m (11ft 0ins) to 3.96 m (13ft 0ins) are available for special installations.

Two boom lamps are usually fitted, one of which is mounted approximately 150 mm (6 ins) from the tip of the boom.

The boom carriers on either side of the machine are fitted with moulded ABS plastic covers. These covers, often referred to as the anti-guillotine shields, shall be fitted securely to provide protection from the equipment as it operates. Arrangements shall be made to replace the shields if they are damaged or missing.

On early models, the main shaft on which the boom mechanism rotates, was carried on plain shell bearings. This main shaft / shell bearing assembly required frequent re- alignment following bearing renewal or if the boom was damaged.

During the 1970s the main shaft / bearing assembly of many machines were converted to a self-aligning bearing arrangement utilising special washers. An oil hole was also provided in the top of the bearing housing.

Many machines were subsequently fitted with PTFE coated bearings to produce a self-lubricating bearing, consequently an oil hole was not provided in the bearing housing.

PTFE coated bearings shall not be oiled as the oil can cause the coating to deteriorate.

4.2 Top Ram Pin Clamp

The hydraulic ram, which operates the barrier, is pivoted from a ram bracket fitted to the bottom of the steel frame attached to the rear of the concrete column.

The bottom pivot may be either a ram pin or bolt and nut assembly. The top of the ram is connected to the boom driving lug sub-assembly by a ram pin.

The ram pins are secured with split pins except where the modified top ram pin is fitted.

The ram journal rotates around the top ram pin as the ram extends and retracts to raise and lower the barrier.

If the pin is not lubricated it is prone to seizure and the barrier might fail in the raised position.

This is a potential Wrong Side Failure condition. However, oiling shall be done carefully to avoid surplus oil contaminating the “Metalastik” bush fitted to the ram journal.

A clamp has been developed to prevent the top ram pin turning in the driving lug sub- assembly.

The ram pin has been modified to incorporate a central hole and a grease nipple, which is fitted to one end of the pin. See Figure 4.

This arrangement makes the lubrication easier to apply and is delivered direct to the ram journal.

The clamp and modified top ram pin assembly can be fitted on site.

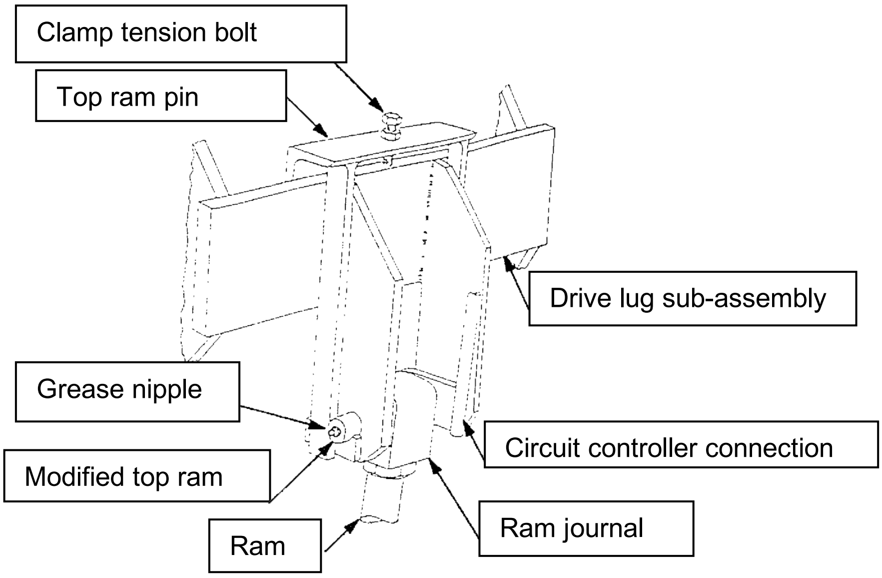


Figure 4 – Top Ram Pin Clamp Assembly

4.3 Local Control

The button switching mechanism is interlocked to check that only one button can be in the depressed position. When a button is depressed it is mechanically latched and is only released when another button is fully depressed and latched.

To check that the crossing is returned to automatic operation, the “Auto” button shall be depressed and the interlocking lever / cam assembly repositioned against the push button fascia.

The cam engages the aperture of the depressed “Auto” button verifying that the other buttons cannot be depressed. Unless this procedure is followed the access, door cannot be shut and locked.

The lever / cam assembly is an interlock and is not intended to force the “Auto” button into the latched position. The button shall remain latched until released by depression of another button.

Due to normal wear, free play might be present in the lever / cam assembly.

Therefore, it is very important that the “Auto” button remains latched irrespective of the position of the interlocking lever.

If the latching mechanism does not operate correctly, arrangements shall be made to replace the unit as soon as possible.

4.4 Barrier Out of Balance (Tip) Force

With the weights fitted and correctly adjusted, check the barrier is able to lower within the specified time. Incorrect setting can affect the lowering time.

The barrier might be slow to lower or prevented from lowering during windy conditions.

It is essential for the continued correct operation of the barrier machine that the correct boom is fitted, especially when a boom is replaced. If a boom of a different weight or of an incorrect length is fitted, the existing boom weights are likely to be incompatible and the out of balance force incorrect.

An incident occurred during strong windy conditions in which an incorrectly weighted boom was still lowering as the train passed over the crossing.

The boom eventually reached the lowered position, just within the time margin, allowing the crossing to normalise before the crossing indication time out period expired.

Consequently, the crossing operation was “normal” and the Signalman was unaware of the problem. A serious accident could have occurred.

Always check the replacement boom is a "like for like" replacement and that the out of balance (tip) force is correct even though the boom might appear to be identical.

NOTE: *Details of the out of balance tip force weights can be found in NR/SMS/PartZ/Z04 (Level Crossing – Reference Values).*

4.5 Hydraulic Unit (Removal)

a) Close the stop valve and manually raise the barrier to the fully raised position using the hand pump. See Figure 5.

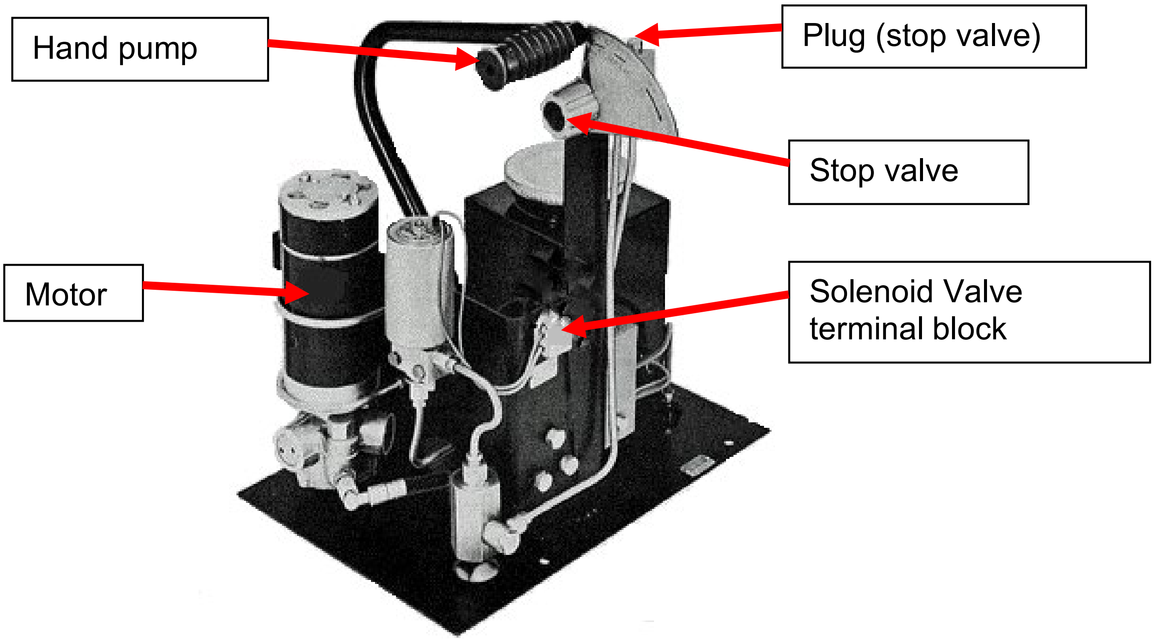


Figure 5 – Hydraulic Unit

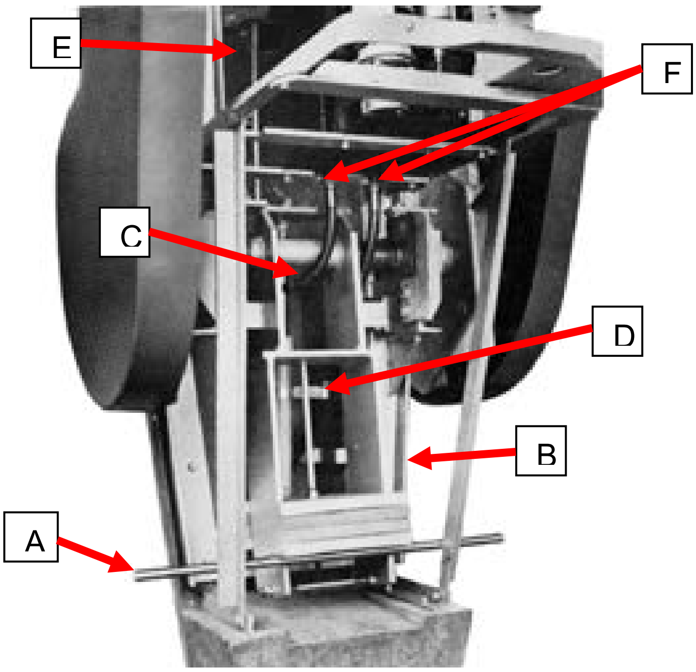


Figure 6 – Hydraulic Unit (Replacement)

b) Place a strong bar (A) between the machine frame and the counter balance weight carrier arm (B). See Figure 6.

c) Open the stop valve (1) to release the hydraulic pressure.

d) Disconnect the wires from the motor (3).

e) Disconnect the wires from the solenoid valve terminal block (4).

f) Carefully remove the plug (5) from the top of the stop valve body and connect the special drain pipe.

g) Close the stop valve (1). With a clean container held beneath the drain pipe, use the manual hand pump (2) to drain the reservoir (E).

h) Loosen the hose connections (F) at the bottom of the reservoir.

i) Remove a blanking plug from the connection at the bottom of the new unit.

j) Check the new unit is protected from contamination.

k) Disconnect one hose (C) and quickly fit the blanking plug to the connection (F) to prevent residual oil running out of the reservoir.

l) Temporarily tie the hose in an upright position to prevent loss of oil.

m) Repeat disconnection procedure for the other hose.

n) Remove the bolts securing the hydraulic unit to the machine frame.

o) Carefully remove the hydraulic unit from the machine frame.

4.6 Hydraulic Unit (Replacement)

a) Manoeuvre the hydraulic unit into the machine frame and bolt in position.

b) Reconnect the flexible hoses (C) to reservoir connections (F).

NOTE: *The hoses shall also be renewed at the time the pack is replaced as any contamination within the existing hoses can migrate back into the reservoir of the pack thus causing early ‘hunting’ problems of the new pack as the contamination takes effect.*

c) Check the bracket (D) securing the flexible hose to the ram body is secure.

d) Reconnect the wires to the solenoid valve terminal block (4).

e) Reconnect the wires to the motor terminals (3).

f) Fill the reservoir with clean approved hydraulic oil. Use the dipstick attached to the filler cap to determine the level. The reservoir capacity is approximately 2.3 litres (1/2 gallon).

g) Close the stop valve (1) and operate the hand pump.

h) With the boom manually supported carefully remove the locking bar (A).

i) Open the stop valve (1) and lower the boom.

j) Use the hand pump (2) to fully raise and lower the boom 3 times to bleed air from the system.

k) Restore the machine to power operation and raise and lower the boom 3 or 4 times and observe that the machine operates correctly.

l) Check the hydraulic system for leaks and rectify as necessary.

m) Check the level of the hydraulic oil and top up as necessary.

n) Replace the filler cap.

o) Check the operating time is correct.

RAISE TIME	4 to 5 seconds
LOWER TIME	6 to 8 seconds

p) Restore machine to automatic operation. See Restoring to Service.

5. G.W.E. Electro / Mechanical and Electro / Hydraulic Barrier Machine

5.1 Limit Switch

The 24-volt battery feed is housed in the pedestal of the Electro/Mechanical barrier machine

The limit switches fitted to the G.W.E. Electro/Mechanical and Electro/Hydraulic machines are manufactured by Crabtree.

The original switches were manufactured with the hole centres spaced at 30 mm x 80 mm and are identified by the Crabtree part number 24395. These dimensions were subsequently changed to 30 mm x 60 mm. The later type can be identified by the Crabtree part number 15045/2.

NOTE: *The original Crabtree switches are now obsolete. New Honeywell types are available but require the mounting plate changing at the same time.*

The Crabtree switches are not interchangeable and the whole mounting plate should be changed. When switches are changed it is essential that the mounting plate and switches are secure and the contact gap is correct.

The internal switch unit is secured within the metal housing by two screws. The housing is tapped to accept a conduit connection; however, when used in the barrier machine a plastic insert is fitted forming an open entry gland for the cable.

Drops of moisture can enter the switch unit through the open cable gland. The resulting contamination and corrosion could cause the switch to malfunction and could result in a Wrong Side Failure. It is therefore essential that the anti-condensation heaters and the thermostat operate correctly. The thermostat should be set to approximately 16°C (60°F).

A rubber grommet or similar cable gland sheath should prevent the ingress of moisture. Mastic sealant is not recommended as it might enter the switch and affect the operation of the contacts and could result in a Wrong Side Failure.

6. G.W.E. Electro/Mechanical Barrier Machine, Electro-Magnetic Clutch Mechanism Type

6.1 Barrier Damping Adjustment

The damper controls the lowering of the barrier and prevents the barrier end stop striking the road surface with excessive force, the result of which could damage the barrier and associated equipment. To check that the feature is operating correctly, proceed as follows:

a) Isolate the machine from power.

b) Observe the barrier as it descends.

The barrier should lower gently to the horizontal position and come to rest without bouncing.

If the damping is insufficient, turn the adjusting valve screw, if fitted, very slightly in a clockwise direction.

NOTE: *The damper adjusting screw is very sensitive and requires minimal adjustment to alter the damping effect. When the correct damping is obtained secure the screw with the locknut.*

If correct damping cannot be obtained by adjusting the screw, the barrier shall be re- balanced using the counter-weights. Moving the counter-weights can be used to increase their effective weight when the barrier is horizontal.

7. Lifting Barrier Machine to BR Spec 843

7.1 Main Shaft Weather Seals

When refurbishing the barrier machine, the seals and the exposed portions of the main shaft shall not be painted. (Else the seals can stick to the main shaft and are damaged when the barrier is operated. This can allow water to penetrate, which on freezing could prevent the barrier operating.

Seals that have been deformed, cut, or torn shall be replaced.

7.2 Main Shaft End Cap

Machines supplied with booms less than 7100 mm (pivot to tip) are not fitted with a support arm. An end cap should be fitted to the machine pedestal to cover the exposed end of the main shaft.

A mastic compound is used to provide a weatherproof seal between the end cap flange and the pedestal. The end cap shall be kept secure and the mastic seal in good condition to prevent the ingress of dirt and water which could freeze during the winter months.

Frozen grease and water caused both barriers at an AHB crossing to remain raised during the passage of a train. Grease expelled from the bearing during greasing could fill the end cap and extreme winter temperatures might cause it to freeze with similar results.

Packing the end cap with grease to prevent the ingress of water is not recommended for the same reason. The use of a frost resistance grease might be necessary during the winter months.

7.3 Boom Re-Fitting Procedure

a) Note the number and size of the weights on each side arm.

b) Remove the weights from the side arms.

c) Lift the side arm to the horizontal position and support.

d) Replace, if necessary, the displacement detection micro switch. See boom displacement detection micro switch re-fitting procedure.

e) Locate the boom adapter (pre-assembled to the boom) on to the two taper bushes fitted to the side arm. Check that the boom adapter is correctly seated in the side arm channel. See Figure 7.

f) Secure with two M12 x 70 bolts, each bolt to be complete with special thick washer (16 mm internal diameter) under the head of the bolt, M12 plain washer and an ordinary M12 hexagonal nut. See Figure 7.

g) Support the boom assembly at the tip.

h) Check that the boom and boom adapter fastenings are tight.

i) Fit and secure, if provided, the skirt linkage to the pedestal.

j) Fit and secure, if provided, support frame. See Support Frame Re-Fitting.

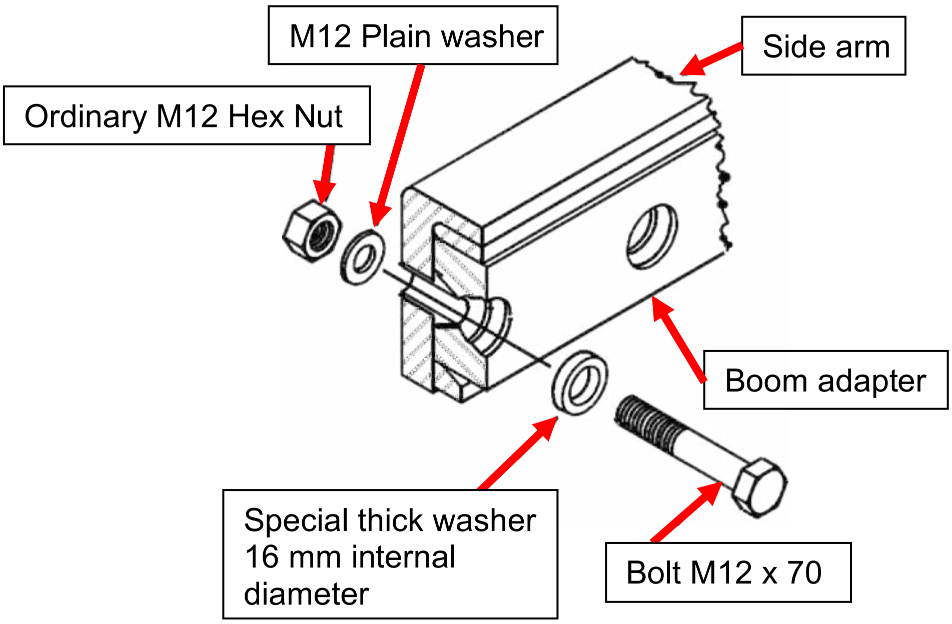


Figure 7 - Boom adapter to side arm - initial assembly

Assemble the Locating Pins with the Special Thick Washer (16 mm internal diameter), “E” Clip, and M6 Slotted Pan Head Screw. See Figure 8.

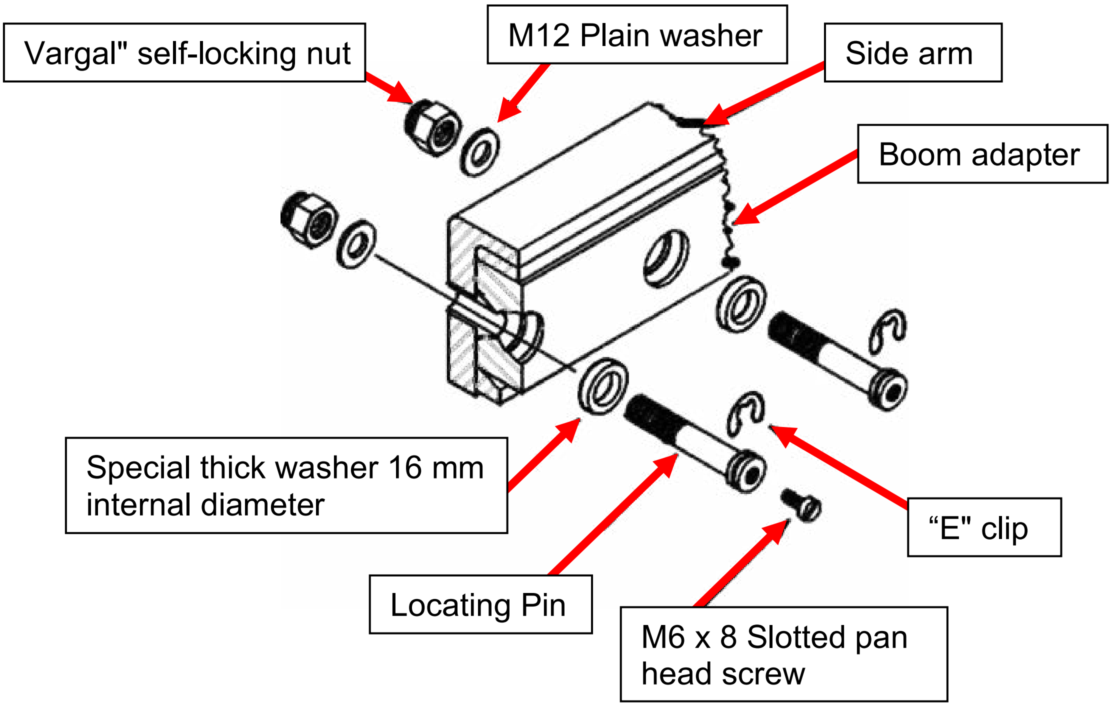


Figure 8 - Boom adapter to side arm fixing

k) Apply adhesive type grease to the locating pin assembly.

l) Remove one temporary M12 x 70 bolt assembly. Replace with a locating pin assembly complete with the special thick washer, M12 plain washer and "Vargal" self-locking nut.

NOTE: *The "Vargal" self-locking nut is designed to be re-used.*

m) Hold the locating pin assembly by inserting a screw driver into the slot of the M6 pan head screw. Tighten the "Vargal" self-locking nut to 16 Nm (12lbs. ft).

n) Remove the M6 pan head screw.

o) Repeat the procedure for the other temporary bolt assembly.

p) Pack the locating pin "E" clip cavity with adhesive type grease.

q) Fit the flexible conduit, which carries the boom light and displacement detection wires, over the fulcrum and then into the pedestal. Secure by means of the cable clips.

r) Route the boom light and displacement detection wires within the pedestal and fix into position. Check that the wires are supported clear of all moving parts and cannot become trapped when the door is closed or when the ram unit operates.

s) Remove the support from the side arm, fit, and secure the weights.

t) Fit, if provided, the strainer wire and adjust as necessary. See '7.6 Strainer Wire Re-Fitting'.

u) Terminate the boom light and displacement detection wires and check that the circuits operate correctly.

v) Measure the tip force and adjust the weights as necessary.

w) Operate the machine manually.

x) Power operate the barrier five times and observe that the operation is satisfactory.

y) Re-adjust the strainer wire, if necessary. See '7.7 Strainer Wire Tension'.

7.4 Assembly Bolts and Spare Locating Pins

It is good practice to keep the M20 x 70 bolts, nuts, washers, spare locating pins complete with "E" clips, M6 pan head screws, "Vargal" nuts and washers in a bag in the relay room or REB. The components are then readily available in the event of boom displacement or false indication.

Where the components have to be stored in the machine pedestal, check that they cannot interfere with the operation of the machine. Anti-rust protection may be necessary in some locations. Rusted or distorted "E" clips shall be replaced otherwise they might fail prematurely in service or during installation.

7.5 Support Frame Re-Fitting Procedure

NOTE: *The support frame shall not be fitted until the boom has been fitted.*

a) Slide the clamp plates into their approximate positions in the boom slot.

b) Fit and secure the support frame adapter to the support frame.

c) Position the Support Frame Adapter and using a 12 mm A/F Hex. Wrench Key screw the two M12 Taper Ended Screws so they protrude into the Side Arm. See Figure 9.

d) Commencing at the Pedestal End of the Support Frame, secure each Cross Member to a Clamp Plate with two M12 x 25 mm bolts and M12 washers. See Figure 10.

e) Check that the Cross-Member fastenings are tight.

f) Adjust the two M12 Taper Ended Screws so their taper ends protrude into the Side Arm by approximately 10 mm when measured from its outside face.

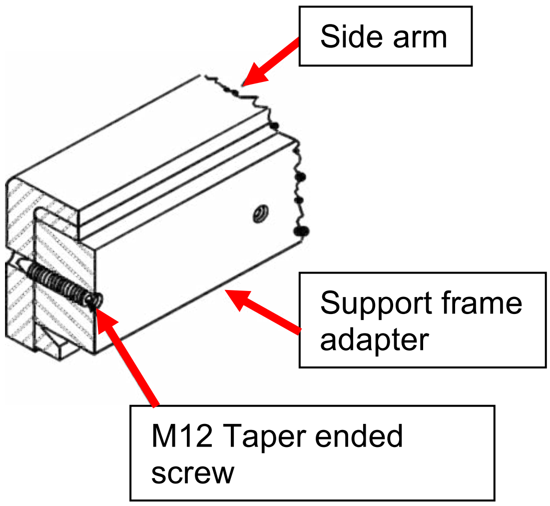


Figure 9 - Support frame adapter and side arm assembly

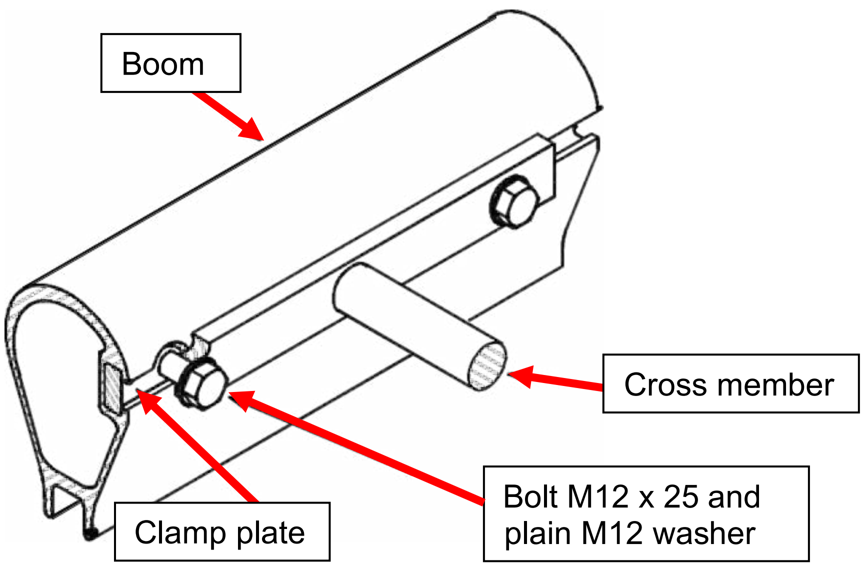


Figure 10 - Cross member to boom assembly

7.6 Strainer Wire Re-Fitting Procedure

a) Fit and secure the Strainer Wire Support and Rear Anchorage assemblies onto the Side Arm.

b) Check that the Boom Tip Eye Bolt assembly is secure.

c) Fit and secure the Strainer Wire.

d) Adjust the tension of the Strainer Wire so that the boom is straight throughout its length. See ‘7.7 Strainer Wire Tension’.

NOTE: *Only approved strainer wire shall be used.*

7.7 Strainer Wire Tension

If after carrying out the SMS process or replacing a strainer wire it requires to be tensioned the following process should be carried out.

With the barrier in the lowered position the strainer wire should maintain the boom in a straight alignment (i.e. minimum sag).

If a boom support is provided it should be removed temporarily before assessing the alignment of the boom or adjusting the tension of the strainer wire.

This is to check that enough tension is applied to the strainer wire to maintain the boom in straight alignment.

When the tension is correct, tighten the Rear Anchorage adjusting nuts.

Apply adhesive type grease to the exposed adjuster threads to protect the threads and make adjustment easier when required.

Refit the boom support, if provided.

7.8 Boom Displacement Detection Micro Switch Replacement Procedure

The micro switch assembly comprises a mounting bracket to which is fitted the micro switch and a short length of wiring harness encased in a flexible conduit. The micro switch assembly is fitted to the underside of the boom adapter. See Figures 11 and 12.

a) Remove the M6 x 15 screw.

b) Remove the M4 Dog point socket head screw.

c) Loosen the M4 socket head screw securing the conduit clamp to the inner face of the side arm.

d) Disconnect the 4-pin connector. (Adjacent to the conduit clamp).

e) Remove the short length of skirt channel (complete with skirt rods, where fitted)

f) Disconnect the 2-pin connector. (Adjacent to the micro switch).

g) Loosen the M4 socket head screw securing the conduit clamp to the boom adapter.

h) Remove the two M4 pan head screws securing the micro switch mounting bracket to the boom adapter.

i) Remove the old micro switch assembly.

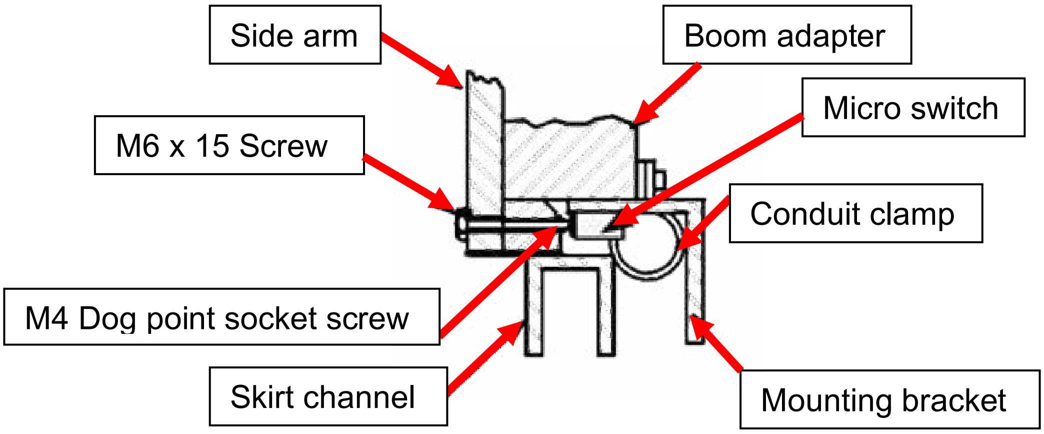


Figure 11 - Section through boom assembly looking towards the machine (cables and wires not shown)

j) Fit the new micro switch assembly and secure to the boom adapter.

k) Locate the flexible conduit in the conduit clamp.

l) Tighten the conduit clamp securing screw.

m) Reconnect the 2-pin connector.

n) Refit the short length of skirt channel (complete with skirt rods, where fitted).

o) Reconnect the 4-pin connector.

p) Tighten the conduit clamp securing screw.

q) Set the boom detection by carefully adjusting the M4 Dog point socket screw until the micro switch contacts just 'make'.

NOTE: *This should be undertaken using a multi-meter as over-tightening of the Dog Point socket screw can cause severe damage to the micro-switch assembly*

r) Turn the screw a further ½ turn (maximum).

s) Refit the M6 x 15 screw to protect the micro switch adjusting screw.

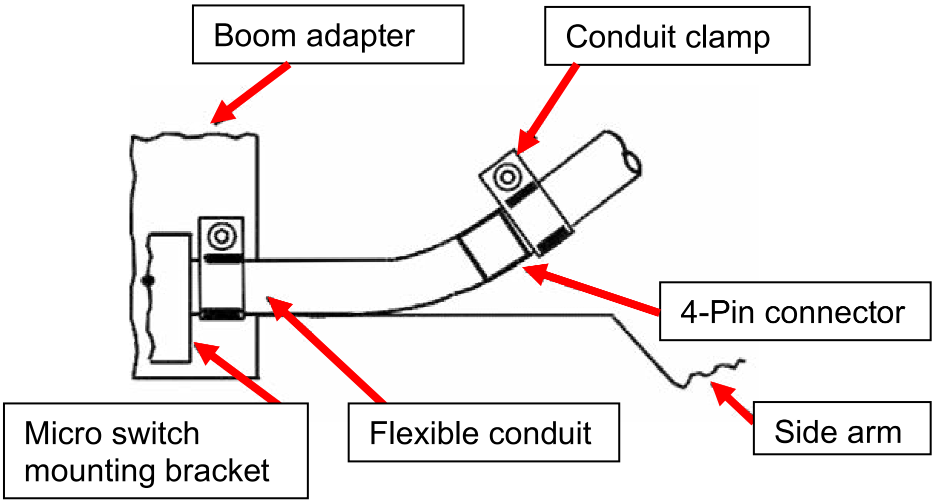


Figure 12 - Micro switch mounting

It is important that the 4-pin connector is located on the correct side of the side arm conduit clamp. Otherwise the connector might not pull apart when the boom is dislodged and the boom displacement detection could fail to operate. To prevent the cable being strained the clamps shall be secure and the conduit held firmly without damage.

7.9 False Indication of Boom Displacement

If false indications of boom displacement are reported, check the setting of the M4 Dog point socket screw that operates the micro switch.

This screw is located beneath the M6 x 15 mm screw fitted at the lower edge of the side arm. See Figure 11.

a) The M4 Dog point socket screw should be set so that the micro switch contacts just 'make'.

NOTE: *This should be undertaken using a multi-meter as over-tightening of the Dog Point socket screw can cause severe damage to the micro-switch assembly*

b) The screw should be turned a further 1/2 turn (maximum).

c) Refit the M6 x 15 screw to protect the micro switch adjusting screw.

If the setting was found to be correct, check that the boom adapter is securely fitted to the side arm. Any movement of the boom adapter might cause the micro switch to operate.

If movement of the boom adapter is suspected, do not try to secure it by tightening the nuts on the locating pins otherwise the “E” clips might be distorted or displaced.

Use the M12 x 70 bolt, washer, and nut assembly to tighten the boom adapter onto the side arm. See ‘7.3 Boom Re-fitting Procedure’.

7.10 Barrier Out of Balance (Tip) Force

With the weights fitted and correctly adjusted, check the barrier is able to lower within the specified time. Incorrect setting can affect the lowering time.

Incorrect setting could affect the lowering time or might prevent the barrier from lowering during windy conditions.

It is essential for the continued correct operation of the barrier machine that the correct type of boom is fitted, especially when a boom is replaced.

If a boom of a different weight or of an incorrect length is fitted, the existing boom weights are likely to be incompatible and the Out of Balance Force incorrect.

An incident occurred during strong windy conditions in which an incorrectly weighted boom was still lowering as the train passed over the crossing. The boom eventually reached the lowered position, just within the time margin, allowing the crossing to normalise before the crossing indication time out period expired.

Consequently, the crossing operation was “normal” and the Signaller was unaware of the problem. A serious accident could have occurred.

Always check the replacement boom is a “like for like” replacement and that the Out of Balance (Tip) Force is correct even though the boom might appear to be identical.

Correct setting of the Out of Balance (Tip) Force is especially important at Automatic Half Barrier Crossing (AHBC), Automatic Full Barrier Crossings Locally Monitored (AFBCL), Automatic Barrier Crossing Locally Monitored (ABCL) and Automatic Open Crossing Locally Monitored plus Barriers (AOCL+B) installations.

NOTE: *Details of the out of balance tip force weights can be found in NR/SMS/PartZ/Z04 (Level Crossing – Reference Values).*

7.11 Hydraulic Unit (Removal)

The power pack can be changed with the barrier either raised or lowered. If, due to local traffic conditions, the pack has to be changed with the barrier in the raised position check that it is safely secured.

NOTE: *Failure to do so results in the barrier crashing down.*

a) Lower the boom.

b) Isolate the machine from the power supply and disconnect the plug coupler on the top of the unit.

c) Remove the bolts from bottom bracket (3). See Figure 13

d) Check that the unit is supported in an upright position and remove the bolts from the top bracket (2).

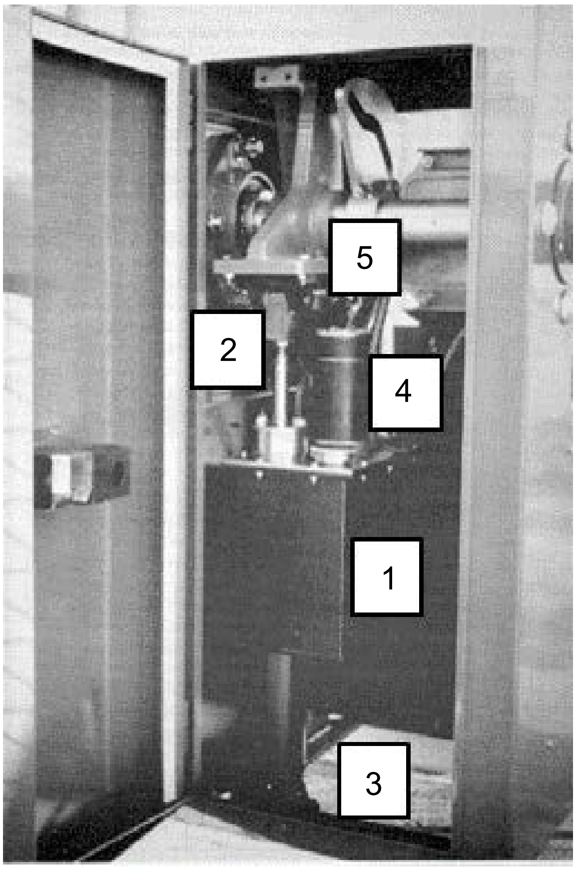
e) Note which holes in the operating arm were used as there are two fixing positions ‘Short Stroke’ and ‘Long Stroke’. The holes not used should have been fitted with nuts and bolts painted red during manufacture. (Arrange replacement if they are missing).

f) The “Long Stroke” position (bolt holes furthest from the pivot shaft) is used if the boom length is in excess of 7100 mm (pivot to tip).

g) Lift the hydraulic unit (3) remove from the barrier machine pedestal.

h) The hydraulic oil can be drained from the unit via the reservoir filler.

i) Replace the cap securely to prevent the ingress of dirt or water.



1 Hydraulic unit and reservoir.

2 Top pivot bracket (see note 2).

3 Bottom pivot bracket (see note 2).

4 Motor.

5 Ram-rod adjustment (see note 1).

Figure 13 – Barrier unit Internal components (front)

NOTE: *The PTFE lined pivot bearings shall not be lubricated.*

NOTE 2: *The length of the ram-rod is set during manufacture and shall not be altered as this affects the timings and damage the machine.*

7.12 Hydraulic Unit (Replacement)

NOTE: *It should be noted that there are two different types of power packs which can be fitted within a BR843 cabinet.*

The Grey units are fitted within AHB and MCB installations and fail in the lowered position if the solenoid feed is disconnected.

Blue coloured units are fitted within ABCL installations and require the solenoids to be energised for the barrier to lower. (i.e. they can fail in the raised position). It should be noted that some drive up drive down GWE units have been replaced with blue packs.

The correct type of power pack should be selected.

a) Remove the new unit from its transit box. Use box to return old unit.

b) Clean the pivot bracket fixing bolts, if necessary.

c) Hold the unit upright and carefully position the bottom pivot bracket (3) onto the mounting in the base of the pedestal and bolt in position.

d) With the unit supported in an upright position fill the reservoir (1) with clean approved hydraulic oil until it is visible in the strainer. The reservoir capacity is 10 litres (2.2 gallons).

e) Check the machine is isolated from the power supply and reconnect the plug coupler.

NOTE: *Current packs are self-bleeding. If the pack is not self-bleeding, the ram shall not be connected to the operating arm until the hydraulic system has been bled as follows:*

f) Keep the unit in the upright position and use the manual pump handle to fully extend the ram.

g) Continue to pump for another 5 full strokes of the manual pump handle.

h) Stow the manual pump handle and restore the power to the motor and solenoid valve.

i) Operate the motor for approximately ten seconds and then isolate the machine from the power supply.

j) Check that the ram top pivot bracket (2) is located in the same position on the operating arm as the original unit and bolt in position.

k) Top and bottom pivot securing bolts shall be fitted with TAB washers.

NOTE: *The dimension between the joint faces of the top and bottom pivot brackets is set at the factory to check that the boom should be horizontal when fully lowered.*

This dimension shall not be altered. Unauthorised adjustment of the ram-rod length might result in incorrect operating times and could damage the ram and associated equipment.

l) Using the hand pump, check that the machine operates correctly. Raise and lower the boom 2 or 3 times. Approximately 20 full strokes of the handle should be necessary to fully raise the boom.

m) Restore the machine to power and raise and lower the boom 3 or 4 times and observe that the machine operates correctly.

n) The barrier should rise smoothly without hesitation and should not oscillate excessively during the last few degrees of movement.

o) Check the operating time is correct.

Boom Length	Up to 7.3 m (24 ft)	Over 7.3 m (24 ft)
Raise Time	4 to 6 seconds	6 to 8 seconds
Lower Time	6 to 8 seconds	8 to 10 seconds

p) Power the boom to the fully raised position. Observe that the boom rises smoothly and remains in the fully raised position without any signs of lowering.

q) When the boom is released, it should lower smoothly and be damped during the last 10° of fall.

r) Set the Auto / Manual valve to the correct mode of operation and secure with the pin and wire seal. See Lock Down Feature Also Restoring to Service.

s) Check the level of the hydraulic oil, top up as necessary. The oil should be just visible in the filler strainer.

t) Replace the filler cap securely.

7.13 Operators Door Micro Switch

When the operators’ door is closed and locked it is electrically proven by a micro switch operated by the movement of the lock tongue.

Problems have occurred when the door has been locked but not proven. To check correct operation of the lock and micro switch proceed as follows:

a) Check that the door is free of obstruction and fully closed.

b) Insert the “Allen” key and turn it clockwise ¼ of a turn to engage the door latch behind the door rebate. Remove the “Allen” key.

c) Turn the Yale key fully in the clockwise direction to verify the maximum extension of the lock tongue and the satisfactory operation of the micro switch via the spring-loaded plunger.

d) Turn the key anti-clockwise to the vertical position and withdraw it.

NOTE: *Unless the Yale key is turned to its fullest extent the door could be locked but not proven. If the door closed proving cannot be obtained on one door the plunger should be lubricated to make sure it moves freely.*

If the proving can still not be obtained then try another key. If both of these options do not work further fault finding should be undertaken. When the door is fully open the key should be removed to prevent it being damaged by the barrier back weight when lowering the barriers.

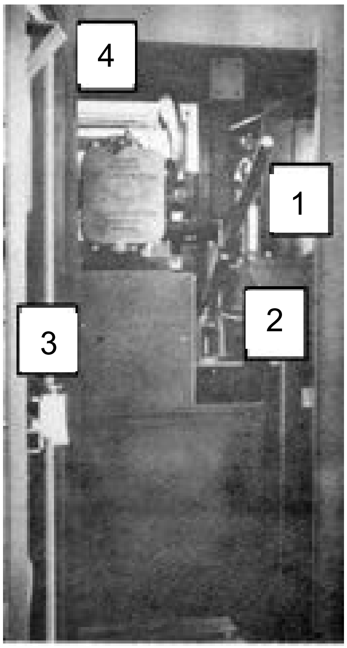
NOTE: *Do not force the key.*

7.14 Manual Pump Handle (Faulty Stowage)

The single acting telescopic manual pump handle is located in a casting bolted to the top of the reservoir.

When the handle is extended for manual operation it lowers into the pumping position. See Figure 14.

With the handle in this position it causes the hand lever stop (HLS) valve to close. Further downward movement operates the pump causing the barrier to rise.



1 Pump handle.

2 Pump handle casting bolted to top of reservoir.

3 Operators door.

4 Operators door pump handle check bracket.

Figure 14 - Barrier unit Internal components (rear)

The extended length of the handle is controlled by a spiral guide pin that protrudes through the slots in the lower shaft. When the handle is lifted, the spiral guide pin engages in guide slots in the pump handle casting.

The handle can then slide down into the stowed position causing the HLS valve to open and the barrier to lower. Unless the handle is in the stowed position the operators' door cannot be closed.

A potential wrong side failure condition was found during a routine test of an AHB crossing. The condition was created by the combination of a step at the bottom of the guide slot in the pump handle casting and a bent spiral guide pin. See Figures 15 and 16.

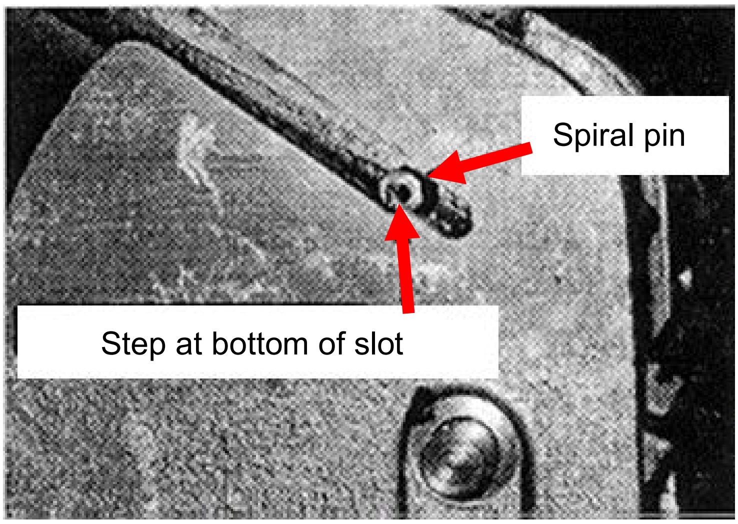


Figure 15 – Wrong side failure example

The step prevented the handle sliding fully home, whilst the bent spiral guide pin allowed the handle to be stowed sufficiently to enable the door to be closed with minimal force.

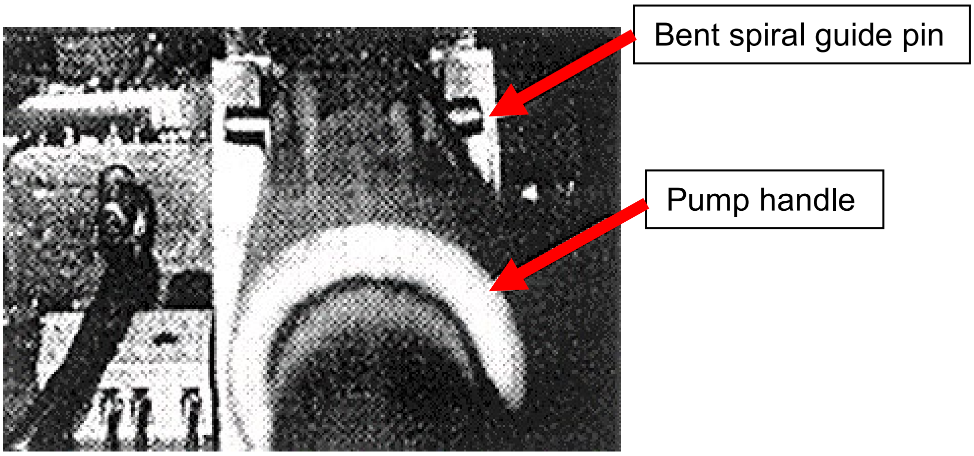


Figure 16 - Wrong side failure example

The closed door applied enough force to the pump handle to cause the spiral guide pin to ride up the step in the guide slot. The bent spiral guide pin allowed the handle to travel just far enough to open the HSL valve. The barrier commenced to lower as expected.

However, as the barrier lowered, the tilting movement of the power pack / ram assembly negated the force applied to the pump handle.

The spiral guide pin dropped down the step causing the HLS valve to close and the barrier stopped lowering.

Other castings have been inspected and found to have similar steps. However, the height of the step was not constant due to the machining tolerances and the width of the cast slot.

Excessive wear on the lower face of the machined slot could increase both the height of the step and the risk of the handle not fully seating at the bottom of the slot.

The machines most at risk are those fitted with booms in excess of 7600 mm (pivot to tip). In these cases, the long stroke coupling position is used which tilts the power pack further from the door check bracket.

In this position the clearance between the closed-door check bracket and the pump handle is increased comparative to that when the “short” stroke position is used.

7.15 Main Shaft Movement

A Wrong Side Failure occurred when a barrier remained in the raised position throughout the crossing sequence. The main shaft had moved through the bearings causing the machine components to come into contact with each other and obstruct the operation of the barrier.

In this case the probable cause was a severe blow to the end of the main shaft. However, the inspection revealed other potential failure conditions affecting BR Spec. 843 machines manufactured by both G.W.E. and Smiths Industries.

In a number of machines manufactured by G.W.E. the main shaft bearings were found to be loose. This made it possible for the rotating shaft to move through the bearings during the barrier operating cycle. The lateral movement would have caused the machine components to foul each other preventing the correct operation of the barrier.

Some machines manufactured by Smiths Industries were found to be slow in operation, which is a potential Wrong Side Failure condition. The cause was attributed to the main shaft bearings being over tightened during manufacture.

In both cases, personnel trained in the use of the special tools required undertook the rectification.

The above conditions should not re-occur. However, if movement of the main shaft is found or suspected, or the specified operating times cannot be achieved when the machine is set up correctly, the cause might be one of the above. It is stressed that adjustments shall not be undertaken locally unless the staff have been trained and the special tools are available.

7.16 Field & Grant Circuit Controller

The type TY 199 group 5 circuit controllers fitted to barrier machines during manufacture or supplied direct from the manufacturer as service replacements from 1996 are pre-set in compliance with BR Spec. 843 and do not require on-site coarse adjustment. However, fine adjustment might be necessary to compensate for local site variations such as site foundation levels, road profiles, or boom lengths.

Where site conditions require fine adjustment of the circuit controller proceed as follows:

a) Open the lid of the circuit controller.

b) Identify the band that requires adjustment.

c) Loosen the nut on the terminal stud just enough to allow the spring contact finger and its associated adjuster to be moved.

d) The adjuster is located into one of seven holes in the contact spring and is to be disengaged to permit the contact spring to be moved.

NOTE: *Very fine tuning can be achieved by moving the adjuster tip in the free space within the original hole in the contact spring. (particularly useful on long WR style booms).*

e) The contact spring has a slotted fixing hole and can be moved in the required direction to achieve the correct setting.

f) Re-engage the adjuster into the next available hole in the contact spring.

g) Carefully tighten the terminal nuts verifying that the contact spring and wire terminations are secure.

h) Test for correct operation.

i) Repeat the above procedure as necessary until the operation is correct.

j) Close and secure the circuit controller lid.

If the circuit controller springs are excessively worn, have lost tension are corroded or have fractured, replacement of the complete controller is recommended as good practice rather than changing the contact springs.

A heavily worn or grooved band is indicative of incorrect spring tension, maladjustment, or malformed springs.

The complete controller should be replaced.

The sleeve is an "Oilite" bearing which continually lubricates throughout the life of the unit. The cover of the modified units carried the letter "P" or "R" adjacent to the logo to aid identification.

The "R" type is fitted with larger spline collars which are coloured red instead of black. Labels with the legend "DO NOT OIL" are fitted to the bearing housings.

Although the type "R" is the latest version, either "P" or "R" types can be fitted.

For optimum performance, the "Oilite" type of bearing relies on 360° rotation of the shaft to distributed the lubricant evenly. However, in this design of circuit controller full rotation does not occur and can result in inadequate distribution of the lubricant and bearing failure.

The end of the bearing nearest the operating arm is also exposed to the atmosphere. In some instances, the lubricant has been found to dry up causing the bearing to seize on the shaft.

The dried lubricant / dirt contamination might appear as a black or brown film in the area of the bearing. However, this is not always visible until the unit is dismantled. If a faulty circuit controller is thought or found to be the cause of slow or faulty operation of the barrier equipment, a replacement controller is the only option.

It is stressed that the "Oilite" type of bearing shall not be lubricated, internally or externally otherwise the porous bearing material can become clogged.
A faulty bearing cannot be rejuvenated and a good bearing might fail prematurely. "Elvolube" contact lubricant contains oil and has a similar affect, it is emphasised that excess lubricant or spillage shall be carefully removed.

7.17 Hydraulic Ram Failures

There have been instances where the hydraulic ram has broken at the upper trunnion block end.

This defect was "masked" by the barrier continuing to operate by driving along the inner face of the pedestal front door.

The fault only comes to light when the front door is opened with the boom in the raised position. Once the door is opened the hydraulic unit is free to fall forward and the barrier falls, uncontrolled, on to the person opening the door.

This issue was immediately addressed by labelling the front door instructing not to be opened with barrier raised.

Later hydraulic units have ram modifications to eliminate this mode of failure.

8. Rural Barriers

8.1 General Description

The rural barrier apparatus usually encountered on the railway was manufactured by Godwin Warren Engineering (G.W.E.). The G.W.E. rural barrier has now been superseded by a version of the Standard Lifting Barrier machine manufactured to BR Spec. 843 by Smiths Industries.

The level crossing barriers are normally in the lowered position and the crossing may also be protected by miniature warning lights or miniature stop lights.

Telephones connected direct to the adjacent signal box or other monitoring point are provided for the crossing user. Operating instructions are displayed on a sign fitted to the side of the machine housing on the approach side of the crossing.

The barriers are raised by the user applying a pumping action to the long handle on the exterior of the machine. Approximately 14 full strokes of the handle are required to produce enough hydraulic pressure to completely raise the barriers.

The BR Spec. 843 machine requires approximately 14 to 24 strokes.

Lifting a small lever on the opposite machine lowers the barriers. Operation of the lever releases a valve causing the hydraulic fluid to return to the reservoir ready for the next operation.

The crossing user is responsible for the correct operation of the equipment, their own safety, and that of others, by lowering the barriers after use.

If the barriers are left raised it might be thought that it is safe to cross and could result in an accident.

Instances of the barriers being left in the raised position, especially if it is a common occurrence at a particular crossing, shall be reported to your manager so that action can be instigated.

8.2 Faulty Operation

The hydraulic system of the G.W.E. rural barrier is a relatively simple design. However, for optimum operation of the system, the reservoirs should be at the same height and the return pipe run below the oil level of the reservoirs throughout its length.

If, due to the profile of the crossing area, the barrier machines are installed at different heights, the variation in reservoir height and associated fluid level can affect the rate of the return flow to the higher reservoir.

The problem could be accentuated when the barriers are repeatedly operated from the same side of the crossing without a significant time delay between operations. The length, gradient, and height of the return pipe can also affect the return cycle of the hydraulic oil.

The fault can self-rectify if enough time has elapsed and therefore the reported barrier malfunction can be difficult to trace.

In severe cases, the combination of excessive use from one side of the crossing and an air lock or restriction in the balance pipe might cause the hydraulic oil to overflow from the lower reservoir whilst starving the higher reservoir. See '8.3 Air in the System'.

8.3 Air in the System

Pump the barriers to the fully raised position usually 14 full strokes are required for the GWE type. The machine derived from the BR Spec. 843 machine needs approximately 40 full strokes.

Lower the barriers and note the lowering time (usually 6 seconds). Both barriers should lower together, although the barrier of the machine at which the lowering lever was operated might tend to lead the other barrier.

If the barriers of the GWE type machine lower slowly check that the bleed valve jet on the ram is clear.

8.4 Bleeding Air from the System (G.W.E. Type)

Hold down the lower release valve and pump air through into the reservoir. Repeat the procedure from the other barrier machine. Loosen the bleed valve at the top of the ram and allow any trapped air to bleed off. Repeat the procedure for the other barrier machine ram.

To check that air is expelled when refilling the system with hydraulic fluid it is necessary to pump through the main pressure feed pipe. To do this, disconnect the pipe from the master barrier and pump fluid through the slave.

When connecting the main pressure pipe hold down the lower release valve and pump the air through into the reservoir, as previously described.

8.5 Bleeding Air from the System (BR Spec. 843 Type)

The ram body incorporates an air bleed groove which allows any air trapped below the piston to escape to the reservoir when the ram is caused to over travel before installation in the pedestal.

If it becomes necessary to bleed the system, the ram top pivot bracket shall be disconnected from the operating arm to allow the ram to over travel and note which fixing holes are used. (Unused holes are usually blanked with bolts and nuts painted red).

a) Keep the unit in the upright position and use the manual pump handle to fully extend the ram. Continue the pumping action to cause the ram to over travel and the air to return to the reservoir.

b) Reconnect the ram top pivot bracket to the original holes in the operating arm.

c) Raise and lower the boom 2 or 3 times and check that the machine operates correctly.

d) The barrier should rise smoothly without hesitation and should not oscillate excessively during the last few degrees of travel.

e) Check the level of the hydraulic oil, top up as necessary. The oil should be just visible in the filter strainer.

f) Replace the filler cap securely.

g) Repeat the procedure for the other barrier machine.

9. Western Region Barrier

9.1 Hydraulic Ram Setting

The correct height at which the lowering barrier is damped is reliant on the dimension between the centres of the barrier pivot and the bottom ram pin. This dimension is 891 mm (2 ft 111/16 ins).

The dimension between the centres of the top and bottom ram pins is 1021 mm (3 ft 43/16 ins) and can be used for the initial setting. See Figure 17.

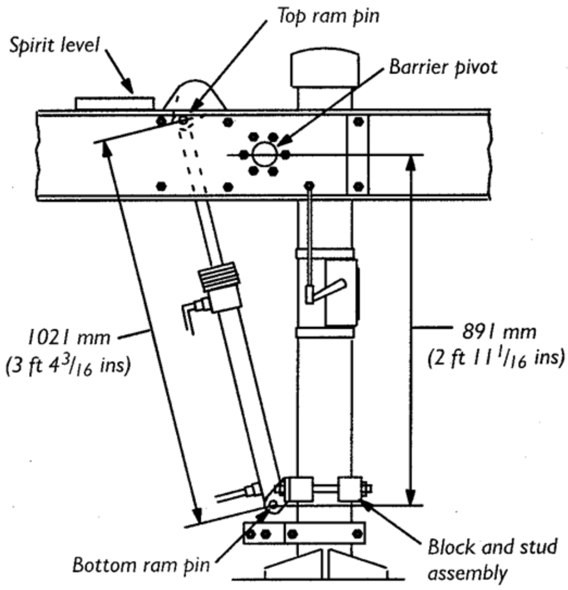


Figure 17 – Hydraulic Ram Setting

Checking this dimension is difficult due to the restricted working area. A simple gauge can be made from an old locking bar and the driving tips from two copper earth rods, See Figure 18.

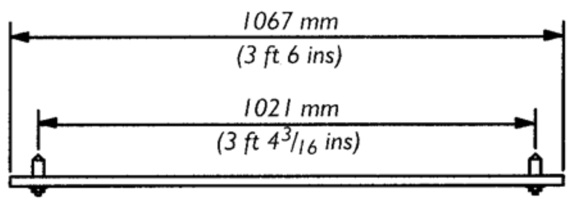


Figure 18 – Dimension Gauge

Cut the bar to length and carefully remove all burrs and sharp edges. Take great care when marking out the position for the two holes for the locating pins (driving tips).

Punch the hole centres and drill through with a sharp 9.5 mm (3/8 in) drill. Assemble the tips to the bar and secure with M10 nuts and washers.

With the barriers in the fully lowered position, check that the barrier is horizontal by placing a spirit level on the top of the side arm channel that carries the boom. See Figure 17.

Wipe each grease nipple and the end of each ram pin before removing the grease nipples. Check they are kept clean prior to refitting when the check is completed.

Check that the tip ends of the gauge are clean and free from dirt. Try to locate the tip ends into the grease nipple holes in the ram pins. If the dimension is correct, they should fit centrally in the holes. If not, adjustment could be required.

This can be achieved by moving the clamp blocks and bottom ram pin bracket assembly, as required. When the dimension is correct, secure the assembly, and re-check the dimension.

If still correct, check that the grease nipples are clean and re- fit them. Replenish the lost grease using a grease gun filled with lithium based grease.

Test the barrier to verify that it operates correctly. Operate the barrier several times to clear any air from the hydraulic system before finally checking the damping action as the barrier lowers.

The barrier should be damped when the tip is approximately 914 mm (3 ft 0 ins) from the road surface. If the damping is incorrect further adjustment may be necessary. Failure to achieve the correct setting may be due to movement of the clamp blocks. See ‘9.2 Bottom Clamp Block Movement’.

9.2 Bottom Clamp Block Movement

During 1977 the bottom clamp block and “U” bolt assembly which also secures the bottom ram pin bracket to the post was replaced with two blocks. The “U” bolt was replaced with two ¾ inch x 10½ inch studs with a ¾ Whitworth thread at either end. Each stud end was fitted with a plain washer, spring washer, and nut.

At some installations the clamp blocks and bottom ram pin assembly moved during operation of the barrier. The movement altered the setting of the ram length dimension and the position at which the barrier was damped as it lowered. The blocks were not securely clamped to the post due to insufficient length of thread on the studs. Although the nuts were fully tightened, they had only “bottomed” on the end of the thread.

If the correct clamping position cannot be maintained, movement of the clamp blocks could be the cause. Fitting additional washers may prove a temporary cure until the faulty studs can be replaced.

Some machines are fitted with a bar between one leg of the lower “U” bolt that secures the barrier pivot bracket to the top of the post and one of the studs that secures the clamp block and bottom ram pin assembly to the bottom of the post.

This was a local modification to address the problem of clamp block movement. However, the bar should not be necessary if the stud thread lengths are correct and a plain and spring washer is fitted beneath each nut.

9.3 Ram Pin Failure

An investigation into the failure of a Western Region type barrier revealed that the top ram pin had broken in half.

In this condition the retaining cotter pin was rendered ineffective allowing the broken ram pin to fall out. The hydraulic ram became detached from the drive lugs of the side arm cross member (rear strut).

This failure occurred with the barrier in the fully lowered position. If the pin had failed during the operating cycle only the counterbalance weights would have prevented the barrier falling without warning.

In high wind conditions the counterbalance forces might not be enough to prevent such an occurrence. Similarly, if the counterbalance weights are not at the optimum setting the result could be the same. In either case a serious accident or injury could occur.

9.4 Top Ram Pin

Lubricant is delivered to the bearing surface via a longitudinal hole drilled along the axis of the pin. A countersunk cross drilled hole connects this gallery with an annular groove at the centre of the pin. See Figure 19.

NOTE: *The following illustrations derived from drawing F1A2239/I5, have been exaggerated for clarity, and are not intended for manufacturing purposes.*

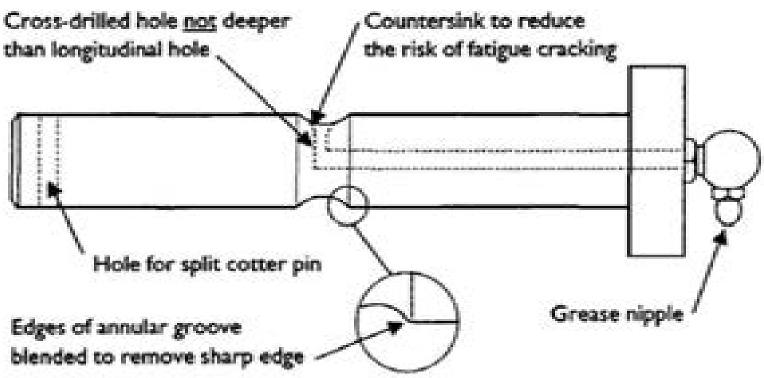


Figure 19 – Correctly manufactured ram pin

10. CLOSED CIRCUIT TELEVISION (CCTV)

10.1 Camera Column (Code of Practice)

The winch mechanisms and ropes used on camera columns should be inspected at regular intervals. This work is done by plant staff who work to NR/L2/ELP/27238 Appendix L.

END

General

Point rollers are designed to assist the movement of the switch rail during the operation of points by reducing the effects of friction. This leads to a reduction in the amount of drive force that is required to operate the points hence reducing the wear on the asset.

The point rollers are adjusted to achieve the minimum amount of lift of the switch rail as quickly as possible during the movement of the switch rail.

If the point rollers are set too high then the point operating equipment has to work harder to lift the switch rail higher than what is required, which leads to an increase in drive forces.

If the point rollers are set too low, then there will still be issues associated with the friction between the switch rail and the slide baseplates, also leading to an increase in drive forces.

Due to the condition of the switch rail i.e. hogging or differing track conditions, the rollers might require adjusting from their optimum setting in order to maintain reliable operation of the point operating equipment.

When the rollers are set to the correct height, it should be possible to slide a 1mm feeler gauge between the bottom of the switch rail and the slide baseplates.

If point rollers are set to a height to accommodate poor switch rail or poor track conditions, there will be a need to reset the position of the point rollers if any track improvement work is carried out (eg. tamping, stone blowing, or lifting and packing) as the relationship between the bottom of the switch rail and slide baseplates will be altered.

Point rollers might also need adjusting due to changes in track condition over time caused by the passage of trains.

Where points are fitted with Remote Condition Monitoring equipment, this should identify where the point rollers are not operating correctly. Also, it should be possible to compare current traces from before and after adjustment to make sure that the point roller adjustment has been effective.

Setting Up Point Rollers

Adjustment of the rollers should be done if they are out of position due to:

- Back Drive adjustment
- Manual Lift & Packaging
- Tamping or Stone Blowing

On Hy-Drive mk2 installations, the rear rollers might need to be lowered to allow manual pumping of the points due to the back of the switch starting to move before the toe leading to the lock arm jamming.

The height of the rollers can only be set when the switch rail is in the closed position.

1.1 Check to see that the switch is fitting up with the stock rail. If this is not the case then the back drive may need to be adjusted before the point rollers are set up.

For each roller assembly:

1.2 Clean the slide / base plates of dust and debris and remove the fixing bolts from the roller package.

It is good practice to grease the holes that are not used with lithium grease to prevent the threads from rusting (see figure 1).

Figure 1 – Grease Holes

1.3 Check the condition of the thread on the fixing bolts, replace them if necessary.

1.4 Place the fixing bolts back onto the roller package, before tightening lower the roller assembly to the lowest setting and slide the roller package horizontally underneath the rail.

1.5 Adjust the height of the roller so it comes into contact with the bottom of the switch rail (see figure 2); make a note of the height.

Figure 2 – Grease Holes

1.6 Slide the roller package out from under the switch rail and raise the roller assembly by 1mm.

1.7 By using a feeler gauge, measure the gap between the bottom of the switch rail and the slide plate (see figure 3), this distance will be known as 'X' mm during the following set up procedure.

Figure 3 - Gap

1.8 Slide the roller package horizontally underneath the switch rail allowing a gap equal to 1mm + 'X' mm to accommodate dynamic loading.

1.9 If a second roller is present, then set the second roller 1mm higher than the first.

1.10 Tighten the fixing bolts to 70NM by using the torque wrench, then recheck the height of the roller assembly as it may have moved in the tightening process.

1.11 Repeat the process for all roller packages throughout the closed switch.

1.12 Check the roller height settings (see figure 4). If they are approaching their maximum height setting, this should be reported to your supervisor as corrective maintenance such as lifting and packing might be required.

Grey roller packages provide a lift upto 6mm whereas blue packages provide a lift upto 4mm.

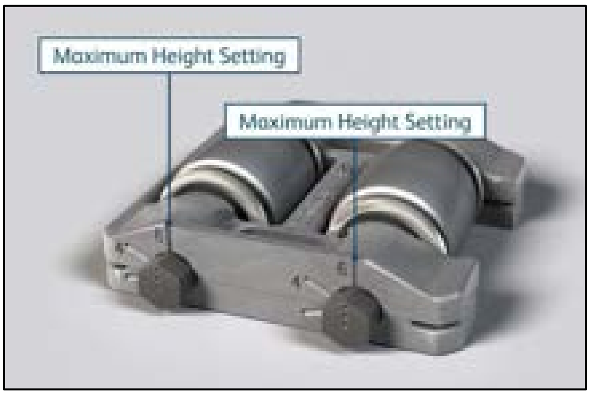


Figure 4 – Height setting

1.13 Operate the switch into the open position so the switch rail moves across the rollers.

1.14 Check the clearance between the bottom of the switch rail and slide baseplates through the switch lengths (see figure 5) . Ideally this gap should be between 1-3mm.

Figure 5 – Clearance check

1.15 If the 1mm clearance has not been achieved then raise the height of the roller, if the clearance is greater than 3mm then the height of the roller shall be reduced.

1.16 Recheck all slide plate clearances are within 1–3mm, if not then readjust.

1.17 Check that the kicking strap has a 6-9mm clearance from the stock rail.

1.18 Once all rollers have been set, operate the switch over and back a few times and assess the roller operation.

1.19 Check for signs of binding.
If the kicking strap is binding and this cannot be adjusted at the time of the roller setup, the front rollers can be lowered whilst arrangements are made to adjust the kicking strap. This should be reported as corrective maintenance.

1.20 Check the switch and rollers function normally after all work has been completed. Any issues that could not be rectified should be reported to a supervisor.

Further details of how to set up the rollers can be found in the standardised task video found on the Network Rail Intranet and How To app.

END

1. Mil Spec 5015 Plug Couplers, General

1.1 Mil Spec 5015 Plug Couplers (Figure 1) are defined in Network Rail standard NR/L2/SIG/30027 and consist of a plug and a receptacle which mechanically lock together via a reverse bayonet fitting.

Figure 1 - Mil Spec 5015 Plug Coupler. Male (left) and female (right)

1.2 Cables are supplied as pre-fitted “sealed units” with plugs/receptacles.

1.3 Maintainers shall not attempt to re-terminate plugs or receptacles.

1.4 A receptacle will typically be provided on lineside equipment by being mounted in the equipment’s housing. Alternatively, the equipment can be fitted with a receptacle on a cable, which is then wired into terminals in the equipment.

1.5 5015 Plug Couplers are supplied with an environment cap to stop contamination of both pins and sockets. See Figure 2.

Figure 2 - Plug Coupler with (detached) environmental cap

2. General Maintenance

2.1 MIL 5015 connectors do not need scheduled maintenance and should not be disconnected during routine maintenance. Routine examination is limited to visual external inspection for signs of damage to the connector/cable boot and incorrect alignment/incomplete locking. It is not necessary to lift troughing etc to inspect inaccessible plug coupled joints.

2.2 Figure 3 shows the locking mechanism in both the locked and unlocked positions.

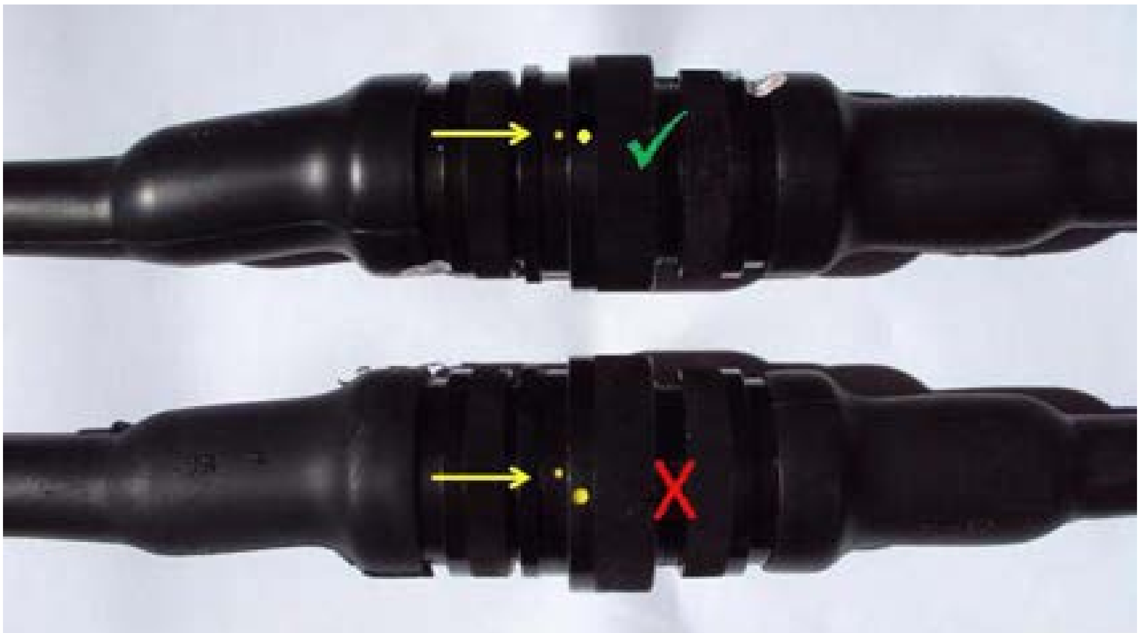


Figure 3 - Plug Couplers showing correct (top) and incorrect (bottom) mating. Note the position of the alignment dots

2.3 If required, disconnect the equipment using links at the location case where possible, not at a plug coupler.

3. Faulting

3.1 Where possible, plug coupled connections should not be opened and instead diagnostic testing should be done from accessible termination points such as Wago links in the location case/ REB. This will enable testing through the plug coupled connector.

3.2 When disconnecting plug coupled connectors, connect an environmental cap to both connectors except when connected to a break out box.

3.3 If environmental caps are not fitted to any exposed connectors i.e. plugs or receptacles, then NR/SMTH/Part04/CA06 (Renew a Plug Coupled Cable ("interconnect") with a Non Certified Replacement) testing shall be required following reconnection.

3.4 A Product Approved breakout box can be used to connect in-line across the plug coupled connections so that test terminals are available.

3.5 A pre-use test of the breakout box shall be carried out in conformance with the manufacturer's instructions.

This enables continuity and insulation resistance testing to be carried out on plug coupled equipment and cables.

3.6 Test Leads SHALL NOT BE INSERTED INTO MIL SPEC PLUG COUPLER PLUGS OR RECEPTACLES WHETHER MALE OR FEMALE UNDER ANY CIRCUMSTANCES.

They might damage the pins/sockets and potentially cause short circuits between cores. Damage inflicted in this way may not be visible to the naked eye.

3.7 Before (re)connecting plug coupled equipment, the Maintainer shall visually check that the plug coupler has not been damaged and that there is no water ingress. If there is, then the affected cable ("interconnect") or equipment shall be replaced.

END

GENERAL

DO NOT INSERT TEST LEADS INTO MIL SPEC PLUG COUPLER PLUGS OR RECEPTACLES WHETHER MALE OR FEMALE UNDER ANY CIRCUMSTANCES since these might damage the pins/sockets and potentially cause short circuits between cores.

INTRODUCTION

Where it is essential to record test measurements at the plug coupler then an approved break out box should be used. This enables continuity and insulation resistance testing to be carried out on plug coupled cables. Some break out boxes can also be inserted at an inline plug coupler so that ‘on load’ voltage can be measured across plug coupler pins.

There are currently a number of prototype break out boxes in service see Figure 1:

Figure 1 – Break Out Box

1. Signal Maintenance Testing

1.1 A product approved breakout box can be used to connect in-line across the plug coupled connections so that test terminals are available. However, if possible, testing should be done from accessible links to avoid the need to open the coupler.

2. Signal Works Testing

2.1 Where an approved break out box is required for testing it shall be stated in the relevant test specification. If it is not specifically identified, then authorisation for its use is referenced in the test instruments section of the test plan.

3. Before Use

3.1 Inspect that the break out box and its components are not damaged.

3.2 Check all end caps have been correctly fitted.

3.3 Remove each cap and inspect each connector to check that there is no damage visible to the pins or sockets.

See Figure 2 and Figure 3 for the type of damage that might be present:

1. Fig 2 a socket has pushed back into the housing.

2. Fig 3 three pins have been pulled forward. No pin shall stand proud of it housing for safety reasons:

Figure 2 – Socket pushed back

Figure 3 – Three pins pulled forward

3.4 Check that the unit has a valid certificate of conformance or an equivalent label attached.

Any deficiencies found shall be reported to the Tester in Charge or the SM(S).

4. Connecting the break out box

4.1 The break out box is configured in pairs of receptacles (R) and Plugs (P).

4.2 Each pair has a numerical ID e.g. R1 and P1.

Pair ID	Insert Arrangement	Number of cores	Plug Type	Receptacle Type
P1 / R1	32 - 013	12	Male	Female
P2 / R2	32 - 013	10	Male	Female
P3 / R3	24 - 2	7	Male	Female
P4 / R4	20 - 4	3	Male	Female
P5 / R5	20 - 4	3	Female	Male

Table 1 – Break out box 1

Pair ID	Insert Arrangement	Number of cores	Plug Type	Receptacle Type
P1 / R1	32 - 013	10	Male	Female
P2 / R2	20 - 23	2	Male	Female
P3 / R3	20 - 4	4	Male	Female
P4 / R4	20 - 4	4	Female	Male
P5 / R5	20 - 4	2	Male	Female

Table 2 – Break out box 2

4.3 Figures 4 shows the Break out Box with environmental covers in place, and Figure 5 shows Environmental covers removed and the Break out Box in use.

Figure 4 – Break Out Box with environmental covers in place

Figure 5 – Break Out Box in use

Insert arrangements are made of two numbers the first being the coupler size and the second being the pin configuration. When looking at the pin configuration blank or removed pins should be taken into consideration.

4.4 Identify the cable to be tested is correctly labelled, of the correct type and that the plug coupler is of the correct size.

4.5 Visually check plug coupler for signs of mechanical damage to connector shell/housing, contacts and that all contacts and filler plugs are inserted correctly.

A break out box shall not be inserted into a circuit until arrangements have been made with the Signaller to book the circuit out of use for testing purposes.

4.6 Check that the relevant arrangements are in place prior to disconnecting any operational equipment.

5. Voltage Check

5.1 For ‘on load’ voltage testing the plug coupled connection needs to be uncoupled and the male and female connections need to be connected either side of the breakout box using the relevant pair of connectors, as shown in Figure 6.

5.2 Check that both Mil 5015 connectors visually, mechanically and audibly secured.

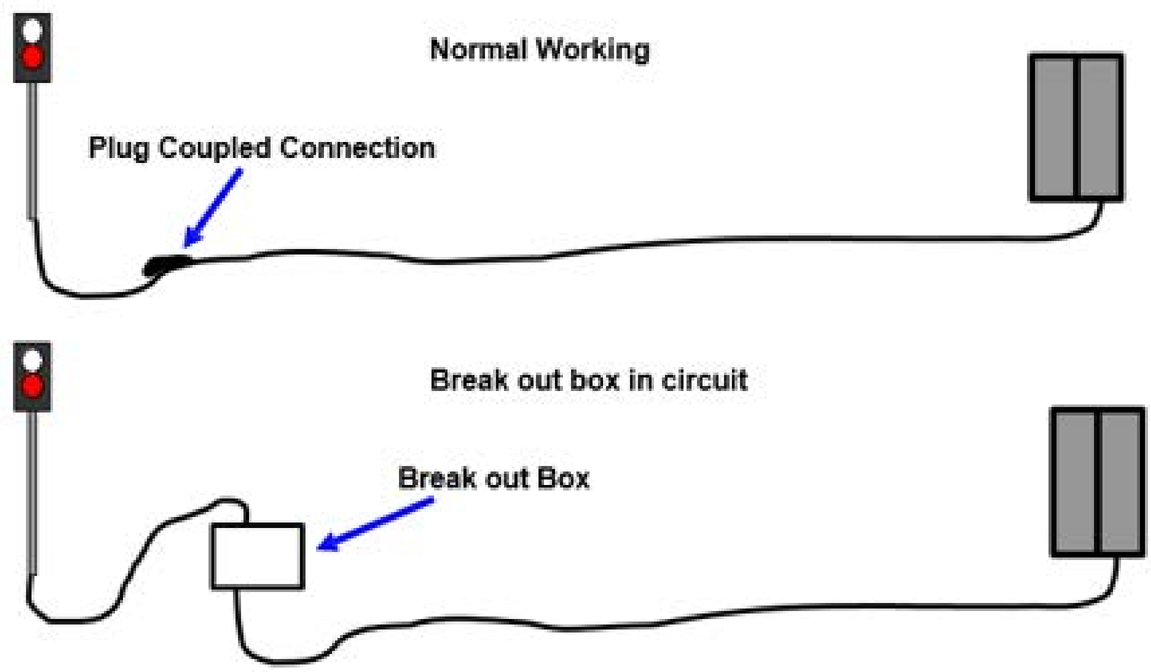


Figure 6 – Inserting a break out box for on load testing

5.3 At this point all of the cable cores are available for via the 4mm plug sockets mounted on the top of the breakout box. These should be used in the same way as if the interconnect was terminated on links. Multiple testing methods can now be employed.

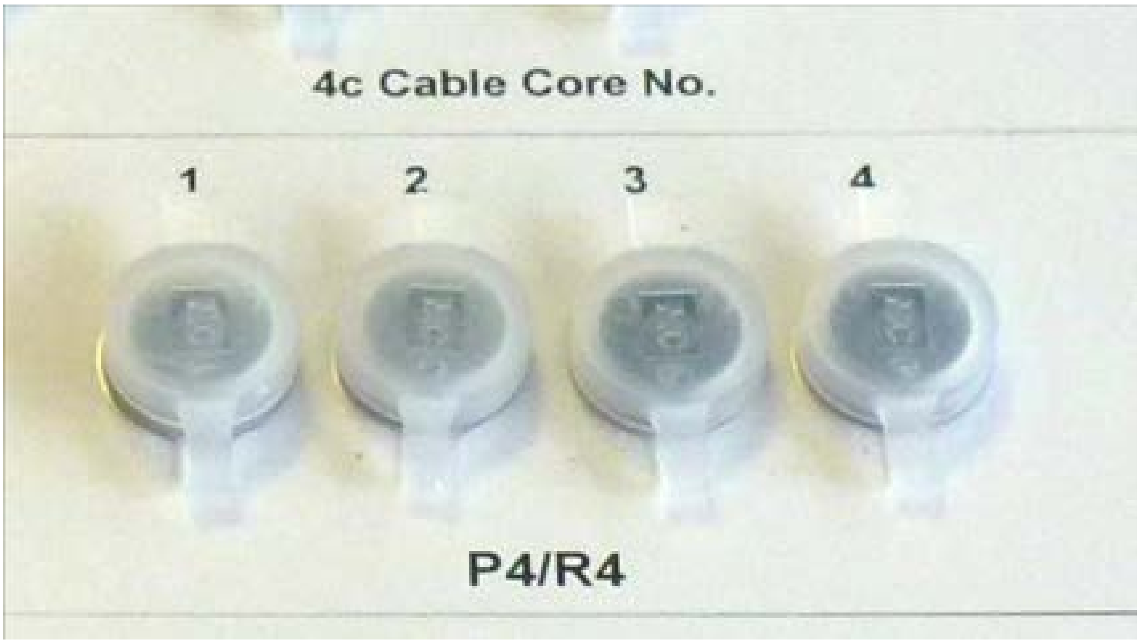


Figure 7 – Break out box sockets

5.4 An example of the 4mm sockets found on the Break out box, associated with a 4 core interconnect/cable, can be seen in Figure 7. Each of the four numbers relate directly to the cable core number.

5.5 By plugging a meter into the relevant test sockets voltages can be measured.

6. Testing for Current

6.1 This test can only be carried out on a two-core cable and would normally only be used to test an AWS.

6.2 On both break out boxes there is a facility to undertake a current reading.

6.3 Break out box 1 has the facility to test only one of the possible connector sizes whereas Break out box 2 caters for both sizes of connector.

6.4 The terminations for the two cored cables differ from all others by having two core one 4mm test sockets.

6.5 With the break out box in circuit and the meter set to read current, the meter leads should be plugged into the 2 terminations marked 1, see Figure 8.

Figure 8 – Current Testing

6.6 Check the circuit being tested is energised and when ready to take the current measurement press the green push button on the front panel.

6.7 Pushing this button inserts the meter into the circuit between the number 1 pins of the connected inline couplers, see Figure 9.

Figure 9 – Current Testing Push Button

6.8 Record readings as required then release the push button

7. Continuity and Insulation Tests

7.1 To carry out both of these tests, a break out box for each plug coupled interconnect end is required.

7.2 Where an interconnect is plugged into a wire receptacle which is then terminated directly onto disconnect able links it is acceptable to test through the interconnect as far as the links.

7.3 Both CONTINUITY TEST and INSULATION TEST shall be carried out as laid down in the defined tests.

8. After Use

8.1 Check that all the plastic test socket covers are correctly re-inserted.

8.2 Check that all the coupler caps are correctly reconnected.

8.3 Where provided, replace the break out box into the carry bag/case.

END

1. Frauscher Advanced Counter FAdC, General

The FAdC is used for safe monitoring of track sections. With the FAdC, the clear and occupied status can be generated by the track sections. The clear and occupied status is output by the software interface or by voltage-free relay contacts. One track section can consist up to 16 counting heads. A counting head consists of a wheel sensor (RSR123), an overvoltage protection unit (BSI005) and an evaluation board (AEB). Double or multiple usage of a counting head is possible.

The FAdC may either be connected to a CAN bus or decentralised across large distances using an Ethernet network.

2. Operating mode of the FAdC

At the start and end of each track section, there is a wheel sensor that acts as a counting head together with the BSI and the AEB. This detects all the axles of rolling stock travelling on this track and also their direction of travel, using two electronic wheel sensor systems. By comparing the counting result for the axles counted in with the result of those counted out, it is possible to make a statement regarding the status of the track section.

Each wheel sensor is connected with an AEB by a four-wire signal cable. This connection provides the power supply to the wheel sensor and transmits the axle information to the AEB. The AEB boards are linked with one another by means of a CAN bus.

An AEB correlates the axle information for all counting heads allocated to a track section into an overall result and uses this to create a clear or occupied indication for this track section.

The COM-AdC or the COM-WNC, which are also connected to the CAN bus, provide an Ethernet interface. Using this interface, the clear and occupied indications can be output via a vital protocol (COM-WNC), for any further processing required. Alternatively, the clear and occupied indications can also be output via voltage-free relay contacts from an IO-EXB connected to the AEB.

3. Test equipment

The following items are used to complete all the testing and maintenance activities on Frauscher Advanced Counter equipment:

- Testing plate PB200.
- Advanced Service Display ASD and Service Display Cable.
- Frauscher Diagnostic System FDS (optional).

- Multimeter, range 1000 mV DC, ± 0.5 % basic accuracy, internal resistance >> 1 kΩ.
- 2 leads with 2 mm male connectors.
- Non-conductive cord.
- Tape measure.

4. Wheel sensor RSR123

The wheel sensor RSR123 detects axles and consists of two sensor systems. Viewed from the plug side, wheel sensor system 1 is on the left hand side, wheel sensor system 2 is on the right hand side. Wheel sensor system 1 and 2 are symmetrically in design and are galvanically separated. Two wires are allocated to each wheel sensor system. On the wheel sensor there is a four-wire cable connected via a plug connection, with a standard length of 5, 10 or 25 m. It is recommended to use a protection tube for the cable.

Figure 2 - RSR123 Wheel Sensor

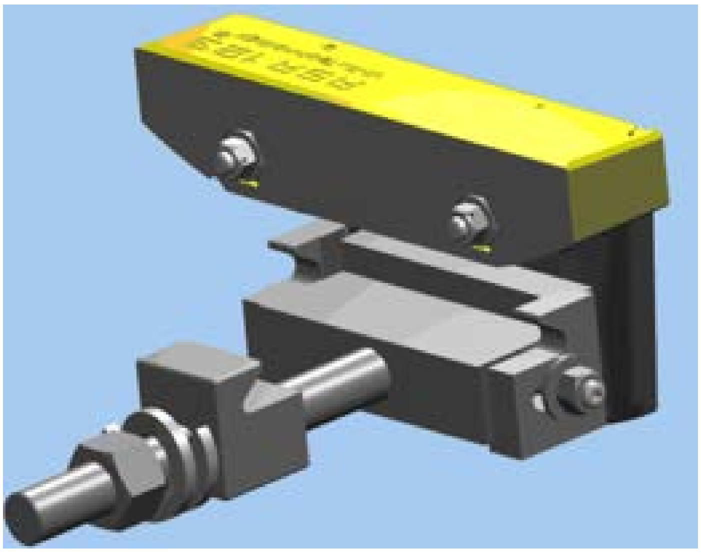


Figure 1 – RSR123 Wheel Sensor Bracket

5. Communication Boards COM-WNC/COM-AdC

The hardware of the COM-WNC is identical with the COM-AdC. In addition to the functionality of the COM-AdC (configuration server and data transmission within the FAdC) the COM- WNC can communicate with an interlocking via Ethernet.

The COM-WNC contains the protocol implementation for the interlocking specific protocol WNC. So, the COM-WNC enables to convert data of the FAdC with the protocol FSC to the protocol WNC of the interlocking and the data of interlocking with the protocol WNC to the protocol FSC of the FAdC.

Figure 3 - COM-AdC Card

Indication/ Function	**Meaning/Use**
Serial Interface	Service Interface (for ASD)
PWR	Power supply
Status Card	Status display (flashing in the event of a fault).
CAN	Illuminated when CF card is present and ok, flashing in case of card access
	Illuminated when software-configuration is obtained, illuminated or flashing in the event of a fault
Ethernet 1	Connection to network 1
Upper LED	Illuminated when a connection to the network is present.
Lower LED	Flashes when data is transmitted or received
Ethernet 2	Connection to network 1 or 2
Upper LED	Illuminated when a connection to the network is present
Lower LED	Flashing when data is transmitted or received
Stop	No function at present
Run	No function at present
Type key (on the top of the hand grip):	
COM-AdCnnn	Board identification code starting with 001
xx...yy	Operating voltage range
GSzz	Version beginning with 01

6. DIP-switches of the COM-AdC / COM-xxx

The DIP-switches can be found on the left-hand side of the COM-AdC/COM-xxx.

There two dip switches for each of the channels.

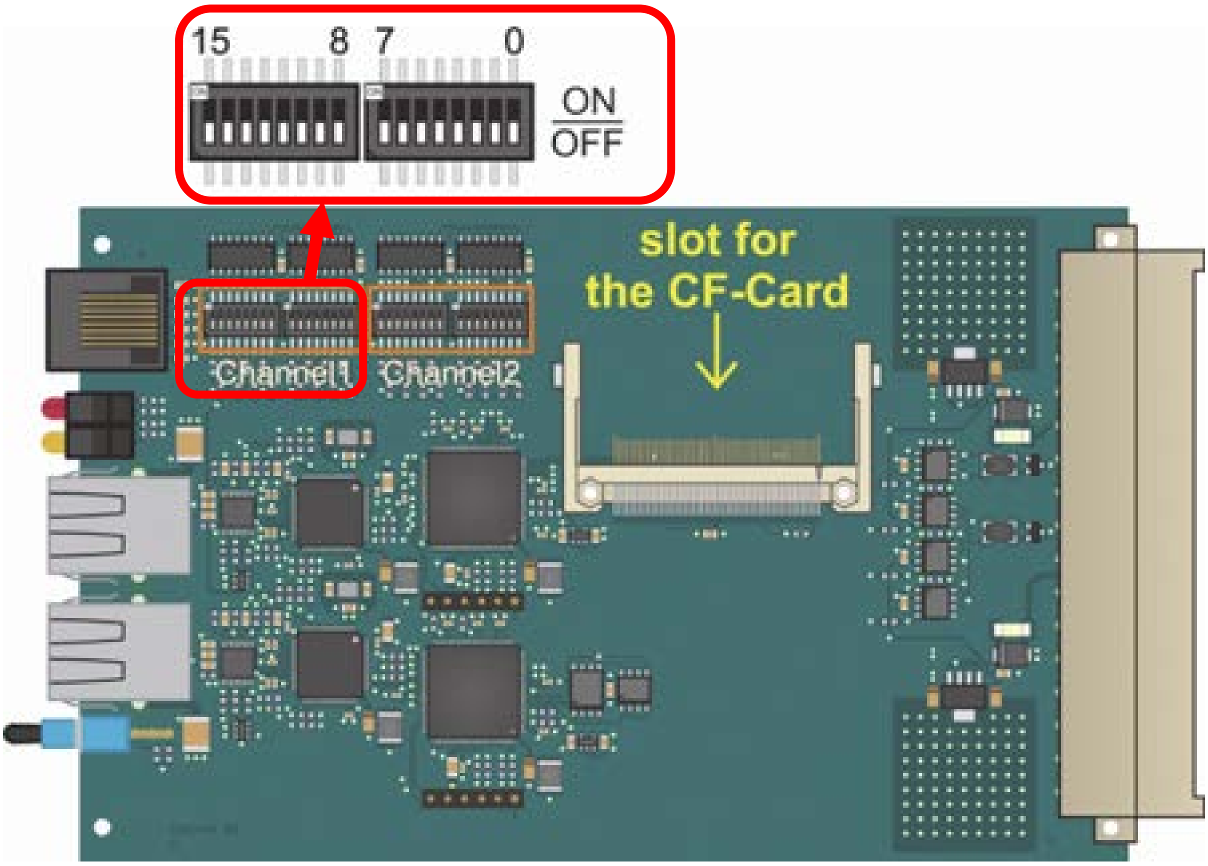


Figure 4 - COM-AdC Dip Switches

7. Advanced Evaluation Board AEB

The AEB is used to supply and evaluate a wheel sensor RSR123. The digital counting head information is output for further processing. Moreover, the AEB's tasks also include counting axles and generating failsafe clear and occupied indications for up to two track sections. An AEB can control up to 8 IO-EXB or 8 CO-EXB boards (the boards can also be used in combination).

Figure 6 – AEB Card

Indication/ Function	Meaning/Use
Serial Interface	Service Interface (for ASD)
PWR	Power supply
Sys1	System 1 occupied (illuminated) or faulty (flashing).
A1	Indicates the clear and occupied status of track section 1 and/or displays counting head control
B1	The AEB obtains its software- configuration (illuminated) or data transfer interfered (illuminated/flashing)
Adjust	Adjust Is required to adjust the wheel sensor / AEB and to carry out a pre-Reset
Test	Simulates damping of system 1
V+/GND	2 mm test sockets, voltage corresponds to the analogue wheel sensor current via an 100 Ω Shunt
PWR	Power supply
Sys2	System 2 occupied (illuminated) or faulty (flashing).
A2	Indicates the clear and occupied status of track section 2 and/or displays counting head control
B2	The AEB obtains its software- configuration (illuminated) or data transfer interfered (illuminated/flashing)
Adjust	Adjust Is required to adjust the wheel sensor / AEB and to carry out a pre-Reset
Test	Simulates damping of system 2
V+/GND	2 mm test sockets, voltage corresponds to the analogue wheel sensor current via an 100 Ω Shunt.
Type key (on the top of the hand grip):	
AEBnnn-1/-3	Board identification code starting with 001, -1 for RSR180, -3 for RSR123
xx...yy	Operating voltage range
GSzz	Version beginning with 01

8. DIP-switches counting head outputs of the AEB

The DIP-switches counting head outputs can be found on the left-hand side of the AEB.

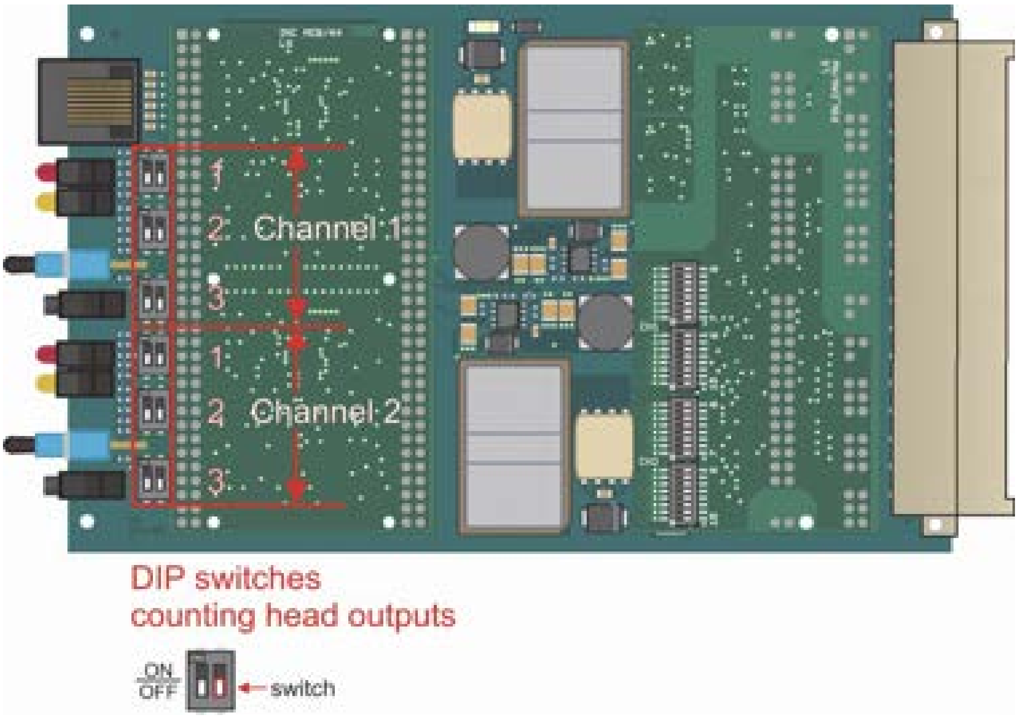


Figure 7 – DIP Switch Positions for Counting Head outputs on the AEB Card

9. DIP-switches ID of the AEB

The DIP-switches ID can be found on the right-hand side of the AEB.

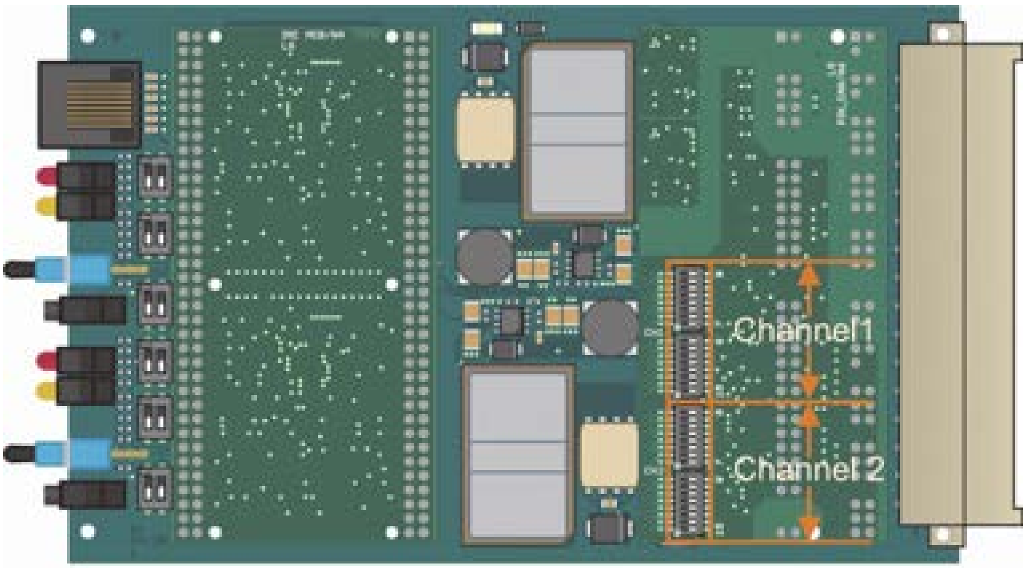


Figure 8 - DIP Switch Positions for the ID of the AEB Card

10. Input/Output Extension Board IO-EXB

The IO-EXB is used for failsafe output of the clear/occupied status for up to 2 track sections, via voltage-free relay contacts, and for output of error codes from the track section or the AEB. Alternatively, the IO-EXB can also be used to input and output failsafe and non-failsafe (depending on configuration) digital arguments (data transmission).

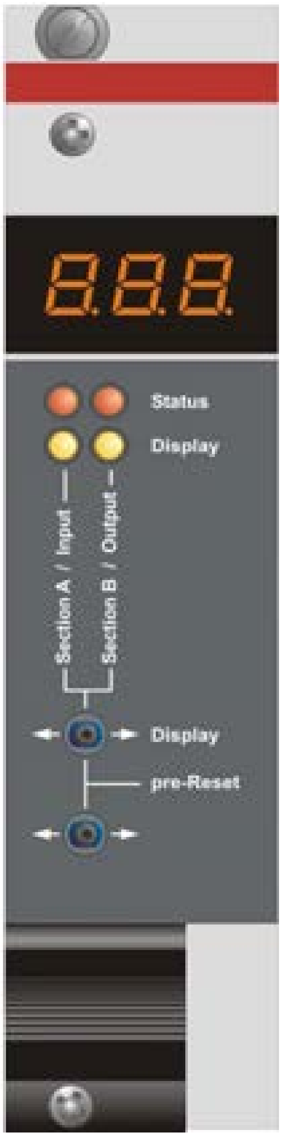


Figure 9 - IO-EXB Board

Indication/ Function	**Meaning/Use**
Display	Number of axles in a track section, Output of error code in the event of a fault, Output of the bit status as a HEX code (in the case of data transmission).
Status	Track section occupied (illuminated) or faulty (flashing). Output of the status of the inputs/outputs (flashing in the event of a fault, illuminated if no AEB is connected).
Display LED	Indicates the track section for which the information is valid, Track section 1 (= Section A) or track section 2(= Section B). These indicate which information (input or output) is currently valid on the display (in the case of data transmission).
Display button	Button to change the display between track section.
pre-Reset	Track section 1 and 2 or input and output Activated by pressing both buttons to the left (track section 1) or the right (track section 2) at the same time.
Type key (on the top of the hand grip):	
AEBnnn-1/-3	Board identification code starting with 001, -1 for RSR180, -3 for RSR123.
xx...yy	Operating voltage range
GSzz	Version beginning with 01.

11. Counting Head Control (CHC)

11.1 Counting Head Control (CHC) is a method of suppressing activation outputs of the RSR123 when no train is approaching.

Function:

a) CHC is active if both sections each side of the wheel sensor are indicating clear.

b) CHC is not active if one or both of the sections are indicating occupied (by a fault or a train) - any sensor activations will be passed to the signalling system.

Settings:

c) The number of outputs that can be suppressed is hard configured between 1 and 100, in a 1-minute period. After 1 minute the counter resets. If this count is exceeded the relevant sections will enter a failsafe state.

d) FAdC version R2 with AEB101 GS04 or later includes the facility to deactivate the CHC function. The method of deactivation/activation will be defined locally.

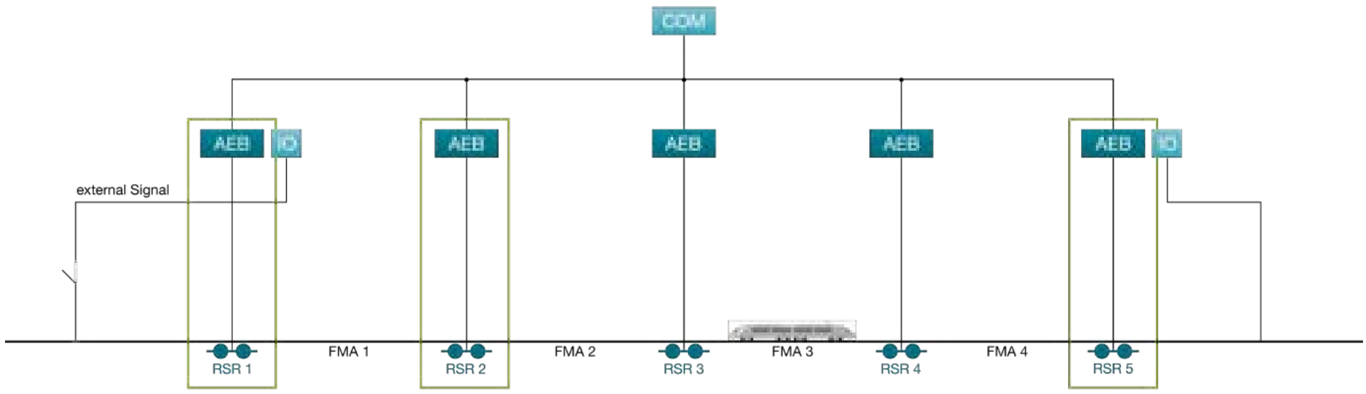


Figure 11 - Sensors with CHC active are highlighted in Green

12. Supervisor Track Section (STS)

12.1 A Supervisor Track Section STS is an additional track section covering two or more signalled track sections.

Function:

a) If the STS is clear, and one or both signalled sections are indicating occupied, then an automatic reset will be carried out on the signalled sections.

b) If both the signalled sections indicate clear, they are able to reset the STS.

Settings:

c) The type of reset is configurable (Unconditional/Conditional – with/without Sweep train).

d) The number of resets that can be carried out is hard configured between 1 and 100. The counter is reset with the successful traverse of a train. If this counter is exceeded a manual reset will be required.

e) FAdC version R2 with AEB101 GS04 or later includes the facility to deactivate the STS function. The method of deactivation/activation will be defined locally.

Occupancies of the signalled sections are highly likely to appear to the signalling systems before the reset is carried out.

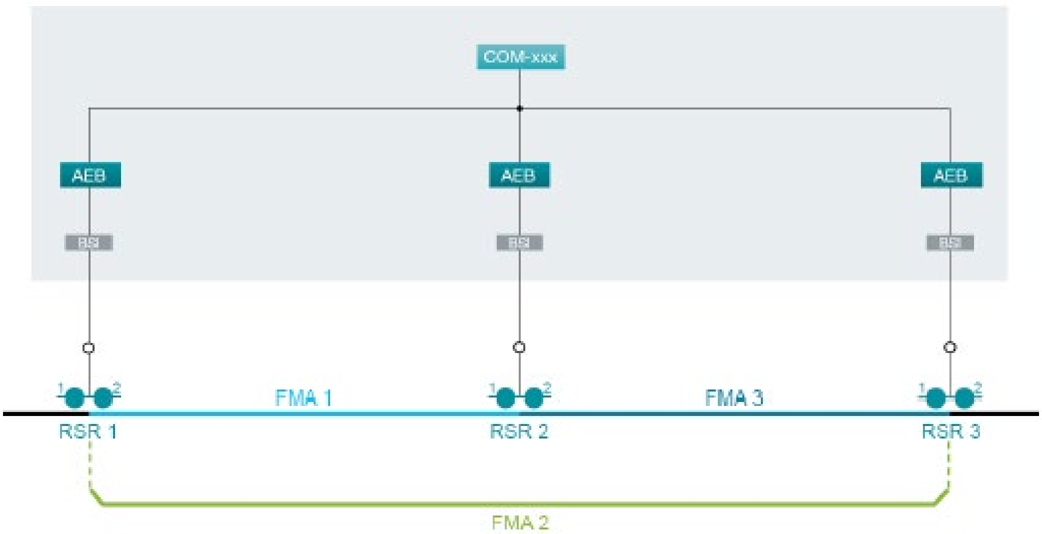


Figure 12 - FMA 2 is an STS covering signalled sections FMA 1 and FMA 3

13. Abbreviations Frauscher Advanced Counter

Abbreviation	Meaning
AEB	Advanced Evaluation Board
ASD	Advanced Service Display
BSI	Overvoltage Protection Unit
CAN	Controller Area Network
CF	Compact Flash
CHC	Counting Head Control
CO-EXB	Configuration Extension Board
COM-AdC	Communication Board for Advanced Counter
COM-WNC	Communication Board (specific implementation of COM-xxx communication board with implemented WNC protocol)
DIP	Dual in-line package
FadC 2.1.x.x-3	Frauscher Advanced Counter with the system number 2.1.x.x-3 (“x” is a free variable parameter for the specific name of the various
FadC	systems)
FDS	Frauscher Diagnostic System
FSC	Frauscher Safe CAN Protocol
IO-EXB	Input/Output Extension Board
PB	Testing plate
PSC	Power Supply with Crowbar
RSR123	Wheel sensor type RSR123
Sys	Sensor system of a wheel sensor
STS	Supervisor Track Section
Reset/pre-Reset	Reset inputs
Fault	An error that can be rectified with a configured Reset procedure, as long the FAdC is/was ready for operation.
Counting head	In functional terms, a counting head consists of a wheel sensor, a BSI and an AEB

END

Includes:	EBI Track 200 Audio Frequency Track Circuit
Excludes:	All other Track Circuits

General

UNDER NO CIRCUMSTANCES should the TX and RX tuning units of one-track circuit be disconnected from the rails at the same time as this can allow unwanted power to pass between the adjacent track circuits resulting in a possible wrong side failure of one of the abutting track circuits.

If an RX or TX is disconnected from its tuning unit, the terminals on that tuning unit to which the 2-core cable was attached should be short circuited, (i.e. terminals 1&2 for an RX or low power TX, terminals 4&5 for a standard power TX) this corrects the tuned zone readings.

A double rail EBI Track 200 track circuit should never be reconfigured as a single rail track circuit.

Before the removal of a Track relay, fed by an analogue RX, the RX should have its power removed to prevent the RX output stage becoming damaged.

The gain or sensitivity should not be increased or decreased where the clear track current (across the 1Ω resistor) has changed by more than 10% without consulting your Supervisor.

Any adjustment should only be to obtain the correct drop shunt, for that track circuit.

Tuned zones should be kept clear of all metallic objects including new or scrap lengths of rail for a distance of at least 1.25m (4ft). The tail cables from the TU to

the rails form part of the tuned circuit, because of this they should wherever possible be bound together, not allowed to form loops and not be run in parallel with the running rails. Failure to observe these items can result in the effectiveness of the tuned area being altered i.e. low or below specification readings.

1. EBI Track 200 Audio Track Circuit:

1.1 EBI Track 200 Layout Configurations

EBI Track 200 track circuits can be used in a number of configurations:

- Single rail configuration using ETUs or TCUs.
- Double rail configuration using TUs for jointless or ETU for jointed track circuits.

- Both single rail and double rail configurations can have multiple Receivers/Track Relays.

Low Power Configurations – Double Rail (ETU & TU)

For track circuits of between 50m (20m where ETUs are used) and 250m in length the EBI Track 200 is configured in a Low Power mode by connecting the TX to terminals 1 and 2 of the tuning unit.

Low Power Configurations - Single Rail

The ETU and SPETU can be used in low power or low power plus modes for tracks between 20m and 250m. Low power is configured by connecting the TX to terminals 1 and 2 of the ETU/SPETU.

Low power plus is configured by connecting the TX to terminals 2 and 5 and providing a strap between terminals 1 and 4of the ETU/SPETU.

Low power plus provides approximately an additional 5% launch voltage over low power tracks for use where single rail tracks are used through S&C.

Additionally, a single rail configuration can be used utilising TCUs which are inherently low power.

1.2 Power Supplies and Fusing

EBI Track 200 can utilise different types of 24VDC power supplies from Bombardier or other suppliers.

An Anti-surge fuse of the type - “Fuse cartridge 3A Anti-surge for PSU AC input, (Cooper Bussmann MDA-3-R Series, ¼” x 1¼”)’. (086/043768)” should be used for both the 110VAC to the Power supply and 24VDC to the Tx/Rx equipment etc.

Relaxation of this requirement is permitted in accordance with the EBI Track 200 Standard NR/L2/SIG/11761.

1.3 SPETU Surge Protection and Fusing

The Surge Protected End Termination Unit is an ETU fitted with surge protection (GDT) and replaceable fuses for use in single rail applications, where protection is required to prevent damage to internal components from traction short circuits.

All applications of the SPETU on Network Rail infrastructure should use the Littelfuse 10Amp 600VAC fuse (KLK D 010, 086/043730). Some MOD states of the SPETU are factory fitted with 5A fuses. These should be replaced by the 10A fuse.

In the event of a SPETU fuse failure; both fuses should be replaced.

In addition, where the GDT is a separate Line Replaceable Unit in later SPETU builds, it should also be replaced by a 145VDC GDT (086/047392) as a precaution against the GDT being stressed and damaged during the original fuse blow event.

Early versions of the SPETU have been delivered with a 95VDC GDT. If the SPETU is reliable there is no need to change the GDT.

However, if the SPETU fuses fail or there is an opportunity to change the GDT, it should be replaced with the 145VDC version (086/047392).

1.4 Test Equipment

A frequency selective meter (FSM), or TI21 Test Meter (TTM), set to the frequency of the track circuit under test should be used for voltage measurements.

It is not acceptable to test EBI Track 200 without an FSM/TTM.

A rail current measuring device such as a Rocoil or Lemflex, used in conjunction with the TTM can be used to measure the TI current in the rail to locate a section of the track bed causing loss of TI power at the Receiver end.

Sleeper testing – The integrity of the Pads and Nylons can be tested using the Bombardier SIT.

1.5 Centre Fed and Cut Section Track Circuits

Each half of a centre fed track circuit or each cut section operates as an independent track circuit and should be tested as such and record cards kept for each part.

1.6 Impedance Bond Tuning

Any impedance bonds within the track circuit should be tuned with the correct resonating capacitor across the auxiliary coil or in the case of B3 3000 and B3 500 bonds (which have no auxiliary coil) the correct tuning module.

Each removable tuning capacitor / module is labelled with the style of bond it should be fitted to; where it is not removable this information appears on the bond itself.

If the earlier PCB type of tuner board (e.g. Howells or WH3 type) is used the correct links should be cut depending on the track circuit frequency.

1.7 Rail-to-Rail Voltage

With the track circuit not shunted by a train or train shunt the rail-to-rail voltage should fall approximately linearly from the TX to the RX end.

In exceptional circumstances (and with permission of the S&T Maintenance Engineer) it may be raised by intermediate tuning capacitors.

1.8 Rail Current

The EBI Track 200 rail current reading gives a more useful reading, than rail voltages, and should be virtually constant throughout the Track Circuit length. It should also be of similar values in both rails.

The Clear Track Current should be within the range defined in Appendix D Table 2.

If the Clear Track Current is outside these values, then the track condition should be investigated to determine the cause of the non-conforming readings.

The Supervisor may advise a higher drop shunt to improve reliability if the track records indicate this is appropriate.

Where impedance bonds, or intermediate tuning capacitors (Bucking Capacitors) have been fitted the current value will have a marked change.

Significant changes in track current indicate leakage faults between the rails which should be investigated and rectified.

It should be noted that PAN8 and Bullhead rail will inherently lose current because of the lack of pads and nylons.

1.9 Tuned Zone Ratios (Pole/Zero Ratios)

Pole – Track under test
Zero – Adjacent/abutting track

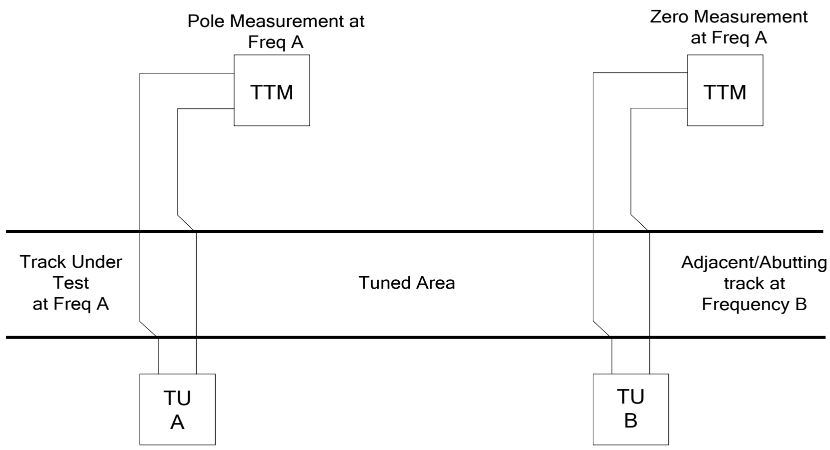


Figure 1 - Tuned Zone Ratios

The Pole voltage is the voltage across the rails at the TU of the track under test (TU A in drawing) at that track's frequency (Frequency A in drawing).

For the purpose of the test this TU can be called the 'Pole TU'.

The zero voltage is measured across the companion tuning unit's (TU B in the drawing) rail terminals at the track under test frequency (Frequency A in the drawing).

For the purpose of the test this TU can be called the 'Zero TU'.

Important points to note are:

- The pole/zero measurement will give no information about the quality of the pole.

  The pole is the property in the Tuning Unit which determines how much signal current is sent down the track to the RX at the other end.

- The pole/zero measurement will give a good measurement of the quality of the zero.

  The zero determines how much unwanted signal flows into the adjacent track.

- The quality of the zero is determined by the impedances caused by:

  - The components within the TU.
  - The tightness of the track and TU connections
  - The layout of the track cables.
  - The equipment (TX/RX) connected to the zero TU.

From the above statements, the following conclusions can be reached:

- Pole/zero ratios are a good method of monitoring the quality of the TU connections and track cable layout.

  As such, they provide evidence that good installation practice has been followed.

- If Pole/zero ratios are measured with an active TX connected to the zero TU, then the ratio will be degraded.

1.10 Mechanical and Electrical Connections

Good quality mechanical and electrical connections are important to obtain reliable operation of the EBI Track 200 equipment.

These connections should be made and maintained in accordance with the torque requirements defined in NR/SMS/PartZ/Z03.

The Advance Plate to Impedance Bond centre tap connection should use the spreader plates and associated installation procedure.

Existing installations should be changed to the updated process if the opportunity arises.

1.11 Spare/Scrap Rail Laid in the 4ft

Placing spare/scrap rail in the 4ft should not affect the operation of the track circuit.

Additionally, the constraint for not placing rail in the 4ft through a Tuned Zone should be complied with.

However, it is recognised that it is not always possible to comply with the TZ constraint. In which case there are some actions which will mitigate against unreliable operation or TC failure.

1.12 TU/ETU/SPETU hoods (Acoustic Jackets)

These should be fitted in areas close to residential property where noise might cause a nuisance.

1.13 Intermediate Tuning Capacitors

These are used to increase the gain at intermediate positions in the track circuit to overcome low ballast resistance caused by poor formation and/or rail fastenings.

They shall not be fitted without permission from the S&TME.

They also require individually specified drop shunt testing along the length of the track circuit at increased frequency

1.14 Receiver Current – Analogue

RX current is measured at the 1Ω resistor on the RX input terminals with a FSM or TTM.

This is the actual physical quantity that the track circuit uses to determine the presence of a train and so is a direct measure of the overall health of the circuit.

Clear track RX current is approximately twice the threshold at which the track relay drops (the threshold is determined by the gain strapping and can be found by reference to Appendix D Table 6.

1.15 Receiver Current – Digital

RX current is measured at the 1Ω resistor on the RX input terminals (TP1 and IPC) with an FSM or TTM or by using the display.

This is the actual physical quantity that the track circuit uses to determine the presence of a train and so is a direct measure of the overall health of the circuit.

Clear track RX current is approximately twice the threshold at which the track relay drops (the threshold is determined during the setup procedure in Appendix E.

1.16 Receiver Current – General

The RX current is affected by:

- The quality of the TX pole.
- The quality of the RX pole.
- Ballast resistance.
- Feed through from adjacent track circuits of the same frequency.

From the previous statements, the following conclusions can be reached:

- RX current is an excellent overall measure of the stability of the track circuit. Significant changes in current are due to either degradation in the TUs, or changes in the leakage current between the rails. e.g. impedance bonds, rail bonds, check rails etc.

A significant change should be determined by which is the greater of:

- a change of ±20% in the track current
- or a change of ±10mA in the track current.

These factors require investigation if fault-free operation is to be maintained’

1.17 Using the Digital Rx Mating Connector with adaptor for or Fork Terminals.

The Digital Rx Mating Connector is used to present the screw terminal connections for wiring purposes, using fork crimps, when an Analogue Rx is converted to a Digital Rx.

If the wrong wiring connections are made to the Receiver, the TC will become unreliable because the Clear Track Current in to the Receiver will be seen to be incorrect.

1.18 Tuned Zones

Pole/zero ratios are useful in monitoring installation standards.RX current is the most effective measure of track circuit performance and stability since it measures the effectiveness of the pole circuit and signal leakage effects.

1.19 Tuned Zones on Steel Sleepers

The following Special instructions for tuned zone installations should be followed:

- The tuned zone is 22m ± 0.5m
- All the sleepers within the zone, and for 3 bays either side, are of a Network Rail accepted steel type
- The tuned zone is not part of a TI 21/Aster hybrid interface
- Single Rail Application
- RX current can be affected by the quality of the rail connections, bonded out joints, IRJ’s and S&C insulations (sole plates, stretcher bars etc).

FAULT FINDING GUIDELINES

2. General

Before starting work, all track connections should be checked for tightness as described in NR/SMS/PartC/TC16 (Track Circuit: EBI Track 200)

The Bombardier Hints and Tips document ‘EBI Track 200 Track Circuit: Aid for Maintenance & Fault Finding’ can be also referenced.

The health of a track circuit can be determined by the voltage measured across the 1Ω resistor.

Any changes to the TX output level, the TX or RX ETU, TU or TCU the track bed or associated tuned zone equipment will affect the receiver input current.

The track relay voltage will indicate the correct functioning of the RX and that the relay coil is not damaged. If the relay coil voltage is low, it will indicate a failing RX unit.

The relay end rail voltage is a measure of the energisation level of the track circuit.

It will change inversely proportional to the drop shunt value and will be affected by the same factors.

A low rail voltage will indicate a faulty TU/ETU/TCU or a faulty connection at any part of the track.

If two adjacent track circuits fail simultaneously, the fault is most likely where the two tracks adjoin. Check the tuning units and associated connections and other shared equipment like the PSU.

For centre fed track circuits any problem within 30 metres of the centre feed will affect both sections.

If low ballast resistance is suspected see if the problem can be localised. On concrete sleepered track Check the pads and clip insulations.

On timber sleepered track Check for poor ballast drainage and P8 type rail fastenings.

If the problem can be isolated, spot replacement of rail insulations or replacement of P8 fastenings with P14 should be considered. (if you are in doubt about the type of fastenings, ask your SM(S)

Checking obtained readings against those on the Record Card and investigating those that have significantly changed can reveal the source of the fault.

Using an FSM/TTM the measurement of the rail-to-rail voltage at regular intervals from TX to RX should show a gradual decrease of the voltage.

The rail current reading gives a more valued reading than track voltage and typical current readings are:

- Normal power = 1.0 - 1.5 Amp
- Low power = 0.5 - 0.75 Amp
- Low power plus = 0.55 - 0.8 Amp

Within a tuned zone

- Each RX =5 Amp, each TX = 10 amp (5 if low power or low power plus) per frequency

3. Feed (Transmitter) End

3.1 Measure the PSU output voltage and current. If the readings are within the specified limits Measure the TX output using TTM. If the voltage is outside its specified limits

3.2 Check the PSU input tapings are set to P5 and P115. If not, adjust the tapping settings.

3.3 Measure the voltage on the 110V signalling supply to the PSU. If the supply is over 115VAC, adjust the PSU output tapings to give between 25V and 27V DC.

Otherwise, adjust the PSU output tapings to give ideally 24V - 26V DC.

If the current drawn by the TX is outside its specified limits, the PSU, TX or TU/ETU/TCU shall be replaced.

3.4 Measure the AC Ripple on the 24V DC from the PSU.

Values exceeding 1V shall be investigated to eliminate the cause or the PSU replaced.

3.5 Check that the TX is emitting a regular warbling noise. If the tone is fixed rather than warbling, this indicates that the unit is not modulating.

In this case, first Check that the mod pin is not connected to B24 or N24. If it is not warbling, or the sound is unusual or irregular, remove the 24V supply fuse and replace it after a couple of minutes.

If this activates the unit, it shall be replaced as it could fail again. If the warbling does not start, also replace the TX.

3.6 Measure the rail voltage between the TX rail connections, if they are outside the specified limits check all the associated TU/ETU/TCU connections (including equipment in the location housing) and then test the units themselves and replace as necessary.

3.7 If the TX is at a tuned zone calculate the tuned zone ratio (Appendix B). If a low ratio is found Check all associated TU/ETU/TCU connections (including equipment in the location housing) and then Test the units themselves and replace as necessary. If the fault has cleared move to 3.9.

3.8 Place a short circuit between terminals T1 and T2 on the adjoining TU/ETU (this will cause the track circuit to show occupied) and Measure the rail voltage at the TX.

It should not have altered from the previous reading in 3.6

If it is not the same, check all the associated TU/ETU/TCU connections (including equipment in the location housing) and then Test the units themselves and replace as necessary.

Remove the short circuit and re-calculate the tuned zone ratio (Appendix B).

3.9 Measure the rail voltage at the TX.

3.10 Connect a shunt set at 1Ω across the rails at the TU/ETU connections and measure the rail voltage again. The rail voltage should decrease by 50%.

3.11 Remove the shunt and the voltage should rise immediately to the first reading. If this is the case then it can be assumed that all the TX equipment is working correctly.

Impedance Bonds (Where Fitted)

Before checking the impedance bond(s) the TX equipment shall first be proved to be operating correctly.

3.12 Check that no corrosion, dirt oil or water is present in the terminal box and/or connection points.

3.13 Measure the voltage across the auxiliary coil or tuning module (NOT applicable to B3 3000 and B3 500 bonds), check it is in the correct ratio with the rail-to-rail voltage (Appendix C).

If it is correct the bond should be operating correctly, if it is incorrect proceed with the next step.

3.14 Check the tuning capacitor/module is correct for the style of bond and the track circuit frequency. Apply a short circuit across the tuning capacitor/module and

3.15 Measure the voltage. Remove the short circuit and Check the voltage rises.

If there is not a dramatic rise in voltage replace the tuning capacitor/module.

If this still does not improve matters consider replacing the bond.

Near ETU units this tuning capacitor/module test might not work.

For Intermediate Bonds Only

3.16 Place the Rocoil over the rail 1 metre before the Bond (TX side) and note the reading on the TTM (= amps, I1).

3.17 Repeat the measurement 1 metre from the bond on the RX side (I2)

3.18 Subtract I2 from I1 thus obtaining the current through the bond at the EBI Track 200 frequency.

3.19 Measure the rail to rail voltage (V) across the impedance bond.

3.20 Divide the voltage (V) by the current calculated from 2.3.6 thus giving the impedance (Z), Z= V / (I1-I2).

This value should be greater than 8Ω.

If less than 8Ω, check for traction imbalance before remedial action is taken with the impedance bond. (The Manufacturers specification is 12Ω when measured at the Capacitor frequency)

It is possible to verify the Impedance Bond is within the manufacturers specification by measuring the Bond inductance without the tuning capacitor connected.

The value should be between 27.8 to 28.2 µHenries.

The value between the rail connections and the centre tap will be half these values.

4. Relay (Receiver) End

4.1 Observe the track relay. If energised, Check the line circuits as the fault is between the relay and the signallers ‘Occupied’ indication.

4.2 Measure the DC voltage across the track relay coils.

- 40V to 75V DC for the analogue RX
- 40V to 44V DC for the digital RX MOD 1 & 2
- 48V to 52V DC for the digital RX MOD 3

If it is within the specified limits remove the receiver 24V supply fuse and replace the relay. Replace the supply fuse on completion.

4.3 Measure the RX 24V DC supply voltage.

- 22.5V to 30.5V DC

4.4 Measure the AC Ripple on the 24V DC from the PSU. It should not exceed 1V. Values above this level should be investigated to eliminate the cause or the PSU replaced.

If the voltages are within the specified limits go to move to Step 4.7.

4.5 Measure using a FSM/TTM the rail voltage at the RX rail connections. If they are within the specified limits go to Step 4.6.

If they are not attention should be given to a track circuit examination and testing at the TX end.

Low rail volts could be due to ballast or other track equipment, as well as a fault at the TX end of the track

4.6 Calculate the tuned zone ratio (Appendix B). If this ratio is lower than the specified limits test all the TU/ETUs and their connections replacing where necessary. If the ratio is within the specified limits and the fault still remains, replace the adjoining TU.

4.7 Measure the Receiver input voltage, using a TTM, and the frequency, using a multimeter, across the surge arrestors.

4.8 At the Transmitter place a shorting link on the B24 and mod transmitter terminals, and note the values at the RX end.

This causes the TX to transmit the upper sideband frequency (USB)

4.9 At the Transmitter remove the B24 – Mod short strap and place the shorting link on the N24 and mod transmitter terminals, and note the values at the RX end.

This causes the TX to transmit the lower sidebands frequency (LSB)

4.10 The USB and LSB frequencies recorded should be within ±4Hz of the figures in Appendix G. If not, then the Transmitter is off frequency and should be replaced.

If the voltages noted at the RX end give a sideband imbalance ratio greater than 1.6:1 for TU, ETU & SPETU or 1.8:1 for TCU ratio, then at least one of the TUs/ETUs/TCUs for that track circuit are out of specification.

If so, then repeat this test at the TX TU/ETU/TCU to determine whether the RX TU/ETU/TCU is at fault or the TX TU/ETU/TCU.

4.11 Remove shorting strap on completion of the steps 4.8 and 4.9.

4.12 Measure the voltage and current supplied by the PSU. If they are not within the specified limits check the PSU tapping and/or replace the PSU.

4.13 Measure the voltage across the 1Ω resistor; compare this reading against the Record Card.

If the obtained reading is not within 10% of the Commissioning reading or last Set-up reading on the Record Card, the reason for the discrepancy should be investigated.

Appendix D Table D2 can be also consulted if the track has a history of poor performance.

If adjustment is required, the initial setting for an analogue RX should be selected from Appendix D table 5 using the voltage across the 1Ω resistor, followed by a drop shunt test. For digital RX, an auto-set routine should be performed.

The gain should only be altered to obtain the correct drop shunt.

5. Interference Test

To check the traction interference levels on the track the following test are carried out on T1-T2 terminals of the ETU/TU or the TCU surge arrestors.

<u>For traction areas only:</u>

5.1 Remove the B24 fuse to the TX and Check the correct track relay drops.

5.2 Measure the voltage across the track using a TTM set to AC 200mV range.

5.3 Measure the frequency across the track using a multimeter.

Record both the voltage and frequency readings.

Readings greater than 100mV are un-acceptable, the track circuit should be investigated and your SM(S) informed.

If there is a problem, this test can be repeated with the Traction supply OFF as this can help to identify the source of the interference.

5.4 If all the readings appear to be correct but the track circuit remains failed then recheck all items above and check there are no problems arising from Spare / Scrap rail laid in the 4ft. See Steps 6.1 and 6.2.

6. Spare/Scrap Rail Laid in the 4ft

Placing spare/scrap rail in the 4ft should not affect the operation of the TC.

Additionally, the constraint for not placing rail in the 4ft through a Tuned Zone should be complied with.

However, it is recognised that it is not always possible to comply with the TZ constraint.

In which case there are some actions which will mitigate against unreliable operation or TC failure.

6.1 Measure the current flowing in the rail laid in the 4ft using a Rocoil. This should be Zero.

If current is found to be flowing in the rail, then there is likely to be physical contact between the running rails and the spare rail. This should be rectified.

6.2 Check the TZR before and after the rail is laid in the 4ft.

If the change in TZR is less than 10%, there should not be any further problems. This check should be repeated when the rail is removed from the 4ft.

7. Using the Digital Rx Mating Connector with adaptor for or Fork Terminals.

The Digital Rx Mating Connector is used to present the screw terminal connections for wiring purposes, using fork crimps, when an Analogue Rx is converted to a Digital Rx.

If the wrong wiring connections are made to the Receiver, the TC will become unreliable because the Clear Track Current in to the Receiver will be seen to be incorrect.

7.1 Check the wiring for the rail connections which should be connected to IP1 and IPC (See figure).

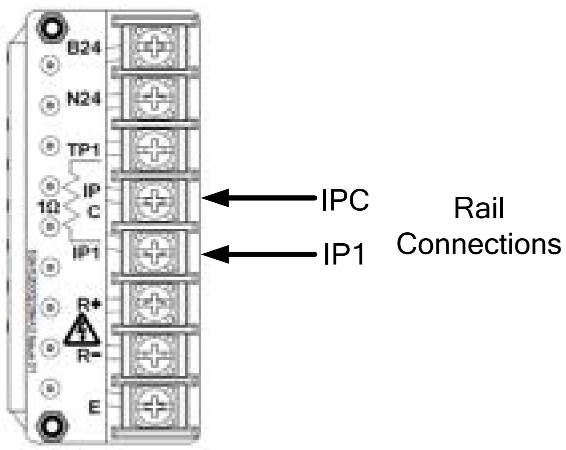


Figure 2 – Rail Connections

In later versions of the Mating Connector with adaptor for Fork Terminals, the screw in TP1 is removed

7.2 Check the Average Current is within 10% of the 1Ω Value from the Record Card.

If the Average Current is approximately 50% of the 1Ω Value from the Record Card, check that the rail connections are not erroneously connected to IP1 and TP1.

If the Average Current is approximately 1% of the 1Ω Value from the Record Card, check that the rail connections are not erroneously connected to IPC and TP1.

APPENDIX A - Typical Rail-to-Rail Voltages (Vp)

Operation	Track Length (m)	TX End Volts Freq ACEG	RX End Volts Freq ACEG
Low Power	20	0.5V – 0.7V	0.6V – 0.7V
	50	0.6V - 0.7V	0.6V – 0.7V
	150	0.9V - 1.1V	0.4V – 0.7V
	250	1.1V - 1.3V	0.3V – 0.5V
Low Power Plus	50	0.6V - 0.8V	0.6V – 0.8V
	150	1.1V – 1.5V	0.4V – 0.7V
	200	1.2V – 1.5V	0.4V – 0.7V
	250	1.3V – 1.5V	0.3V – 0.6V
Normal Power	200	4.5V – 5.3V	1.1V – 2.6V
	400	4.2V – 6.0V	0.5V – 1.0V
	600	4.2V – 6.1V	0.3V – 1.0V
	900	4.2V – 6.2V	0.2V – 0.7V
	1100	4.2V – 6.2V	0.1V – 0.5V

Table 1 – Rail Voltage's for Frequencies A C E and G

Operation	Track Length (m)	TX End Volts Freq BDFH	RX End Volts Freq BDFH
Low Power	20	0.9V – 1.1V	0.9V – 1.1V
	50	1.0V – 1.2V	0.8V – 1.1V
	150	1.4V - 1.7V	0.6V – 0.8V
	250	1.6V – 2.0V	0.5V – 0.6V
Low Power Plus	50	1.0V – 1.3V	0.8V – 1.2V
	150	1.7V – 2.2V	0.6V – 0.8V
	200	1.8V – 2.2V	0.6V – 0.9V
	250	1.9V – 2.3V	0.5V – 0.7V
Normal Power	200	5.8V – 7.1V	1.9V – 2.8V
	400	6.1V – 7.5V	0.9V – 1.6V
	600	6.0V – 7.6V	0.6V – 1.1V
	900	6.0V – 7.7V	0.3V – 0.7V
	1100	6.0V – 7.7V	0.2V – 0.6V

Table 2 - Rail Voltage's for Frequencies B D F and H

APPENDIX B - Tuned Zone Ratios

These ratios are the absolute MINIMUM values acceptable. The table below takes into account the latest installation standards and cable types.

If the Tuned Zone Ratio is not achievable, check the quality of the installation.

Pole	Frequency	Zero	Frequency	Ratio
Tx	ACG	Rx	BDH	12:1
Tx	ACG	Tx	BDH	11:1
Rx	ACG	Tx	BDH	12:1
Rx	ACG	Rx	BDH	12:1
Tx	BDFG	Rx	ACEG	18:1
Tx	BDFG	Tx	ACEG	15:1
Rx	BDFG	Tx	ACEG	18:1
Rx	BDFG	Rx	ACEG	18:1
Tx	E	Rx	F	9:1
Tx	E	Tx	F	8:1
Rx	E	Tx	F	9:1
Rx	E	Rx	F	9:1

Table 3 – Tuned Zone Ratios

APPENDIX C - Impedance Bond Voltage Ratios

Impedance Bond Style	Voltage Ratio
DE	40:1
MR	56:1
P3	45:1
S	56:1
WH3	56:1
B3 500	Not applicable
B3 3000	Not applicable

Table 4 - Impedance Bond Voltage Ratios

APPENDIX D - Analogue RX

Gain	Drop Across 1Ω Resistor (mV)	Input 1	Input 2 Strap (Note D)	Strap 1	Strap 2
1	390	1H	1L		
2	195	3L	1L	1H-3H	
3	134	3H	3L		
4	98	1H	3L	1L-3H	
5	78	3L	9L	1H-9H	1L-3H
6	65	3L	9L	3H-9H	
7	56	3L	9L	1H-3H	1L-9H
8	50	1L	9L	1H-9H	
9	45	9H	9L		
10	39	1H	9L	1L-9H	
11	35.4	3H	9L	1L-3L	1H-9H
12	32.4	3H	9L	3L-9H	
13	30	1H	9L	1L-3H	3L-9H

Table 5 - Receiver Gain Connections

The voltage measured across the 1Ω resistor is the clear track current.

A Strap 1 and Strap 2 refer to wire positions not labels.

B When no straps are listed in the table, they are not required.

C Input 1 and Input 2 can be either of the pair of cores from the tuner unit.

D Input 2 is always taken to the bottom of the 1Ω resistor; its associated strap is always taken from the top of the 1Ω resistor to the terminal shown.

E The drop across the 1Ω resistor is used with this table to set the initial gain, the final setting is made by placing a shunt box across the rails at the RX tuning unit and adjusting the tapping to obtain an optimum shunt value.

	Clear Track Receiver Current (mA)			
Track Length	**Normal Power**		**Low Power or Low Power Plus**	
(m)	**Min**	**Max**	**Min**	**Max**
20 – 100	-	-	43	106
100 – 150	-	-	38	90
150 – 200	-	-	33	76
200 – 250	130	251	28	66
250 – 300	110	213	-	-
300 – 400	81	184	-	-
400 – 500	62	143	-	-
500 – 600	48	116	-	-
600 – 700	38	98	-	-
700 – 800	31	84	-	-
800 – 900	25	74	-	-
900 – 1000	24	66	-	-
1000 – 1100	24	60	-	-

Table 6 - Expected Range of Track Currents against Track Circuit Lengths

This table provides a reference for Operational tracks to give guidance on the expected Clear Track Receiver Current depending on the track length.

NOTE: *This table is not required for setting up the track.*

Where Transmitter circuits use LMUs, the line losses become insignificant and therefore the table also applies.

However, where long TX to TU/ETU cables are in use without LMUs, then the table does not apply due to the losses in the cable.

Typical Gain Setting figures for single rail using TCUs

The Table shows the initial sensitivity setting at the Receiver for the combination of track circuit lengths and combined rail-to-TCU cable lengths. The combined rail-to-TCU cable length is the length of the transmitter TCU-to-rail feed cable plus the length of the receiver TCU-to rail feed cable.

		Total TX + RX Rail-to-TCU Cable Length			
		0 to 70m	**70 to 130m**	**130 to 200m**	**200-350m**
Track	**0 to 70m**	60mA	55mA	50mA	35mA
	70 to 130m	75mA	60mA	55mA	35mA
	130 to 200m	90mA	65mA	55mA	35mA

Table 7 - Digital Rx

		Total TX + RX Rail-to-TCU Cable Length			
		0 to 70m	**70 to 130m**	**130 to 200m**	**200-350m**
Track	**0 to 70m**	6 – 7	7	8	11
	70 to 130m	5 – 6	6 - 7	7 - 8	11 – 12
	130 to 200m	4 - 5	6	7	12

Table 8 - Analogue Rx

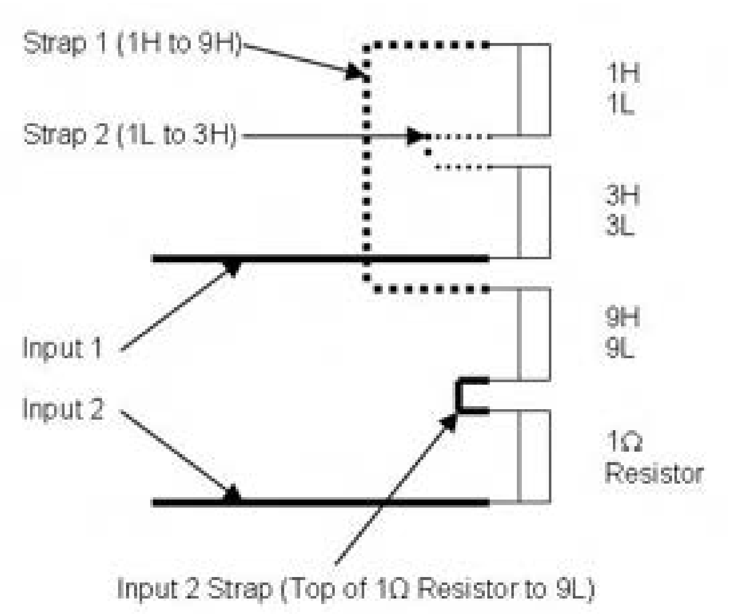


Figure 3 – An Example of the Strapping of an Analogue Receiver

Figure 3 shows the connections and strapping require to set the receiver gain to setting 5

- Input 1 from TU/ETU to 3L
- Input 2 from TU/ETU to bottom of 1Ω resistor
- Input 2 strap from top of 1Ω resistor to 9L
- Strap 1 from 1H to 9H
- Strap 2 from 1L to 3H

APPENDIX E - DIGITAL RX Set up procedure for the Digital Receiver

This procedure shall be completed regardless of whether the unit has been previously used or not.

If safe track access is possible then this process. If not, then the follow the set-up procedure shown in Appendix G can be used.

1. Power up the Receiver. The display will respond with ‘KEY?’. Fit the correct frequency key for the track circuit under test.

2. The display will echo back the frequency in the format, for example ‘200A’ for frequency A, and then display ‘NewK’.

A previously set up Receiver will display the relay state (‘PICK’ or ‘drop’).

3. Confirm that RX has a supply voltage within the range 24V to 26V.

<u>On the Receiver</u>

Press OK then ‘NEXT’ until ‘Vpsu’

Press OK this displays the PSU Voltage

Note this Value

4. Confirm the track circuit has a Sideband imbalance ratio less than:

- 1.6:1 for TU/ETU/SPETU
- 1.8:1 for TCU

On the Receiver

Press OK then 'NEXT' until 'INOW'

Note this Value

Press OK then Next Until 'USB'

Press OK and note the value.

Press 'BACK' then 'NEXT' until 'LSB'

Press OK and note the value.

Calculate and record sideband imbalance by dividing the larger value by the smaller value.

Note this Value

NOTE: *If the sideband imbalance exceeds the ratio values above, the track circuit should be investigated to ascertain the cause of the imbalance. Carry out steps 4.7 to 4.11.*

5. Confirm Average current seen by the RX.

On the Receiver

Press OK then 'NEXT' until 'INOW'

Press OK then Next Until 'AV'

Press OK this displays the average current seen by the Unit.

Note this Value

For existing installations:

6. Using the Average Current value from the test above, confirm that it is the same as that recorded on the track Record Card or within 10% of that value.

If the clear track current is more than 10% below the expected level, or is pulsing this indicates that the track circuit is losing current and is not a receiver problem.

In this case the cause of the current loss should be determined and rectified otherwise the safety margin of the circuit can be eroded.

<u>For new digital receiver Installations (Projects or Maintenance replacement)</u>

7. Refer to Table 6 (Typical Track Currents against Track Circuit Lengths) and confirm that the value noted in 5A above is within 20% of the expected value from the table.

8. Determine the ratio between the TX end and RX end rail currents as described below.

9. Using a TI21 Test Meter (TTM) and a Rocoil rail current Transducer (or functional equivalent);

   Measure the signal current at the meter points shown in figure 4.

   Compare I1a with I1b and discard the lower value.

   Compare I2a with I2b and discard the higher value.

   Obtain the ratio IRail by dividing the RX end current (lowest I2) by the TX end value (highest I1).

   Record this value on the record card.

   NOTE: *In points tracks, where multiple receivers are used, then a current measurement must be taken adjacent to each receiver and the values added together to obtain the I2 value for use in Tables 9 to 14.*

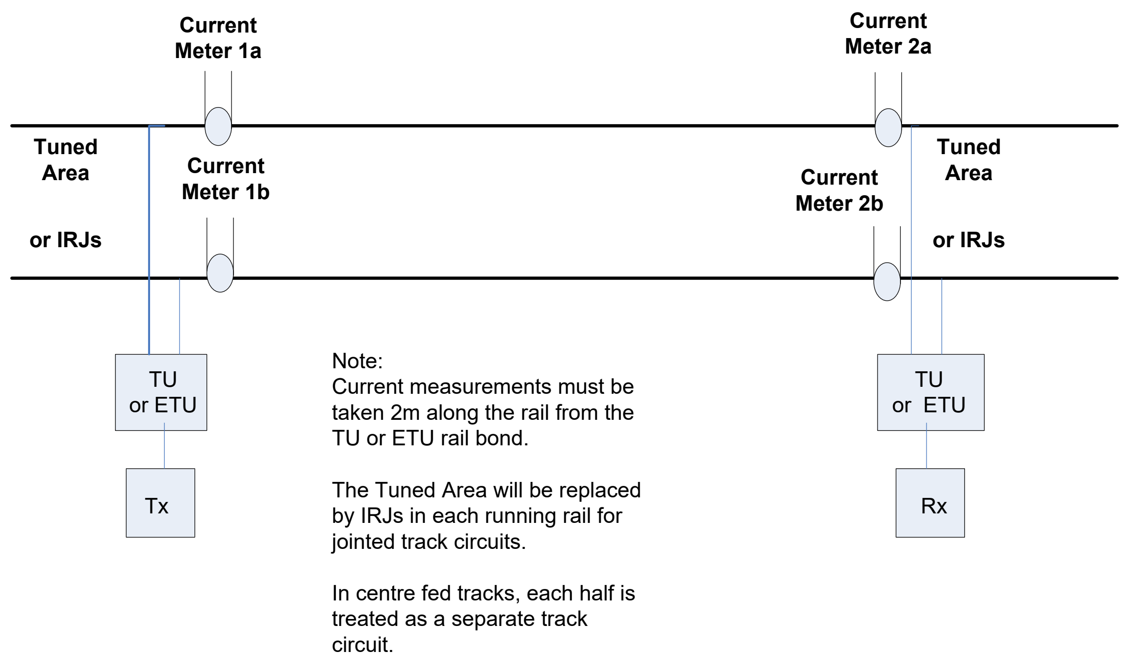


Figure 4 - Measurement Points for IRail Ratio Determination

10. Determine the value of ballast impedance by inspection of the Tables 9 to 14 (check that the table appropriate to the frequency and low power / normal power setting of the track circuit is used).

    Record this value on the record card.

Determination of Ballast Impedance from Irail ratio % for Various Track Lengths

Track Length (m)	Ballast Impedance Ωkm									
	2	**3**	**4**	**5**	**6**	**8**	**10**	**15**	**20**	**200**
200-249	89	92	94	95	96	97	98	98	99	99
250-349	81	87	90	92	93	95	96	97	98	100
350-449	73	81	86	88	90	93	94	96	97	100
450-549	63	74	80	84	87	90	92	95	96	100
550-649	54	66	74	79	82	87	89	93	95	100
650-749	44	58	67	73	77	83	86	91	94	100
750-849	36	50	59	66	71	78	83	89	92	100
850-949	29	42	52	60	65	74	79	86	90	100
950-1049	24	36	45	53	59	68	74	83	88	100
1050-1100	19	30	39	47	53	63	70	80	86	100

Table 9 - Normal Power Frequencies A and E

Track Length (m)	Ballast Impedance Ωkm									
	2	**3**	**4**	**5**	**6**	**8**	**10**	**15**	**20**	**200**
200-249	85	90	92	94	95	96	97	98	98	100
250-349	76	83	87	90	91	93	95	97	97	100
350-449	65	75	81	85	87	91	92	95	96	100
450-549	54	66	74	79	82	87	90	93	95	100
550-649	43	57	66	72	77	83	86	91	94	100
650-749	34	48	57	65	70	77	82	89	92	100
750-849	27	39	49	57	63	72	77	86	90	100
850-949	21	32	42	50	56	66	72	82	87	100
950-1049	17	27	35	43	49	59	67	78	84	100
1050-1100	13	22	30	37	43	53	61	74	81	100

Table 10 - Normal Power Frequencies B, C, F and G

Track Length (m)	Ballast Impedance Ωkm									
	2	**3**	**4**	**5**	**6**	**8**	**10**	**15**	**20**	**200**
200-249	81	87	90	92	93	95	96	97	98	100
250-349	71	80	84	87	89	92	94	96	97	100
350-449	60	71	78	82	85	88	91	94	96	100
450-549	48	61	70	75	79	84	88	92	94	100
550-649	38	52	61	68	73	79	84	89	92	100
650-749	30	43	53	60	66	74	79	86	90	100
750-849	23	35	44	52	58	68	74	83	88	100
850-949	18	28	37	45	51	61	68	79	85	100
950-1049	14	23	31	38	45	55	62	75	82	100
1050-1100	11	19	26	33	39	49	57	70	78	100

Table 11 - Normal Power Frequencies D and H

Track Length (m)	Ballast Impedance Ωkm									
	2	**3**	**4**	**5**	**6**	**8**	**10**	**15**	**20**	**200**
20-74	I_{Rail} Ratio measurement not required									
75-124	95	96	97	98	98	99	99	99	99	100
125-174	92	94	96	97	97	98	98	99	99	100
175-224	89	92	94	95	96	97	98	98	99	100
225-250	85	90	92	94	95	96	97	98	98	100

Table 12 - Low Power Frequencies A and E

Track Length (m)	Ballast Impedance Ωkm									
	2	**3**	**4**	**5**	**6**	**8**	**10**	**15**	**20**	**200**
20-74	I_{Rail} Ratio measurement not required									
75-124	93	95	96	97	97	98	98	99	99	100
125-174	89	92	94	95	96	97	98	98	99	101
175-224	85	90	92	94	95	96	97	98	98	100
225-250	80	86	90	92	93	95	96	97	98	100

Table 13 - Low Power Frequencies B, C, F and G

Track Length (m)	Ballast Impedance Ωkm									
	2	3	4	5	6	8	10	15	20	200
20-74	IRail Ratio measurement not required									
75-124	91	94	95	96	97	98	98	99	99	100
125-174	86	90	93	94	95	96	97	98	98	100
175-224	81	87	90	92	93	95	96	97	98	100
225-250	76	83	87	90	91	93	95	97	97	100

Table 14 - Low Power Frequencies D and H

11. Determine the set-up shunt to be used by inspection of Tables 15 and 16 (use appropriate Low Power / Normal Power table).

If the set-up shunt is given as ‘Special’ this indicates that the ballast is in a very poor condition.

As an interim measure, until the ballast can be rectified, track circuits should be set up at 3Ω.

Affected track circuits should be monitored weekly for changes in Rx clear track current (Inow on the Rx display).

If Inow changes by more than 10% from the value at set up, then the track shal be re-set. Record the set-up shunt value on the record card.

If the ballast measurement of a track circuit in special measures does not return to normal levels and can be shown to be stable over several months, then a case can be made for reducing the set-up shunt.

NOTE: *If the IRail ratio measurement requires the use of higher shunt values, and the track is not very wet, then this indicates that there is severe loss of current down the track which should be investigated and corrected.*

Determination of Set Up Shunt from Ballast Impedance for Various Track Lengths

Track Length (m)	**Ballast Impedance Ωkm**							
	2	**3**	**4**	**5**	**6**	**8**	**10**	**15 and above**
200-249	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
250-349	1.2	1.2	1.0	1.0	1.0	1.0	1.0	1.0
350-449	1.2	1.2	1.2	1.0	1.0	1.0	1.0	1.0
450-549	1.4	1.2	1.2	1.2	1.0	1.0	1.0	1.0
550-649	1.6	1.4	1.2	1.2	1.2	1.0	1.0	1.0
650-749	2.0	1.4	1.2	1.2	1.2	1.0	1.0	1.0
750-849	2.4	1.6	1.4	1.2	1.2	1.2	1.0	1.0
850-949	Special	1.8	1.4	1.4	1.2	1.2	1.0	1.0
950-1050	Special	2.2	1.6	1.4	1.2	1.2	1.0	1.0
1050-1100	Special	2.8	1.8	1.6	1.4	1.2	1.2	1.0

Table 15 - Set Up Shunt (Ω) for Normal Power All Frequencies

Track Length (m)	**Ballast Impedance Ωkm**				
	2	**3**	**4**	**5**	**6 and above**
20-74	1.5	1.5	1.5	1.5	1.5
75-124	1.7	1.5	1.5	1.5	1.5
125-174	1.7	1.7	1.7	1.5	1.5
175-250	1.9	1.7	1.7	1.7	1.5

Table 16 - Set Up Shunt (Ω) for Low Power All Frequencies

An example set-up shunt determination:

- Frequency B track circuit, 757m long.
- I1a = 1.012A   I1b = 1.023   Use 1.023A
- I2a = 757mA   I1a = 782mA Use 757mA
- IRail Ratio = 757/1023 = 0.74 = 74%
- Ballast (Table E1.b) = 8Ω
- Set Up Shunt (Table E1.g) = 1.2Ω

12. Connect a shunt box across the rails at the receiver TU or ETU track connections.

    Set the drop shunt to the value determined in step 11.

    Check that clear track current has fallen to less than 80% of the value before the shunt box was connected.

13. Replace the frequency key with the set-up key.

    The display will respond with ‘SET?’

    Press the ‘OK’ button to begin the automatic set-up process

    NOTE: *If the set up key is left in place for more than 1 minute, then the set up function will time out and the threshold will be set to zero.*

14. The condition monitoring display will show the legend ‘WAIT’, followed by ‘PASS’ or ‘FAIL’.

    ‘PASS’ indicates that set-up has been successful, and the new gain settings have been locked into the unit.

    ‘FAIL’ indicates that set-up was unsuccessful because, for example, the wrong frequency key has been used, or the track current is too low.

    In this case, ‘FAIL’ will cycle with the reason for failure shown as a code. (See APPENDIX H)

    The track circuit should be investigated, and faults corrected before set-up is attempted again.

    NOTE: *If the set up fails, then the threshold will be set to zero.*

15. Leaving the Shunt box applied. Replace the set-up key with the frequency key.

16. Check that clear track current is still below 80% of the value without the shunt box connected.

17. Remove the shunt box and check that the current recovers to the value noted in step 4.

    If step 17 is positive then release the shunt push button and confirm that the track relay picks.

18. Connect a shunt box, set to 0.7Ω, across the rails at the transmit end TU / ETU track connections and check that the track circuit drops.

19. Record the threshold level on the track circuit record card and confirm that the clear track current is correctly recorded.

20. Carry out a full test of the track circuit and record all values as required in the track Record Card

This completes the receiver set up.

NOTE: *Where Low Power or Low Power Plus tracks are used, the appropriate 'Low Power' or 'Low Power Plus' labels are required for the TX, RX and TUs / ETUs / SPETUs*

APPENDIX F - An alternative method for setting up the track circuit after a failed Transmitter LMU-TX, LMU-TU or TU/ETU

The SM(S) should risk assess the ability to gain safe site access and the competence of Maintenance staff attending the track circuit equipment and should satisfy themselves that the use of the procedure is appropriate and authorise its use.

A full test should be carried out as soon as practically possible.

Deferral of testing, up to a limit of 48 hours, can be permitted on the basis of safety if this setup procedure is used.

1. Remove the faulty unit and replace with the new one.

2. Note the clear track and threshold current values recorded on the track circuit record card.

3. Check that the threshold value on the receiver (Ith) is the same as that entered on the record card.

   For track circuits with multiple receivers, all thresholds shall be checked.

   If the thresholds have not changed then proceed to Step 9

4. Check that the clear track current is within ±20% of the original value.

   If the clear track current is more than ±20% of the original value proceed to Step 7 unless track access is not available to perform drop shunt testing, in which case proceed to Step 9.

5. Check that all receivers drop with 0.8Ω across their rail connections, and that 0.7Ω at the transmitter rail connections drops all receivers in the track circuit.

If the drop shunt tests fail proceed to Step 9.

6. Fill in the record card. Set up completed. Do not carry out steps 7, 8 or 9

7. Check that all receivers drop with 0.8Ω across their rail connections, and that 0.7Ω at the transmitter rail connections drops all receivers in the track circuit.
If the drop shunt tests fail proceed to step 9.

8. Complete the record card.

The setup has been completed. Do not proceed to step 9.

9. The criteria for using the shortened set up procedure have not been met. A Full Test shall be performed.

A full Set-Up procedure (APPENDIX E) should be carried out as soon as practically possible.

Deferral of Setting Up and Testing, up to a limit of 48 hours, might be permitted on the basis of safety if this setup procedure is used.

This completes the track set up using this process.

NOTE: *Where Low Power or Low Power Plus tracks are used, the appropriate 'Low Power' or 'Low Power Plus' labels are required on the TX, RX and TUs / ETUs / SPETUs*

APPENDIX G - An alternative method for setting up the Receiver after a failed Receiver or failed Set-up Key

The SM(S) should risk assess the ability to gain safe site access and the competence of Maintenance staff attending the track circuit equipment and should satisfy themselves that the use of the procedure is appropriate and authorise its use.

A full test shall be carried out as soon as practically possible.

Deferral of testing, up to a limit of 48 hours, may be permitted on the basis of safety if this setup procedure is used.

This procedure is to be completed regardless of whether the unit has been previously used or not.

1. Power up the Receiver. The display will respond with 'KEY?'.

2. Fit the correct frequency key for the track circuit under test.

The display will echo back the frequency in the format, for example ‘200A’ for frequency A, and then display the relay state (‘PICK’ or ‘drop’) or can display ‘NewK’.

3. Confirm that RX has a supply voltage within the range 24V to 26V

On the Receiver

Press OK then ‘NEXT’ until ‘Vpsu’

Press OK this displays the PSU Voltage

Note this Value

4. Confirm Average current seen by the RX.

On the Receiver

Press OK then ‘NEXT’ until ‘INOW’

Press OK then Next Until ‘AV’

Press OK this displays the average current seen by the Unit.

Note this Value

5. Confirm the track circuit has a Sideband imbalance ratio less than:

- 1.6:1 for TU/ETU/SPETU
- 1.8:1 for TCU

On The Receiver

Press OK then ‘NEXT’ until ‘INOW’

Press OK then Next Until ‘USB’

Press OK and note the value.

Press ‘BACK’ then ‘NEXT’ until ‘LSB’

Press OK and note the value.

Calculate and record sideband imbalance by dividing the larger value by the smaller value.

NOTE: *If the sideband imbalance exceeds the ratio values above, the track circuit should be investigated to ascertain the cause of the imbalance. Carry out steps 4.7 to 4.11.*

6. Using the Average Current value from the test above, confirm that it is the same as that recorded on the track Record Card or within 20% of that value.

If the clear track current is more than 20% outside the required level, or is pulsing this indicates that the track circuit is losing current and is not a receiver problem.

In this case the cause of the current loss should be determined and rectified otherwise the safety margin of the circuit can be eroded.

NOTE: *Items such as Ballast or Equipment degradation and Environmental Conditions (Temperature Extremes, Heavy Rainfall) etc. should all be considered.*

Variations are permitted under exceptional circumstances depending on ballast and environmental conditions.

7. Using the 2mm test lead adaptors, attach a Shunt Box across the IPC and IP1 terminals, or at the equivalent point on the surge arrestor terminals.

Adjust the shunt resistance so that the average track current reads the same as the threshold current value recorded on the test record card.

8. Leaving the Shunt Box in place, remove the frequency key and replace it with the set-up key.

The display will respond with ‘SET?’.

Press the ‘OK’ button to begin the automatic set-up process.

9. The condition monitoring display will show the legend ‘WAIT’, followed by ‘PASS’ or ‘FAIL’.

‘PASS’ indicates that set-up has been successful, and the new gain settings have been locked into the unit.

‘FAIL’ indicates that set-up was unsuccessful because, for example, the wrong frequency key has been used, or the track current is too low.

In this case, ‘FAIL’ will cycle with the reason for failure shown as a code. (See APPENDIX E)

The track circuit should be investigated, and faults corrected before set-up is attempted again.

10. Leaving the Shunt box applied. Remove the Set-up key and replace with the Frequency Key. Confirm that the INOW AV current is the same as the Record Card Ith.

    If not, then the set-up procedure needs to be repeated.

11. If Step 10 is positive then release the shunt push button and confirm that the track relay picks.

12. Check that the clear track current is within ±20% of the original value. If this is the case, then proceed to step 12C.

    If the clear track current is more than ±20% of the original value a Full Test is required.

13. Check that all receivers drop with 0.8Ω across their connections which go out to the rails, and that 0.7 Ω at the transmitter connections which go out to the rails, drops all receivers in the track circuit.

    If the drop shunt tests pass, then proceed to 13C.

14. Record all values as required in the track Record Card.

    A full Set-Up procedure (APPENDIX E) should be carried out as soon as practically possible.

    Deferral of Setting Up and Testing, up to a limit of 48 hours, might be permitted on the basis of safety if this setup procedure is used.

This completes the RX set up.

NOTE: *Where Low Power or Low Power Plus tracks are used, the appropriate 'Low Power' or 'Low Power Plus' labels are required on the TX, RX and TUs / ETUs / SPETUs*

APPENDIX H - Digital Receiver Set Up Error codes

The automatic set-up failure code consists of 4 letters which are designed to focus the fault investigation:

- "M" indicates that the modulation rate is in error, e.g. mod pin stuck on high sideband.
- "S" indicates that the sideband imbalance is too great (exceeds 100%) suggesting a TU fault.

- "H" indicates that the input signal is too high suggesting the track should be moved to 'Low Power' or 'Low Power Plus'.
- "L" indicates that the input signal is too low suggesting open circuits / poor connections.

Message	Meaning of Code	Field Examples
L	Input signal low.	Over-long TC. Poorly set-up tuned area. Loose connections.
H	Input signal high	TC too short.
HL	Input signal high and low	Internal RX fault.
S	Sideband imbalance high	Failed TU.
SL	Sideband imbalance high and signal low	
SH	Sideband imbalance high and signal high	
SHL	Sideband imbalance high, signal high and low	Internal RX fault.
M	Mod rate incorrect	Faulty TX.
ML	Mod rate incorrect and signal low	Open circuit in TC. Wrong frequency TX or RX key.
MH	Mod rate incorrect and signal high	
MHL	Mod rate incorrect and signal high and low	Internal RX fault.
MS	Mod rate incorrect and sideband imbalance high	MOD pin tied on TX or TX MOD fault.
MSL	Mod rate incorrect, sideband imbalance high and signal low	Incorrect frequency key used.
MSH	Mod rate incorrect, sideband imbalance high and signal high	Unlikely to occur
MSHL	All signals incorrect	Internal RX fault.
Thld Tol	A-B mismatch between thresholds.	High level traction interference signal present.
Time Out	-	During the set up process when the set-up key is inserted - if 'OK' is not pressed within 60 seconds, the set up process will time out and the Threshold set to Zero.
Key Wrte	-	Faulty key or process corrupted.
WRNG	-	Set-up key inserted before frequency key or incorrect frequency key inserted to finish the process.

Table 17 - Typical Automatic Set-up Failure Codes

APPENDIX I - Error Codes

Error Code	Quantity / Error Code	Test	Display	Mtce. Action Required
0	Internal Circuit Fault	Circuit monitoring tests failed. This test has highest priority	'ERR' cycling with 'PICK' or 'drop' On pressing <OK> display routes to 'Stat' then pressing <OK> routes to 'INT'	Replace digital RX
1	Temperature	Error raised if internal temperature outside the range -30°C to +100°C	'ERR' cycling with 'PICK' or 'drop' On <OK> display routes to 'Temp'	Check Internal temperature of enclosure. If within temp. range then consider replacing digital RX
2	PSU Voltage	Error raised if PSU voltage outside the range +22V to +31V	'ERR' cycling with 'PICK' or 'drop' On <OK> display routes to 'Vpsu'	Check PSU setup.
3	Relay Current Note: Only relevant to MOD State 1 Dig RX.	Error raised if Relay Current exceeds 100mA.	'ERR' cycling with 'PICK' or 'drop' On <OK> display routes to 'Iout'	Check wiring and if no fault found replace digital RX
4	Relay Voltage	Error raised if Relay Voltage below 10V and output is ON.	'ERR' cycling with 'PICK' On <OK> display routes to 'Vout'	Check for a fault in the TR wiring, if no fault found change the Digital Rx
5	Relay State	Error raised if relay voltage > 10V and relay state = drop.	'ERR' cycling with 'drop' On <OK> display routes to 'Vout'	Check for a fault in the TR wiring, if no fault found change the Digital Rx
6	Modulation Frequency	Modulation Frequency out of range : 3.4Hz to 6.2Hz	'ERR' cycling with 'PICK' or 'drop' On <OK> display routes to 'Stat' then <OK> routes to 'MOD'	Check TC installation, however this is likely to be a TX fault. Change the TX.
7	Sideband Imbalance	Sideband imbalance out of specification. SB ratio exceeds 2:1.	'ERR' cycling with 'PICK' or 'drop' On <OK> display routes to 'Stat' then <OK> routes to 'SB'	Check TC installation, specifically TU/ETU, as this is not likely to be a digital RX fault. Carry out tests 1.16 to 1.19

Error Code	Quantity / Error Code	Test	Display	Mtce. Action Required
8	Over-range Signal	Input current exceeds 500mA	‘ERR’ cycling with ‘PICK’ or ‘drop’ On <OK> display routes to ‘Stat’ then <OK> routes to ‘OVR’	Check TC installation as this is not likely to be a digital RX fault. Check TU/ETU setting is on correct power mode.
9	Power Up			Not an error code. Timestamp of last power up.
10	Relay Current Trip Note: Only relevant to MOD State 1 Dig RX.	Relay current exceeds 110mA	‘ERR’ cycling with ‘drop’ On <OK> display routes to ‘Stat’ then <OK> routes to ‘TRIP’	Check TR wiring, if no fault found and TR is operating correctly, change the Digital RX.
10	Relay Power Trip MOD State 2 MOD State 3 Dig RX onwards	Relay power exceeds 2.4W 6.25W	‘ERR’ cycling with ‘drop’ On <OK> display routes to ‘Stat’ then <OK> routes to ‘TRIP’	Check TR wiring, if no fault found and TR is operating correctly, change the Digital RX.
11	FPGA Fail	One or both FPGA test flags are clear.	‘ERR’ cycling with ‘drop’ On <OK> display routes to ‘Stat’ then <OK> routes to ‘INT’	Replace digital RX
12	Auto set	An auto set has successfully occurred.		Not an error code. Time stamp of that last Auto set.
13	Relay Power Note: Only relevant for MOD State 2 Dig RX.	Error raised if Relay Power exceeds 2.2W.	‘ERR’ cycling with ‘PICK’ or ‘drop’ On <OK> display routes to ‘Pout’	Check TR wiring, if no fault found and TR is operating correctly, change the Digital RX.
13	Relay Current Applies to MOD State 3 Dig RX onwards	Error raised if Relay Current exceeds 260mA.	‘ERR’ cycling with ‘PICK’ or ‘drop’ On <OK> display routes to ‘Iout’	Check TR wiring, if no fault found and TR is operating correctly, change the Digital RX.
None	Assertion error	An assertion error occurs during normal operation.	‘ErSW’ displayed (Note: this error is not logged).	Replace the key as it could be a latent logging problem and cycle the unit's power. If ErSW appears again replace the unit and carry out an Autoset.

Error Code	Quantity / Error Code	Test	Display	Mtce. Action Required
None	Corrupt Key	Error raised if a corrupt key is detected upon initial insertion.	BADK	Replace frequency key and carry out an Auto set

These errors are not latched, i.e. if the quantity causing the error returns to normal, the 'ERR' display will be cleared and the fault relay energised. Note that the error is recorded in the error log.

The errors have a priority, 0 being the highest. If multiple errors exist then the only the highest priority error is shown. When it is cleared the next highest priority, error is shown.

The last error generated will be stored and made available as one of the data items over the serial link.

APPENDIX J - EBI Track 200 Frequencies

	Nominal	Lower Sideband	Upper Sideband
A	1699 Hz	1682 Hz	1716 Hz
B	2296 Hz	2279 Hz	2313 Hz
C	1996 Hz	1979 Hz	2013 Hz
D	2593 Hz	2576 Hz	2610 Hz
E	1549 Hz	1532 Hz	1566 Hz
F	2146 Hz	2129 Hz	2163 Hz
G	1848 Hz	1831 Hz	1865 Hz
H	2445 Hz	2428 Hz	2462 Hz

Table 18 - EBI Track 200 Frequencies

APPENDIX K - EBI Track 200 B3 3000 Impedance Bond Information

Frequency	Capacitance µF	Tolerance
A	308.23µF	± 1.5%
B	167.22µF	± 1.5%
C	222.07µF	± 1.5%
D	130.79µF	± 1.5%
E	373.41µF	± 1.5%
F	191.80µF	± 1.5%
G	259.76µF	± 1.5%

H	147.29µF	± 1.5%

Table 19 - Capacitor Box capacitance values

The Inductor in the Impedance Bond should be between 27.8µH – 28.2µH

END

1. General

The EBI Gate 200 Level Crossing System is an overlay system for use at footpaths, bridleways and UWC crossings. The system can be powered from a 110v/240v AC. supply or a solar/wind 24v DC. Supply.

The system can be configured for use on single or dual lines and has bi-directional capability.

Each line has two block sections and the system uses Frauscher RSR123 Wheel Sensors for train detection.

The distance of the normal direction strike-in (NDI) and the opposite direction strike-in (XDI) from the crossing varies depending on line speed and other design factors.

The wheel sensor at the crossing (NDO) on each line performs the input to one block section and the output to the adjacent block section.

Each wheel sensor is connected to an overvoltage protection unit (BSI005) in the EBI Gate 200 master unit by a 2 pair cable.

Each overvoltage protection unit is connected to a Frauscher ACS 2000 Evaluation Board (IMC).

The status of each block section is monitored by a Frauscher ACS 2000 Axle Counter Board (ACB).

The output of the Frauscher axle counter system (block section status) is used as the input to the safety rated PLC (programmable logic controller) architecture that determines the occupancy of the crossing approach block section.

The PLC drives the crossing user lights, audible warnings via safety rated IO Modules, it also provides auto-dial fault reporting and data logging capabilities.

Each crossing comprises of two EBI Gate units designated as master and slave. Both units contain Red/Green lights, audible warning units and the On-Demand mode push buttons (where required).

In addition, the master unit contains the PLC, IO modules, Battery backup/UPS, Frauscher axle counter units and power supply unit. The two units are connected by a 10 pair Plug Coupler cable.

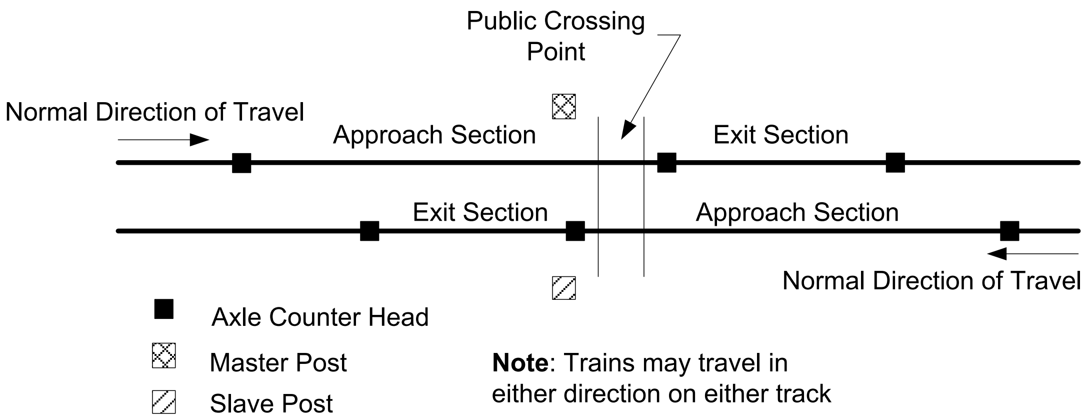


Figure 1 - A typical dual track system schematic

2. Operating Modes

The EBI Gate 200 Level Crossing System can be used in two modes.

a) Automatic.

b) On Demand.

In automatic mode the system operates as for a standard miniature red/green MSL crossing.

In On-Demand mode the user pushes a button located below the Red/Green lights on the EBI Gate 200 unit which when activated it displays a Green light if the crossing is available.

However, if the crossing is not available (train in section) at the time the button is activated then a Red light is displayed, and audible warning is given.

In “On-Demand” mode, when the button is pushed, and a Green or Red light is displayed. The system reverts to “energy saving” mode after a period of 5 minutes.

The EBI Gate 200 Level Crossing System gives another train warning tone and verbal warning on multi-track lines.

The EBI Gate 200 Level Crossing System has an inbuilt auto-restore facility and automatically sends a failure message followed by a system restored message to the designated monitoring point.

In the event that the system cannot restore itself the system sends a failed message to the monitoring point.

3. Test Equipment

The following items are used to complete all the testing and maintenance activities on Frauscher Advanced Counter equipment:

- Testing plate PB200.
- Test Box AMB100.
- Multi-meter, range 1000 mV DC, ± 0.5 % basic accuracy, internal resistance > 1 kΩ.
- 2 leads with 2 mm male connectors at both ends.
- Non-conductive cord (Plumb Line).
- Screwdriver (Flat-Headed Electrical Type).
- Tape measure.
- 30mm Spanner .
- 2.5mm Allan Key.
- Cord line and stepped treadle gauge.
- SD Card reading device (Laptop PC).

4. Wheel sensor RSR123

The wheel sensor RSR123 detects axles and consists of two sensor systems.

Viewed from the plug side, wheel sensor system 1 is on the left-hand side, wheel sensor system 2 is on the right-hand side.

Wheel sensor system 1 and 2 are symmetrically in design and are galvanically separated.

Two wires are allocated to each wheel sensor system. On the wheel sensor there is a four-wire cable connected via a plug connection, with a standard length of 5, 10 or 25 m. It is recommended to use a protection tube for the cable.

Figure 2 - Serial Number Location

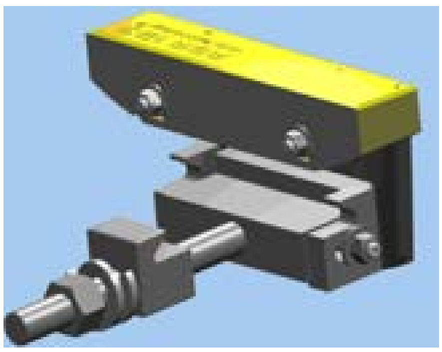


Figure 3 – General View

5. Axle Counter Evaluation Board (IMC)

The evaluation board is used to power and evaluate a wheel sensor with two sensor systems. The output switching signals are transmitted to the Axle Counting Board (ACB) via the Axle counting Back Plane (ABP).

Key to Board Image

Indication / Function	Meaning / Use
Serial Interface	Socket for diagnostic link
PWR	Supply voltage channel
Sys1	Illuminated - Illuminates when a wheel passes over Sys 1 sensor. This appears to flicker as each wheel passes over the sensor due to the speed of train. If A1 is permanently lit there is a cable fault.
A1	**Slow Flashing –** Cable or adjustment errors: Sys1 is either incorrectly connected, faulty, not adjusted, has a short circuit or an interruption in the supply line.
	Fast Flashing – Internal or operating error: The adjustment process was terminated; an invalid operation sequence was triggered (flash duration 2s) or an internal malfunction of the module has occurred. Turn the power supply of the IMC module off and on again!
	Short Flash – Wheel Sensor fault in Sys1: The life signal is lacking or there is an impermissible quiescent current drift.
B1	Illuminated - indicating switching its output when wheel detected.
A2	**Slow Flashing –** Cable or adjustment errors: Sys2 is either incorrectly connected, faulty, not adjusted, has a short circuit or an interruption in the supply line.
	Fast Flashing – Internal or operating error: The adjustment process was terminated; an invalid operation sequence was triggered (flash duration 2s) or an internal malfunction of the module has occurred. Turn the power supply of the IMC module off and on again!
	Short Flash – Wheel Sensor fault in Sys2: The life signal is lacking or there is an impermissible quiescent current drift.
	Slow Flashing – Cable or adjustment errors: Sys2 of the wheel sensor is either incorrectly connected, faulty, not adjusted, has a short circuit or an interruption in the supply line.
B2	Illuminated - indicating switching its output when wheel detected.
Adjust...	Is required to adjust the wheel sensor /IMC and to carry out a pre-Reset
Test	Damping of system 1
V+/GND	2 mm test sockets, voltage corresponds to the analogue wheel sensor current via a 100 Ω Shunt
nnn	Board identification code (IMC039)
xx…..yy	Month and Year of Manufacture
VDC	Operating voltage range (19 -72 volts DC)
ZZ	Version, beginning with 03

6. Axle Counter Board (ACB)

The ACB processes the counting head data supplied by the evaluation boards. Based on the data of the evaluation boards, the clear track or occupied track status of the track section to be controlled is determined and transmitted to the "clear/occupied" interface using direct output relays (potential-free).

Key to Board Image

Indication / Function	Meaning / Use
5v	Power supply
Occupied	Track section clear (not illuminated), track section occupied (illuminated) track section faulty (flashing).
Display	Number of axles in a track section, status information (error).
pre-Reset	Activated by pressing both buttons to the left at the same time to pre-reset the A/C heads.
Serial Interface	Socket for diagnostic link
nnn	Board identification code (ACB120)
xx…..yy	Month and Year of Manufacture
VDC	Operating voltage range (19 -72 volts DC)
ZZ	Version, beginning with 04

7. Fuse Board (SIC)

The SIC is used as supply voltage protection for ACS2000.

Indication / Function	Meaning / Use
Si1	Fuse for supply voltage at channel 1
Si2	Fuse for supply voltage at channel 2
nnn	Board identification code (SIC006)
xx…..yy	Month and Year of Manufacture
VDC	Operating voltage range (19 -72 volts DC)
ZZ	Version, beginning with 01

8. Axle Counter Board (ACB) Power Up Sequence Indications

Code				Meaning
L	R	N	0	No processor initialized, show for approximately 5 seconds
*	*	*	*	Flashing (successful initialization), show for approximately 10 seconds
-	1	0	9	The display alternates between the two codes indicating the ACB does not know the status of the axle counter section. At least one axle shall be correctly counted in and counted out.
-	2	0	9	
			0	Display status after axle in / axle out simulated.
/	/	/	/	If during power up a wheel sensor assigned to a track section is occupied
/	*	*	*	If a wheel sensor assigned to a track section is occupied during a serious or minor error.
S	C	I		A serial connection or communication has been interrupted / disrupted after power up but before reset. This can indicate a defective modem
B	O	O	T	This indicates a defective display processing unit. The ACB board should be
*	*	*	*	Not Flashing shown after power up and an axle count in or out.

9. Axle Counter Board (ACB) Diagnostic Indications

The ACB has a four-digit alphanumeric display. This is used to show the section axle count and also to show coded error/fault messages.

Codes that can be shown in display position 1**:**

Code				Meaning
-				Minor error or axle counted out
+				Minor error or axle counted in
/				One or more systems occupied
*				Steady, serious error
*				Flashing, error after reset

Codes that can be shown in display position 2:

Code				Meaning
	1			Channel 1 / System 1
	2			Channel 2 / System 2
	3			Channel 1 / System 1 of second axle counting board (second subsystem)
	4			Channel 2 / System 2 of second axle counting board (second subsystem)

10. Minor Error Codes, causes and actions Codes 00 to 7F (Hex)

Some of the codes that can be shown in display positions 3 and 4**:**

Code				**Brief Description**	**Cause**	**Action**
		0	0	No fault is present	fault-free operation	
		0	1	Another subsystem is reporting a minor error	see error code of the other subsystem	
		0	2	Another subsystem is not responding to the applied Reset	serial communication has been temporarily interrupted or disrupted (component error of a board)	repeat Reset, check the transmission medium, if necessary, replace the board
		0	3	Partial traversing on another subsystem	see error code of the other subsystem	
		0	4	Waiting for clearing of track after Reset (modem operation)	At least one axle shall be correctly counted in and out again, whereby one counting process shall take place on each subsystem (a train shall traverse from one subsystem to the other).	
		0	5	Occupied / clear comparison faulty in transmission mode.	EMC-interference (Hardware error)	Carry out a reset; if the error occurs again, replace the affected ACB.
		0	6	Negative axle in (modem operation)	For errors 21 to 26, if the serial communication is interrupted or disrupted.	Carry out a reset; if the error occurs again, replace the affected ACB.
		0	7	Pre-Reset carried out in (modem operation)	reset restriction removed through pre-Reset operation; the code is displayed after successful execution as confirmation.	
		0	8	Results of the counting logic and hardware evaluation	EMC-interference (Hardware error)	
		0	9	Waiting for clearing of track after Reset (isolated	At least one axle shall be correctly counted in and out again. This counting in and out process can be carried out at each counting head	
		0	A	Comparison of channel 1 and 2 faulty	overcurrent due to e.g. wire break, short circuit or interference on the wheel sensor cabling evaluation board has been removed or is not adjusted correctly Short circuit or interruption in double usage wiring evaluation board defective D|P-switches different wheel sensor has dropped off the track wheel sensor poles are reversed	
		0	B	Comparison of hardware evaluation 1 and 2 does not match		
		0	C	Negative axle in isolated operation	The same causes as with errors 21 to 26; display of this error code, if the serial communication is interrupted or disrupted.	

Code				Brief Description	Cause	Action
		0	E	Pre-Reset carried out in isolated operation	If a reset restriction has been removed with a pre-Reset operation, this code is displayed as confirmation after successful execution.	
		0	F	Failure of the serial communication	Serial communication (modem connection) is out of action for longer than 30 days.	Establish connection again; reverse the axle counting system by carrying out a simple reset.
		1	1	Partial traversing at the 1ST evaluation board.	Partial traversing e.g. during shunting works Very small wheel Check wheel sensor mounting (mounted too deep)	
		1	2	Partial traversing at the 2ND evaluation board.		
		1	3	Partial traversing at the 3RD evaluation board.		
		1	4	Partial traversing at the 4TH evaluation board.		
		1	5	Partial traversing at the 5TH evaluation board.		
		1	6	Partial traversing at the 6TH evaluation board.		
		2	1	Negative axle at the 1ST evaluation board.	System reset, with at least one axle in the track section Very small wheel Check wheel sensor mounting (mounted too deep)	
		2	2	Negative axle at the 2ND evaluation board.		
		2	3	Negative axle at the 3RD evaluation board.		
		2	4	Negative axle at the 4TH evaluation board.		
		2	5	Negative axle at the 5TH evaluation board.		
		2	6	Negative axle at the 6TH evaluation board.		
		3	1	System pulse of the 1ST evaluation board too short.	EMC-Interference Interference on the double usage wiring Evaluation board defective	If this error occurs with increasing frequency, the evaluation board affected should be replaced.
		3	2	System pulse of the 2ND evaluation board too short.		
		3	3	System pulse of the 3RD evaluation board too short.		

Code				Brief Description	Cause	Action
		3	4	System pulse of the 4TH evaluation board too short.		
		3	5	System pulse of the 5TH evaluation board too short.		
		3	6	System pulse of the 6TH evaluation board too short.		
		4	1	System 1 and 2 simultaneously on the 1st evaluation board	- Very large wheel - Wiring short circuit on the wheel sensor cabling - EMC-interference on the wheel sensor cabling - interference on the double usage wiring - check wheel sensor mounting (mounted too deep)	
		4	2	System 1 and 2 simultaneously on the 2nd evaluation board		
		4	3	System 1 and 2 simultaneously on the 3rd evaluation board		
		4	4	System 1 and 2 simultaneously on the 4th evaluation board		
		4	5	System 1 and 2 simultaneously on the 5th evaluation board		
		4	6	System 1 and 2 simultaneously on the 6th evaluation board		
		5	1	Pulse edge sequence not correct, too many edges at the 1st evaluation board	- EMC-interference - Very large wheel - Wiring short circuit on the wheel sensor cabling - EMC-interference on the wheel sensor cabling - interference on the double usage wiring	
		5	2	Pulse edge sequence not correct, too many edges at the 2nd evaluation board		
		5	3	Pulse edge sequence not correct, too many edges at the 3rd evaluation board		
		5	4	Pulse edge sequence not correct, too many edges at the 4th evaluation board		
		5	5	Pulse edge sequence not correct, too many edges at the 5th evaluation board		
		5	6	Pulse edge sequence not correct, too many edges at the 6th evaluation board		

Code				Brief Description	Cause	Action
		6	0	Relay Test	- Relay test active	unplug/plug relay
		6	1	The other subsystem is reporting clearing of track	- See error code of the other Subsystem	
		6	2	occupancy at the wrong time	- Defective wheel sensor - Defective evaluation board	
		7	1	Relay feedback faulty #1	An overcurrent due to e.g. wire break, short circuit or interference on the wheel sensor cabling short circuit or interruption in double usage wiring evaluation board defective - DIP-switches different relay contacts oxidised relay activation defective relay defective fault on the readback wire wheel sensor has dropped off the track wheel sensor poles are reversed	if this error occurs, troubleshooting should be executed in the sequence opposite (cause column); if necessary, the voltage supply should be interrupted and a reset should be carried out; if the fault occurs again, the affected ACB should be replaced.
		7	2	Relay feedback faulty #1		
		7	3	Relay feedback faulty #1		

#1. Detection of error during change from the clear to the occupied status or from the occupied to the clear status.

11. Serious Error Codes, causes and actions

Code				Brief Description	Cause	Action
		8	2	Power up, 4 asterisks are shown on the display.	Status after application of the supply voltage.	Reset required.
		8	3	Pre-Reset and Reset actuated at the simultaneously	- Pre-reset and Reset actuated at the simultaneously - Short circuit between the pre-reset and reset inputs	.
		8	4	DIP-switches changed during operation	- DIP-switches changed during operation.	Check diagrams for correct settings.
		9	0	Another sub-system is reporting a serious error	See error code on other sub- systems.	

Code				Brief Description	Cause	Action
		A	4	Relay feedback faulty #1	Relay contacts oxidized Relay activation defective Relay defective Fault on readback wire	If this error occurs the supply voltage should be interrupted, and a reset carried out. If it occurs again replace the affected ACB board.
		A	5			
		A	6			
		A	7			
		A	9			
		A	A			
		A	B			
		A	C			
		A	D			
		A	E			
		A	F			
		B	1			
		B	2			
		B	3			
		B	4			
		B	5			
		B	6			
		B	7			
		B	9			
		B	A			
		B	B			
		B	C			
		B	D			
		B	E			
		B	F			
		C	1			
		C	2			
		C	3			
		C	4			
		C	5			
		C	6			
		C	7			
		C	9			
		C	A			
		C	B			
		C	C			
		C	D			
		C	E			
		C	F			

#1 Detection of error during change from the clear to the occupied status or from the occupied to the clear status.

Code				Brief Description	Cause	Action
		D	0	Error in the program code test #2	- Program code faulty - EMC - interference	If this error occurs the supply voltage should be interrupted, and a reset carried out. If it occurs again replace the affected ACB board.
		D	1	Error in the data storage test #2	- SRAM faulty - EMC-interference	
		D	2	Error in the register test #2	- Register faulty - EMC-interference	
		D	3	Error in the Watch Dog Timer test #2	- Watch Dog Timer faulty - EMC-interference	
		D	4			
		D	5			
		D	6	Error in the overvoltage test #2	- Overvoltage Monitoring faulty - EMC-interference	
		D	7			
		D	8			
		D	9			
		D	A	Error in the read back input 2	- ACB faulty - EMC-interference	
		D	B			

#2. Detection of error during a power-up or caused by cyclical tests.

12. EBI Gate 200 System Messages

Message	Meaning
DAY LOG STATUS	System Periodic Test Ok This message sent on Power up and at 12:00 GMT every day.
RED DARK MODE ON	This message is sent if the crossing has entered Dark Mode and a successful reset has not occurred after 45 minutes. It continues to be sent every 45 minutes until the crossing has been restored.
GREEN SYSTEM RESTORED	This message is sent once the system is available to the user to display a red/green signal.
POWER FAILURE	This message sent on power failure

13. EBI Gate Abbreviations

Abbreviation	Meaning
ABP	Axle Counter Back Plane
ACB	Axle Counter Board
AMB100	Test Box
BSI	Overvoltage Protection Unit
IMC	Axle Counter Evaluation Board

Abbreviation	Meaning
NDI	Crossing Strike-in head in the normal direction of running
NDO	Crossing Strike-out head for both normal direction of running and bi-directional running
PB 200	Testing plate
RSR123	Wheel sensor type RSR123
Sys	Sensor system of a wheel sensor
SIP	Crossing Strike-in point
XDI	Crossing Strike-in head bi-directional running

14. Interpretation of the DataLog Files

In order to assist with the interpretation of the details shown in the columns of the DayLog this section contains expanded explanations of the details, grouped by column.

Column A - Date and Time

Date/Time	Explanation
01/02/70-00:00:15	Time/Date Stamp, DD/MM/YY-HH:MM:SS

Column B – Event

Event Description	Trigger
No Description	
1 Minute Check	Current Minute <> Last Log Minute
System Periodic Test OK	Logged on Power up and Mid-Day Only
Frauscher Reset	Frauscher Block Sections Reset after a “Self-Reset” or “Power Up”
AMBER Awaiting Train Reset	System has Initialised
GREEN System Restored	System Restored
Green Aspect On	The GREEN aspects have been illuminated on the posts
Green Aspect Off	The GREEN aspects have been switched off
Red Aspect On	The RED aspects have been illuminated on the posts
Red Aspect Off	The RED aspects have been switched off
RED Dark Mode On	Entering Dark Mode
Energy Save On	The Energy Save mode has activated
Demand Press	The “On-Demand” button has been pressed on either post
Manual Reset	Manual Reset has been carried out using the “Reset” Switch

Event Description	Trigger
Test Activated	System Test has been activated using the “Test” Switch
Audio 1 On	Audio 1 has been activated
Audio 1 Off	Audio 1 has been turned off
Audio 2 On	Audio 2 has been activated
Audio 2 Off	Audio 2 has been turned off
Open /Replace <file>	A file is open
Created: <File>	A new file is created
Train Update	Train Movement
Power Failure	Systems Power Lost
SMS Power Failure	Power failure Text Message
SMS Power Restored	Power Restored Text Message
Hardware Fault	System has entered an irrecoverable fault
Door open	Enclosure door open (Future Use)
Door Closed	Enclosure door Closed (Future Use)

Column D – Inputs

Block Input Message	Description
F	Sensor Fault
O	Transition State
FM	Block Clear
P	Block Occupied
DB	Demand Button Pressed
MR	Manual Reset

Inputs	Explanation
FM,--,--,--,--,--,--,--,	Block Section 1 Clear
P,--,--,--,--,--,--,--,	Block Section 1 Occupied
--,FM,--,--,--,--,--,--,	Block Section 2 Clear
--,P,--,--,--,--,--,--,	Block Section 2 Occupied
--,--,FM,--,--,--,--,--,	Block Section 3 Clear
--,--,P,--,--,--,--,--,	Block Section 3 Occupied
--,--,--,FM,--,--,--,--,	Block Section 4 Clear

Inputs	Explanation
--,--,--,P,--,--,--,--,	Block Section 4 Occupied
FM,FM,FM,FM,--,--,--,--,	All 4 Block Sections Clear
P,P,P,P,--,--,--,--,	All 4 Block Sections Occupied
DB,DB,DB,BD,--,--,--,--,	“On Demand” Button Pressed
MR,MR,MR,MR,--,--,--,--,	“Reset” Button Pressed

Column E - Block Status

Block Section Status	Description
CL	Block Section Clear
Oc	Occupied
WC	Waiting to Clear
I	Initialising
D1	Sensor Fail Timer
D2	Direction Timer Fail
RF	Red Fail Timer
GF	Green Fail Timer
HF	Hardware Fault
DM	Dark Mode
E	Energy Save Mode
--	Transition State

Inputs	Explanation
Cl,--,--,--,--,--,--,--,	Block Section 1 Clear
Oc,--,--,--,--,--,--,--,	Block Section 1 Occupied
WC,--,--,--,--,--,--,--,	Block Section 1 Waiting to Clear
I,--,--,--,--,--,--,--,	Block Section 1 In Initialization State
D1,--,--,--,--,--,--,--,	Block Section 1 Illegal Move Detected
D2--,--,--,--,--,--,--,	Block Section 1 Sensor Fail Timer

Inputs	Explanation
RF--,--,--,--,--,--,--,	Block Section 1 Direction Timer Fail
GF--,--,--,--,--,--,--,	Block Section 1 Red Fail Timer
HF--,--,--,--,--,--,--,	Block Section 1 Green Fail Timer
DM--,--,--,--,--,--,--,	Block Section 1 Hardware Fault
E--,--,--,--,--,--,--,	Block Section 1 Dark Mode

Column F - Status of Displayed Aspects

Aspect	Explanation
G,G,G,G,--,--,--,--,	GREEN Aspect Displayed
R,G,G,G,--,--,--,--,	RED Aspect Displayed Due to Block Section 1 Occupied
G,R,G,G,--,--,--,--,	RED Aspect Displayed Due to Block Section 2 Occupied
G,G,R,G,--,--,--,--,	RED Aspect Displayed Due to Block Section 3 Occupied
G,G,G,R,--,--,--,--,	RED Aspect Displayed Due to Block Section 4 Occupied
E,E,E,E,--,--,--,--,	Energy Save Mode. No Aspects Illuminated
--,--,--,--,--,--,--,--,	Aspect States During Initialization

15. Data Scenarios

To further improve the interpretation of the details the following DayLog extracts show the normal data sequences recorded for a number of scenarios.

Scenario 01- Up Road Train Normal Direction

Record	Date/Time	Event	Inputs	BlockStatus	Aspect	Explanation
47	01/11/13-00:36:34	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	No trains in the crossing area. 1 Min Checks occurring as expected.
48	01/11/13-00:37:35	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	
49	01/11/13-00:38:36	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	
50	01/11/13-00:39:36	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	
51	01/11/13-00:40:37	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	
52	01/11/13-00:41:37	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	

Record	Date/Time	Event	Inputs	BlockStatus	Aspect	Explanation
53	01/11/13-00:41:50	Train Update	P,FM,FM ,FM,--,--,--,--,	Oc,Cl,Cl,Cl,--,--,--,--,	R ,G,G,G ,--,--,--,--,	Block Section 1 is occupied by train
54	01/11/13-00:41:50	Green Aspect Off	P,FM,FM ,FM,--,--,--,--,	Oc,Cl,Cl,Cl,--,--,--,--,	R ,G,G,G ,--,--,--,--,	Green aspect turns off as Block Section 1 is occupied by train
55	01/11/13-00:41:50	Red Aspect On	P,FM,FM ,FM,--,--,--,--,	Oc,Cl,Cl,Cl,--,--,--,--,	R ,G,G,G ,--,--,--,--,	Red aspect turns on as Block Section 1 is
56	01/11/13-00:41:50	Audio 1 On	P,FM,FM ,FM,--,--,--,--,	Oc,Cl,Cl,Cl,--,--,--,--,	R ,G,G,G ,--,--,--,--,	Audio 1 turns on as Block Section 1 is occupied by train
57	01/11/13-00:42:18	Train Update	P,P,FM,FM ,--,--,--,--,	Oc,WC,Cl,Cl,--,--,--,--	R ,R ,G ,G ,--,--,--,--,	Train transitions the crossing, Block Section 1 and Block Section 2 is occupied by train
58	01/11/13-00:42:18	Train Update	FM,P,FM,FM ,--,--,--,--,	Cl,WC,Cl,Cl,--,--,--,--	G ,G ,G ,G ,--,--,--,--,	Green aspect turns on as train clears the crossing, Block Section 1 clears, and Block Section 2 is occupied by train
59	01/11/13-00:42:18	Green Aspect On	FM,P,FM,FM ,--,--,--,--,	Cl,WC,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Green aspect turns on as train clears the crossing, Block Section 1 clears, and Block Section 2 is occupied by train
60	01/11/13-00:42:18	Red Aspect Off	FM,P,FM,FM ,--,--,--,--,	Cl,WC,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Red aspect turns off as train clears the crossing, Block Section 1 clears, and Block Section 2 is occupied by train
61	01/11/13-00:42:18	Audio 1 Off	FM,P,FM,FM ,--,--,--,--,	Cl,WC,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Audio 1 turns off as train clears the crossing, Block Section 1 clears, and Block Section 2 is occupied by train
62	01/11/13-00:42:39	Train Update	FM,P,FM,FM ,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Train clears Block Section 2.
63	01/11/13-00:43:19	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	The train leaves the crossing Block Section 2 clears. 1 Min Checks resume.
64	01/11/13-00:44:19	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	No trains in the crossing area. 1 Min Checks occurring as expected.
65	01/11/13-00:45:20	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	No trains in the crossing area. 1 Min

Record	Date/Time	Event	Inputs	BlockStatus	Aspect	Explanation
66	01/11/13-00:46:20	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Checks occurring as expected.
67	01/11/13-00:47:21	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	
68	01/11/13-00:48:21	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	

Scenario 02- Up Road Train Wrong Direction

Record	Date/Time	Event	Inputs	BlockStatus	Aspect	Explanation
50	01/11/13-00:39:36	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	No trains in the crossing area. 1 Min Checks occurring as expected.
51	01/11/13-00:40:37	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	
52	01/11/13-00:41:37	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	
53	01/11/13-00:41:50	Train Update	FM,**P** ,FM,FM,--,--,--,--,	Cl,Oc,Cl,Cl,--,--,--,--,	G ,R ,G ,G,--,--,--,--,	Block Section 2 is occupied by train
54	01/11/13-00:41:50	Green Aspect Off	FM,**P** ,FM,FM,--,--,--,--,	Cl,Oc,Cl,Cl,--,--,--,--,	G ,R ,G ,G,--,--,--,--,	Green aspect turns off as Block Section 2 is occupied by train
55	01/11/13-00:41:50	Red Aspect On	FM,**P** ,FM,FM,--,--,--,--,	Cl,Oc,Cl,Cl,--,--,--,--,	G ,R ,G ,G,--,--,--,--,	Red aspect turns on as Block Section 2 is occupied by train
56	01/11/13-00:41:50	Audio 1 On	FM,**P** ,FM,FM,--,--,--,--,	Cl,Oc,Cl,Cl,--,--,--,--,	G ,R ,G ,G,--,--,--,--,	Audio 1 turns on as Block Section 2 is occupied by train
57	01/11/13-00:42:18	Train Update	P,FM,FM,FM ,--,--,--,--,	WC, Oc,Cl,Cl,--,--,--,--,	G ,R ,G ,G ,--,--,--,--,	Train tansitioning from Block Section 2 to Block Section 1
58	01/11/13-00:42:18	Train Update	P,FM,FM,FM ,--,--,--,--,	WC,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Train clears the crossing, Block Section 2 clears and Block Section 1 is occupied by train
59	01/11/13-00:42:18	Green Aspect On	P,FM,FM,FM ,--,--,--,--,	WC,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Green aspect turns on as train clears the crossing, Block Section 2 clears and Block Section 1 is occupied by train
60	01/11/13-00:42:18	Red Aspect Off	P,FM,FM,FM ,--,--,--,--,	WC,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Red aspect turns off as train clears the crossing, Block Section 2 clears and Block Section 1 is occupied by train

Record	Date/Time	Event	Inputs	BlockStatus	Aspect	Explanation
61	01/11/13-00:42:18	Audio 1 Off	P,FM,FM,FM ,--,--,--,--,	WC,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Audio 1 turns off as train clears the crossing, Block Section 2 clears and Block Section 1 is occupied by train
62	01/11/13-00:43:19	Train Update	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	The train leaves the crossing are, Block Section 1 clears..
63	01/11/13-00:43:19	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	1 Min Checks resume.
64	01/11/13-00:44:19	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	No trains in the crossing area. 1 Min
65	01/11/13-00:45:20	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	1-minute Checks occurring as expected.
66	01/11/13-00:46:20	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	
67	01/11/13-00:47:21	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	

Scenario 03 - Down Road Train Normal Direction

Record	Date/Time	Event	Inputs	BlockStatus	Aspect	Explanation
50	01/11/13-00:39:36	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	1-minute time Checks occurring as expected.
51	01/11/13-00:40:37	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	
52	01/11/13-00:41:37	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	
53	01/11/13-00:41:50	Train Update	FM,FM,FM,P,--,--,--,--,	Cl,Cl,CL,Oc,--,--,--,--,	G,G ,G ,R ,--,--,--,--,	Block Section 4 is occupied by train
54	01/11/13-00:41:50	Green Aspect Off	FM,FM,FM,P,--,--,--,--,	Cl,Cl,CL,Oc,--,--,--,--,	G,G ,G ,R ,--,--,--,--,	Green aspect turns off as Block Section 4 is occupied by train
55	01/11/13-00:41:50	Red Aspect On	FM,FM,FM,P,--,--,--,--,	Cl,Cl,CL,Ocl--,--,--,--,	G,G ,G ,R ,--,--,--,--,	Red aspect turns on as Block Section 4 is occupied by train
56	01/11/13-00:41:50	Audio 1 On	FM,FM,FM,P,--,--,--,--,	Cl,Cl,CL,Oc,--,--,--,--,	G,G ,G ,R ,--,--,--,--,	Audio 1 turns on as Block Section 4 is occupied by train
57	01/11/13-00:42:16	Train Update	FM,FM,P ,FM,--,--,--,--,	Cl,Cl,WC,Oc,--,--,--,--,	G ,G ,G ,R ,--,--,--,--,	Train Transitioning from Block Section 4 to Block Section 3

Record	Date/Time	Event	Inputs	BlockStatus	Aspect	Explanation
58	01/11/13-00:42:18	Train Update	FM,FM,P ,FM,--,--,--,--,	Cl,Cl,WC,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Train clears Block Section 4 and Block Section 3 is occupied by train
59	01/11/13-00:42:18	Green Aspect On	FM,FM,P ,FM,--,--,--,--,	Cl,Cl,WC,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Green aspect turns on as train clears the crossing, Block Section 4 clears and Block Section 3 is occupied by train
60	01/11/13-00:42:18	Red Aspect Off	FM,FM,P ,FM,--,--,--,--,	Cl,Cl,WC,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Red aspect turns off as train clears the crossing, Block Section 4 clears and Block Section 3 is occupied by train
61	01/11/13-00:42:18	Audio 1 Off	FM,FM,P ,FM,--,--,--,--,	Cl,Cl,WC,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Audio 1 turns off as train clears the crossing; Block Section 4 clears and Block Section 3 is occupied by train
62	01/11/13-00:43:19	Train Update	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	The train leaves the crossing area, Block Section 3 clears.
63	01/11/13-00:43:19	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	The train leaves the crossing area, Block Section 3 clears. 1 Min Checks resume.
64	01/11/13-00:44:19	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	No trains in the crossing area. 1 Min Checks occurring as expected.
65	01/11/13-00:45:20	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	
66	01/11/13-00:46:20	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	

Scenario 04 - Down Road Train Wrong Direction

Record	Date/Time	Event	Inputs	BlockStatus	Aspect	Explanation
51	01/11/13-00:40:37	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	No trains in the crossing area. 1 Min Checks occurring as expected.
52	01/11/13-00:41:37	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	
53	01/11/13-00:41:50	Train Update	FM,FM,P ,FM,--,--,--,--,	Cl,Cl,Cl,Oc,--,--,--,--,	G ,G ,G ,R ,--,--,--,--,	Block Section 4 is occupied by train

Record	Date/Time	Event	Inputs	BlockStatus	Aspect	Explanation
54	01/11/13-00:41:50	Green Aspect Off	FM,FM,P ,FM,--,--,--,--,	Cl,Cl,Cl,Oc,--,--,--,--,	G ,G ,G ,R ,--,--,--,--,	Green aspect turns off as Block Section 4 is occupied by train
55	01/11/13-00:41:50	Red Aspect On	FM,FM,P ,FM,--,--,--,--,	Cl,Cl,Cl,Oc,--,--,--,--,	G ,G ,G ,R ,--,--,--,--,	Red aspect turns on as Block Section 4 is occupied by train
56	01/11/13-00:41:50	Audio 1 On	FM,FM,P ,FM,--,--,--,--,	Cl,Cl,Cl,Oc,--,--,--,--,	G ,G ,G ,R ,--,--,--,--,	Audio 1 turns on as Block Section 3 is occupied by train
57	01/11/13-00:42:16	Train Update	FM,FM,P ,FM,--,--,--,--,	Cl,Cl,WC,Oc,--,--,--,--,	G ,G ,G ,R ,--,--,--,--,	Train Transitioning from Block Section 4 to Block Section 3
58	01/11/13-00:42:18	Train Update	FM,FM,FM,P ,--,--,--,--,	Cl,Cl,Oc,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Block Section 4 clears and Block Section 3 is occupied by train
59	01/11/13-00:42:18	Green Aspect On	FM,FM,FM,P ,--,--,--,--,	Cl,Cl,Cl,WC,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Green aspect turns on as train clears the crossing, Block Section 4 clears and Block Section 3 is occupied by train
60	01/11/13-00:42:18	Red Aspect Off	FM,FM,FM,**P** ,--,--,--,--,	Cl,Cl,Cl,WC,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Red aspect turns off as train clears the crossing, Block Section 4 clears and Block Section 3 is occupied by train
61	01/11/13-00:42:18	Audio 1 Off	FM,FM,FM,P ,--,--,--,--,	Cl,Cl,Cl,WC,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Audio 1 turns off as train clears the crossing, Block Section 4 clears and Block Section 3 is occupied by train
61	01/11/13-00:43:19	Train Update	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	The train leaves the crossing are, Block Section 3 clears.
63	01/11/13-00:43:19	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	The train leaves the crossing are, Block Section 3 clears. 1 Min Checks resume.
64	01/11/13-00:44:19	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	No trains in the crossing area. 1 Min Checks occurring as expected.
65	01/11/13-00:45:20	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	
66	01/11/13-00:46:20	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	

Scenario 05 - Up Road Train Normal Direction then a Down Road Train Normal Direction ATC

Record	Date/Time	Event	Inputs	BlockStatus	Aspect	Explanation
672	01/11/13-08:53:52	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	No trains in the crossing area. 1 Min Checks occurring as expected.
673	01/11/13-08:54:52	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	
674	01/11/13-08:55:53	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	
675	01/11/13-08:56:34	Train Update	P,FM,FM,FM,--,--,--,--,	Oc,Cl,Cl,Cl,--,--,--,--,	R ,G ,G ,G ,--,--,--,--,	Block Section 1 is occupied by train
676	01/11/13-08:56:34	Green Aspect Off	P ,FM,FM,FM,--,--,--,--,	Oc,Cl,Cl,Cl,--,--,--,--,	R ,G ,G ,G ,--,--,--,--,	Green aspect turns off as Block Section 1 is occupied by train
677	01/11/13-08:56:34	Red Aspect On	P ,FM,FM,FM,--,--,--,--,	Oc,Cl,Cl,Cl,--,--,--,--,	R ,G ,G ,G ,--,--,--,--,	Red aspect turns on as Block Section 1 is occupied by train
678	01/11/13-08:56:34	Audio 1 On	P ,FM,FM,FM,--,--,--,--,	Oc,Cl,Cl,Cl,--,--,--,--,	R ,G ,G ,G ,--,--,--,--,	Audio 1 turns on as Block Section 1 is occupied by train
679	01/11/13-08:56:53	Train Update	P ,FM ,P ,FM,--,--,--,--,	Oc,Cl,Oc,Cl,--,--,--,--,	R ,G ,R ,G ,--,--,--,--,	Down Road Train Strikes into Block Section
680	01/11/13-08:56:55	Train Update	P ,P ,P ,FM,--,--,--,--,	Oc,WC,Oc,Cl,--,--,--,--,	R ,G ,R ,G ,--,--,--,--,	Up Road Train Transitions Block Section 1 to Block Section 2
681	01/11/13-08:56:55	Audio 2 On	P ,P ,P ,FM,--,--,--,--,	Oc,WC,Oc,Cl,--,--,--,--,	R ,G ,R ,G ,--,--,--,--,	Audio 2 turns on as a Down Road Train Strikes into Block Section 3 and the Up-Road Train transitions Block 1 to 2
680	01/11/13-08:56:57	Train Update	FM ,P ,P ,FM,--,--,--,--,	Cl,WC,Oc,Cl,--,--,--,--,	G ,G ,R ,G ,--,--,--,--,	Up Road Train clears Block Section 1 and occupies Block Section 2
681	01/11/13-08:57:10	Train Update	FM ,FM ,P ,FM,--,--,--,--,	Cl,Cl,Oc,Cl,--,--,--,--,	G ,G ,R ,G ,--,--,--,--,	Up Road Train clears Block Section 2
682	01/11/13-08:57:18	Train Update	FM ,FM ,P ,FM,--,--,--,--,	Cl,Cl,Oc,WC,--,--,--,--,	G ,G ,R ,G ,--,--,--,--,	Down Road Train Transitions Block Section 3 to Block Section 4

Record	Date/Time	Event	Inputs	BlockStatus	Aspect	Explanation
683	01/11/13-08:57:22	Train Update	FM,FM,FM,FM ,--,--,--,--,	Cl,Cl,Cl,WC,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Down Road Train clears the crossing, Block Section 3 clears, and Block Section 4 is occupied by train
684	01/11/13-08:57:22	Red Aspect Off	FM,FM,FM,P ,--,--,--,--,	Cl,Cl,Cl,WC,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Red aspect turns off as train clears the crossing, Block Section 3 clears, and Block Section 4 is occupied by train
685	01/11/13-08:57:22	Audio 1 Off	FM,FM,FM,P ,--,--,--,--,	Cl,Cl,Cl,WC,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Audio 1 turns off as train clears the crossing, Block Section 3 clears, and Block Section 4 is occupied by train
686	01/11/13-08:57:22	Audio 2 Off	FM,FM,FM,**P** ,--,--,--,--,	Cl,Cl,Cl,WC,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Audio 2 turns off as train clears the crossing, Block Section 3 clears, and Block Section 4 is occupied by train
687	01/11/13-08:57:23	Green Aspect On	FM,FM,FM,**P** ,--,--,--,--,	Cl,Cl,Cl,WC,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Red aspect turns off as train clears the crossing, Block Section 3 clears, and Block Section 4 is occupied by train
688	01/11/13-08:58:23	Train Update	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	The train leaves the crossing area, Block Section 4 clears. 1 Min Checks resume.
689	01/11/13-08:59:24	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	No trains in the crossing area. 1 Min Checks occurring as expected.
690	01/11/13-09:00:24	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	
691	01/11/13-09:01:25	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	

Scenario 06 - Start Up Sequence

Record	Date/Time	Event	Inputs	BlockStatus	Aspect	Explanation
1370	21/07/16-09:38:48	Train Update	P ,P ,FM,FM,--,--,--,--,	I ,I ,Cl,Cl,--,--,--,--,	--,--,--,--,--,--,--,--,	Updates as Power Turned On
1371	21/07/16-09:38:48	Power Restored	P ,P ,FM,FM,--,--,--,--,	I ,I ,Cl,Cl,--,--,--,--,	--,--,G ,G ,--,--,--,--,	Power Restore Detected
1372	21/07/16-09:38:48	Door Closed	P ,P ,FM,FM,--,--,--,--,	I ,I ,Cl,Cl,--,--,--,--,	--,--,G ,G ,--,--,--,--,	Door Contacts Detected
1373	21/07/16-09:38:48	Frauscher Reset	P ,P ,FM,FM,--,--,--,--,	I ,I ,Cl,Cl,--,--,--,--,	--,--,G ,G ,--,--,--,--,	Axle Counters Reset
1374	21/07/16-09:38:48	AMBER Awaiting Train Reset	P ,P ,FM,FM,--,--,--,--,	I ,I ,Cl,Cl,--,--,--,--,	--,--,G ,G ,--,--,--,--,	SMS Message Sent

Record	Date/Time	Event	Inputs	BlockStatus	Aspect	Explanation
1375	21/07/16-09:38:49	Green Aspect Off	P ,P ,FM,FM,--,--,--,--,	I ,I ,Cl,Cl,--,--,--,--,	--,--,G ,G ,--,--,--,--,	Green Aspect Output Off
1376	21/07/16-09:38:49	Red Aspect Off	P ,P ,FM,FM,--,--,--,--,	I ,I ,Cl,Cl,--,--,--,--,	--,--,G ,G ,--,--,--,--,	Red Aspect Output Off
1377	21/07/16-09:38:49	Audio 1 Off	P ,P ,FM,FM,--,--,--,--,	I ,I ,Cl,Cl,--,--,--,--,	--,--,G ,G ,--,--,--,--,	Audio 1 Output Off
1378	21/07/16-09:38:49	Audio 2 Off	P ,P ,FM,FM,--,--,--,--,	I ,I ,Cl,Cl,--,--,--,--,	--,--,G ,G ,--,--,--,--,	Audio 2 Output Off
1379	21/07/16-09:39:19	System Periodic Test OK	P ,P ,FM,FM,--,--,--,--,	I ,I ,Cl,Cl,--,--,--,--,	--,--,G ,G ,--,--,--,--,	Periodic Test
1380	21/07/16-09:40:00	1 Min Check	P ,P ,FM,FM,--,--,--,--,	I ,I ,Cl,Cl,--,--,--,--,	--,--,G ,G ,--,--,--,--,	1 Minute Self Check
1381	21/07/16-09:40:47	Train Update	MR,MR,MR,MR,--,--,--,--,	I ,I ,Cl,Cl,--,--,--,--,	--,--,G ,G ,--,--,--,--,	Manual Reset Operated
1382	21/07/16-09:40:47	Manual Reset	MR,MR,MR,MR,--,--,--,--,	I ,I ,Cl,Cl,--,--,--,--,	--,--,G ,G ,--,--,--,--,	Manual Reset Operated
1383	21/07/16-09:40:47	Train Update	P ,P ,FM,FM,--,--,--,--,	I ,I ,Cl,Cl,--,--,--,--,	--,--,G ,G ,--,--,--,--,	Block Section State Change
1384	21/07/16-09:40:49	Train Update	P ,P ,FM,FM,--,--,--,--,	I ,I ,GF,GF,--,--,--,--,	--,--,--,--,--,--,--,--,	GF Registered as 2 minutes from startup
1385	21/07/16-09:40:50	Frauscher Reset	P ,P ,FM,FM,--,--,--,--,	I ,I ,GF,GF,--,--,--,--,	--,--,--,--,--,--,--,--,	Axle Counters Reset
1386	21/07/16-09:40:55	Train Update	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,GF,GF,--,--,--,--,	G ,G ,--,--,--,--,--,--,	Block Section State Change
1387	21/07/16-09:40:55	Train Update	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Block Section State Change. All Blocks Clear
1388	21/07/16-09:40:55	GREEN System restored	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	SMS Message Sent
1389	21/07/16-09:40:55	Green Aspect On	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Green Aspect Output On
1390	21/07/16-09:41:00	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	1 Minute Self Check
1391	21/07/16-09:42:00	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	1 Minute Self Check
1392	21/07/16-09:42:52	GREEN System restored	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	SMS Message Sent
1393	21/07/16-09:43:00	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	1 Minute Self Check
1394	21/07/16-09:44:00	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	1 Minute Self Check
1395	21/07/16-09:45:00	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	1 Minute Self Check
1396	21/07/16-09:45:52	Energy Save On	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	E ,E ,E ,E ,--,--,--,--,	Energy Save after 5 Minutes
1397	21/07/16-09:45:52	Green Aspect Off	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	E ,E ,E ,E ,--,--,--,--,	Energy Save after 5 Minutes

Scenario 07 - Typical Dark Mode / Auto Reset Sequence

Record	Date/Time	Event	Inputs	BlockStatus	Aspect	Explanation
1246	21/05/14-15:23:23	Train Update	P ,FM,FM,FM,--,--,--,--,	Oc,Cl,Cl,Cl,--,--,--,--,	R ,G ,G ,G ,--,--,--,--,	Block Section 1 occupied
1247	21/05/14-15:23:23	Audio 1 On	P ,FM,FM,FM,--,--,--,--,	Oc,Cl,Cl,Cl,--,--,--,--,	R ,G ,G ,G ,--,--,--,--,	Section 1 occupied and AWD on

Record	Date/Time	Event	Inputs	BlockStatus	Aspect	Explanation
1248	21/05/14-15:23:23	Green Aspect Off	P ,FM,FM,FM,--,--,--,--,	Oc,Cl,Cl,Cl,--,--,--,--,	R ,G ,G ,G ,--,--,--,--,	green off due to occupancy of section 1
1249	21/05/14-15:23:23	Red Aspect On	P ,FM,FM,FM,--,--,--,--,	Oc,Cl,Cl,Cl,--,--,--,--,	R ,G ,G ,G ,--,--,--,--,	red aspect on due to occupancy of section 1
1250	21/05/14-15:23:28	Train Update	FM,P ,FM,FM,--,--,--,--,	Oc,WC,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Train Transitioning from Block Section 1 to Block Section 2 lit
1251	21/05/14-15:23:31	Train Update	FM,P ,FM,FM,--,--,--,--,	Cl,WC,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Section 1 clear, section 2 occupied, green aspect lit
1252	21/05/14-15:23:31	Green Aspect On	FM,P ,FM,FM,--,--,--,--,	Cl,WC,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Section 1 clear, section 2 occupied, green aspect lit
1253	21/05/14-15:23:31	Red Aspect Off	FM,P ,FM,FM,--,--,--,--,	Cl,WC,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Red aspect off due to section 1 clear
1254	21/05/14-15:23:31	Audio 1 Off	FM,P ,FM,FM,--,--,--,--,	Cl,WC,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Audio off due to section 1 clear
1255	21/05/14-15:24:32	1 Min Check	FM,P ,FM,FM,--,--,--,--,	Cl,WC,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Standard 1 minute cyclical input check
1256	21/05/14-15:25:31	Train Update	FM,P ,FM,FM,--,--,--,--,	GF,GF,GF,GF,--,--,--,--	--,--,--,--,--,--,--,--,	Green Aspect Failure Registered
1257	21/05/14-15:25:31	Green Aspect Off	FM,P ,FM,FM,--,--,--,--,	GF,GF,GF,GF,--,--,--,--	--,--,--,--,--,--,--,--,	Green aspect off due to 120 second timer being exceeded
1258	21/05/14-15:25:31	Dark Mode On	FM,P ,FM,FM,--,--,--,--,	GF,GF,GF,GF,--,--,--,--	--,--,--,--,--,--,--,--,	Dark mode on
1259	21/05/14-15:25:41	Train Update	FM,P ,FM,FM,--,--,--,--,	I ,I ,Cl,Cl,--,--,--,--,	--,--,G ,G ,--,--,--,--,	
1260	21/05/14-15:25:41	Frauscher Reset	FM,P ,FM,FM,--,--,--,--,	I ,I ,Cl,Cl,--,--,--,--,	--,--,G ,G ,--,--,--,--,	Internal reset within Frauscher system
1261	21/05/14-15:25:45	System Initialised	FM,P ,FM,FM,--,--,--,--,	I ,I ,Cl,Cl,--,--,--,--,	--,--,G ,G ,--,--,--,--,	internal reset within Frauscher system

Record	Date/Time	Event	Inputs	BlockStatus	Aspect	Explanation
1262	21/05/14-15:26:11	Train Update	P,P ,FM,FM,--,--,--,--,	Oc ,I ,Cl,Cl,--,--,--,--,	--,--,G ,G ,--,--,--,--,	Block Section 1 occupied
1263	21/05/14-15:26:55	Train Update	P,P ,FM,FM,--,--,--,--,	Oc,Oc,Cl,Cl,--,--,--,--,	--,--,G ,G ,--,--,--,--,	Train Transitioning from Block Section 1 to Block Section 2
1264	21/05/14-15:26:55	Train Update	P,P ,FM,FM,--,--,--,--,	Cl,Oc,Cl,Cl,--,--,--,--,	G,--,G ,G ,--,--,--,--,	Block Section 1 clear, Block section 2 occupied
1265	21/05/14-15:27:12	Train Update	P,P ,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G,G,G ,G ,--,--,--,--,	Block Section 2 Clears
1266	21/05/14-15:27:12	GREEN System restored	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Train has passed through section correctly and system has restored
1267	21/05/14-15:27:12	Green Aspect On	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	Green aspect on due to all sections clear
1268	21/05/14-15:27:12	GREEN System restored	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	SMS Message Sent
1269	21/05/14-15:28:12	1 Min Check	FM,FM,FM,FM,--,--,--,--,	Cl,Cl,Cl,Cl,--,--,--,--,	G ,G ,G ,G ,--,--,--,--,	standard 1 minute cyclical input check

END

Includes:	EBI Track 400 Audio Frequency Track Circuit
Excludes:	All other Track Circuits

1. EBI Track 400 Audio Track Circuit: GENERAL

This document provides technical information for the setting up, faulting and maintenance of EBI Track 400 track circuits.

Under no circumstances shall the TX and RX tuning units of one track circuit be disconnected from the rails at the same time.

This can allow unwanted power to pass between the adjacent track circuits resulting in a possible failure of an abutting track circuit.

The TU cables form part of the tuned circuit, because of this they should wherever possible be bound together, not allowed to form loops and not be run in parallel with the running rails. Failure to observe these items can result in the effectiveness of the tuned area being altered i.e. low or below specification readings.

Numerous parameters are usually accessible via Remote Condition Monitoring and can be used to assist with fault investigations.

1.1. EBI Track 400 Layout Configurations

EBI Track 400 track circuits can be used in a number of configurations:

a) Double rail configuration using TUs for jointless or ETUs for jointed track circuits using Open Line frequencies.

b) Double rail configuration using SATUs for jointless or CUs for jointed track circuits using Station Area frequencies.

c) Single rail configuration using ETUs, SPETUs.

d) Both single rail and double rail configurations can have multiple Receivers/Track Relays.

1.2. Warning:

If an RX or TX is disconnected from its tuning unit, the terminals on that tuning unit to which the 2-core cable was attached shall be short circuited.

A double rail EBI Track 400 track circuit shall never be reconfigured as a single rail track circuit.

1.3. Caution:

The gain or sensitivity shall not be increased or decreased where the clear track current (across IPC-IP1 OL, IPC-IP2 SA.) has changed by more than 10% without consulting your S(MS).

Any adjustment should only be to obtain the correct drop shunt, for that track circuit.

Tuned zones shall be kept clear of all metallic objects including new or scrap lengths of rail for a distance of at least 1.25m (4ft). The tail cables from the TU to the rails form part of the tuned circuit, because of this they should wherever possible be bound together, not allowed to form loops and not be run in parallel with the running rails. Failure to observe these items can result in the effectiveness of the tuned area being altered i.e. low or below specification readings.

1.4. Power Supplies and Fusing

EBI Track 400 utilises PULS power supplies which provide a stabilised 48VDC. The 110VAC supply to the power supplies are fused with 5A BS88 Joint Services Fuse. The 48VDC supply to Transmitters use 5A and 7A BS88 Joint Services Fuse depending on the feed lengths and Receivers use a 3A BS88 Joint Services Fuse. BS88 fuses are mandated for reliability.

1.5. Test Equipment

A TI21 Test Meter (TTM), TI21-M Test Meter (MTM) or EBI Track Track Circuit Meter (ETTCM) set to the frequency of the track circuit under test shall be used for voltage measurements. It is not acceptable to test EBI Track 400 without a TTM, MTM or ETTCM.

A Rail current measuring devices such as a Rocoil or Lemflex, used in conjunction with the TTM/MTM/ETTCM, can be used to measure the EBI Track 400 current in the rail to locate a section of the track bed causing loss of power at the Receiver end.

1.6. Centre Fed and Cut Section Track Circuits

Each half of a centre fed track circuit or each cut section operates as an independent track circuit and shall be tested as such and record cards kept for each part.

1.7. Impedance Bond Tuning

Any impedance bonds within the track circuit shall be tuned with the correct resonating capacitor across the auxiliary coil or in the case of B3 3000 and B3 500 bonds (which have no auxiliary coil) the correct tuning module.

Each removable tuning capacitor / module is labelled with the style of bond it should be fitted to. Where it is not removable this information appears on the bond itself.

If the earlier PCB type of tuner board (e.g. Howells or WH3 type) is used, the correct links shall be cut depending on the track circuit frequency.

1.8. Rail to Rail Voltage

With the track circuit not shunted by a train or train shunt the rail-to-rail voltage should fall approximately linearly from the TX to the RX end. In exceptional circumstances (and with permission of the S&T Maintenance Engineer) it may be raised by intermediate tuning capacitors.

1.9. Rail Current

The EBI Track 400 rail current reading gives a more useful reading, than rail voltages, and should be virtually constant throughout the track circuit length. It should also be of similar values in both rails.

Where impedance bonds, or intermediate tuning capacitors (Bucking Capacitors) have been fitted the current value will have a marked change. Significant changes in track current indicate leakage faults between the rails which should be investigated and rectified.

It should be noted that PAN 8 and Bullhead rail will inherently lose current because of the lack of pads and nylons.

1.10. Tuned Zone Ratios (Pole/Zero Ratios)

Pole – Track under test
Zero – Adjacent/abutting track

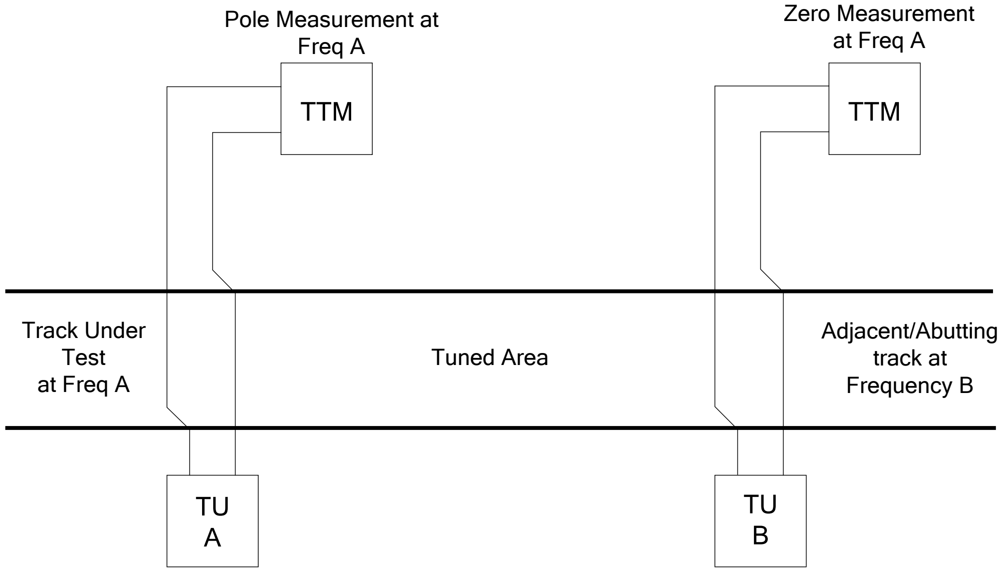


Figure 1 – Tuned Zone Ratio Pole Zero Positions

The Pole voltage is the voltage across the rails at the TU of the track under test (TU A in drawing) at that track's frequency (Frequency A in Figure 1). For the purpose of the test this TU can be called the 'Pole TU'.

The zero voltage is measured across the companion tuning unit's (TU B in the drawing) rail terminals at the track under test frequency (Frequency A in the drawing). For the purpose of the test this TU can be called the 'Zero TU'.

Important points to note are:

a) The pole/zero measurement gives no information about the quality of the pole. The pole is the property in the tuning unit which determines how much signal current is sent down the track to the RX at the other end.

b) The pole/zero measurement will give a good measurement of the quality of the zero. The zero determines how much unwanted signal flows into the adjacent track.

c) The quality of the zero is determined by the impedances caused by:

- The components within the TU.
- The tightness of the track and TU connections.
- The layout of the track cables.
- The equipment (TX/RX) connected to the zero TU.

From the above statements, the following conclusions can be reached:

a) Pole/zero ratios are a good method of monitoring the quality of the TU connections and track cable layout. As such, they provide evidence that good installation practice has been followed.

b) If pole/zero ratios are measured with an active TX connected to the zero TU, then the ratio will be degraded.

1.11. Mechanical and Electrical Connections

Good quality mechanical and electrical connections are important to obtain reliable operation of the EBI Track 400 equipment.

These connections shall be made and maintained in accordance with the torque requirements defined in Appendix G.

1.12. Spare/Scrap Rail Laid in the 4ft

Placing spare/scrap rail in the 4ft should not affect the operation of the track circuit.

However, if placing spare/scrap rail through a Tuned Zone is unavoidable, the following actions will mitigate against unreliable operation:

a) Measure the current flowing in the rail laid in the 4ft using a Rocoil. This should be Zero.

If current is found to be flowing in the rail, then there is likely to be physical contact between the running rails and the spare rail. This should be rectified.

b) Check the TZR before and after the rail is laid in the 4ft. If the change in TZR is less than 10%, there should not be any further problems. This check should be repeated when the rail is removed from the 4ft.

1.13. TU/ETU/SPETU hoods (Acoustic Jackets)

These should be fitted in areas close to residential property where noise might cause a nuisance.

1.14. Intermediate Tuning Capacitors

These are used to increase the gain at intermediate positions in the track circuit to overcome low ballast resistance caused by poor formation and/or rail fastenings.

They shall not be fitted or removed without permission from the S&T Maintenance Engineer.

They require individually specified drop shunt testing along the length of the track circuit at increased frequency.

1.15. Transmitter and OM3 Failures

Transmitter and OM3 failures will generally result in a hard failure of the track causing it to show occupied. If these items are replaced, either individually or both at the same time, and the OM3 set up in accordance with the switch setting information from the record card and provided the receiver is not changed; then a check of the clear track current will determine how much testing is required before the track is returned to operational service.

If, after the equipment is replaced, the clear track current is within 10% of the clear track current recorded, **at Commissioning**, on the record card then a full test shall be carried out in accordance with the defined procedures.

If the clear track current has changed by more than 10% then the receivers shall be set up again followed by carrying out a full test in accordance with the defined procedures.

1.16. Receiver Current

RX current is measured at the RX input terminals (IP1 & IPC for Open Line tracks, IP2 & IPC for Station Area tracks) with a TTM, MTM, ETTCM or by using the display. This is the actual physical quantity that the track circuit uses to determine the presence/absence of a train and so is a direct measure of the overall health of the track circuit.

1.17. Receiver Current – General

The RX current is affected by:

a) The quality of the TX pole.
b) The quality of the RX pole.
c) Ballast resistance.
d) Feed through from adjacent track circuits of the same frequency.

From the previous statements, the following conclusions can be reached:

RX current is an excellent overall measure of the stability of the track circuit. Significant changes in current are due to either degradation in the TUs, or changes in the leakage current between the rails. e.g. impedance bonds, rail bonds, check rails etc.

A significant deviation is indicated if the change of track current is greater than:

±20% OR

±10mA.

These factors require investigation if fault-free operation is to be maintained'.

1.18. Tuned Zones

Pole/zero ratios are useful in monitoring installation standards.

RX current is the most effective measure of track circuit performance and stability since it measures the effectiveness of the pole circuit and signal leakage effects.

1.19. Tuned Zones on Steel Sleepers

Special instructions for tuned zone installations shall be followed:

a) Open Line Tuned zone is 22m ± 0.5m.
b) Station Area Tuned Zone is 5m ± 0.1m.
c) All the sleepers within the zone, and for 3 bays either side, are of a Network Rail accepted steel type.

There have been instances of re-railing where concrete/timber sleepers have been replaced by steel sleepers and the tuned zone has not been changed accordingly.

Where an EBI Track 400 Tuned Zone on steel sleepers is found to be not installed to 22m+/-0.5m, it shall be reported as corrective maintenance.

1.20. Single Rail Application

RX current can be affected by the quality of the rail connections, bonded out joints, IRJ's and S&C insulations (sole plates, stretcher bars etc).

1.21. Testing for Crosstalk / Feed through

Where it is required to test and check for crosstalk / feed through values, the procedure below is to be performed:

Check that all track circuits which can cause interference to the track circuit being tested are operational, including:

(a) The next track circuits of the same frequency.
(b) Track circuits connected to the track circuit under test by cross bonding.

Switch off the transmitter associated with the tack circuit under test, and check that the track relay de-energises.

Using the Receivers Condition Monitoring display, record the value 'Inow (AV)' on the track circuit record card as part of the record for the test and check for permitted values against Table 1.

Track Circuit Configuration	Crosstalk / Feed Through Max (mA)
Double Rail Open Line frequency Track Circuits	8mA
Single Rail Open Line frequency Track Circuits (with 30m Bonding/Cross Bonding)	3mA
Double Rail Station Area frequency Track Circuits	Less than 10% of Ith or 20mA whichever is the lower

Table 1 – Crosstalk / Feed Through values

Where a SR track circuit is identified as not having the 30m bonding/cross bonding:

- The crosstalk / feed through could be higher than 3mA. A crosstalk / feed through value of greater than 8ma should be investigated for corrective action.

- The track circuit should be reported for corrective action to apply the 30m bonding/cross bonding.

A current higher than the stated maximum values should be investigated. Look for disconnected or incorrect bonding, tuning unit failure, etc.

2. Fault Finding - Guidelines

2.1. General

Before starting work, all track connections shall be checked for tightness as described in NR/SMS/PartC/TC17 (Track Circuits: EBI Track 400).

The generic EBI Track 400 Bombardier Manuals can be also referenced.

The health of a track circuit can be determined by the voltage measured across IPC-IP1 OL, IPC-IP2 SA . Any changes to the TX/OM3 output level, the TX or RX ETU, SPETU, TU, SATU or CU the track bed or associated tuned zone equipment will affect the receiver input current.

The track relay voltage will indicate the correct functioning of the RX and that the relay coil is not damaged. If the relay coil voltage is low, it will indicate a failing RX unit.

The relay end rail voltage is a measure of the energisation level of the track circuit. It will change inversely proportional to the drop shunt value and will be affected by the same factors. A low rail voltage will indicate a faulty TU/ETU/SPETU/SATU/CU or a faulty connection at any part of the track.

If two adjacent track circuits fail simultaneously, the fault is most likely where the two tracks adjoin. Check the tuning units and associated connections and other shared equipment like the PSU.

For centre fed track circuits any problem within 30 metres of the centre feed will affect both sections.

If low ballast resistance is suspected see if the problem can be localised. On concrete sleepered track check the pads and clip insulations. On timber sleepered track check for poor ballast drainage and P8 type rail fastenings. If the problem can be isolated, spot replacement of rail insulations or replacement of P8 fastenings with P14 shall be considered. (if you are in doubt about the type of fastenings, ask your Supervisor).

Checking obtained readings against those on the Record Card and investigating those that have significantly changed can reveal the source of the fault.

Using a TTM/MTM/ETTCM a measurement of the rail-to-rail voltage at regular intervals from TX to RX should show a gradual decrease of the voltage.

Rail current readings give a more valued reading than track voltage.

2.2. Open Line Frequency Tracks

2.2.1. OL Track Circuit Tests – General

WARNING

High voltages can be present at the EBI Track 400 Transmitter Output Module terminals, line matching unit terminals and at receiver output terminals.

Before fitting or removing these units, power shall be removed from the associated transmitter or receiver. Personnel delegated to work on these units while in operation, shall be suitably competent.

Do not allow the output of the Output Module to become short-circuited.

The OM3 resistor shall remain switched to the 0R position in "Open Line" operation.

If the OM3 resistor is found not switched to the 0R position, this shall only be corrected with permission from the S&T Maintenance Engineer.

Observe all safety procedures that are in force for track possession, and for working on or near the track.

NOTE: *High voltages can be present at rail connections due to traction currents.*

IMPORTANT

Before disconnecting any Tuning Unit rail connections, both track circuits adjacent to the affected track are switched off. This is because the disconnected TU can have formed the short circuit that prevented energy from one adjacent track feeding through to the other. There is a danger of false feeding a track circuit and causing a wrong side failure if this precaution is not observed and another Tuning Unit were to become disconnected.

Short circuiting connections to a TU or disconnecting a transmitter or receiver from a TU can cause a right side failure by dropping the companion track circuit (the track circuit that shares the tuned area being tested with the track that is under investigation).

Measurements of voltage and current of the EBI Track 400 frequency signal for a track can be corrupted by signals from the companion track and other AC sources. To overcome this problem, a TTM/ETTCM, set to the frequency of the track circuit under test, should be used for all readings. If a TTM/ETTCM is not available, to reduce the problem, the Transmitter of the companion track should be switched off as follows:

(1) Always switch off the companion Transmitter if it shares the tuned area being tested. Switch off by removing a power supply fuse - do not disconnect the Transmitter from the Tuning Unit as this will upset the "pole" tuning.

(2) When signal levels less than or equal to receive end rail voltages are being measured, switch off the companion Transmitter even if it is remote from the tuned area being tested.

Unless a TTM/ETTCM is used, there is always a danger that interference from other tracks or 50 Hz mains can reduce the accuracy of measurements. In electrified areas measurements should not be made when a train is nearby on any line in case harmonics in the traction current at EBI Track 400 frequencies corrupt the readings. A TTM/ETTCM will not satisfactorily filter out other signals within 30 Hz of that selected for measurement.

The TTM/ETTCM could be influenced by strong magnetic fields. Consequently it is advisable that a TTM/ETTCM is not placed directly onto traction current carrying components, such as running rails, impedance bonds, traction return cables, etc. Also, on some schemes with concrete track beds there is the possibility of stray currents flowing in concrete reinforcements of the track bed.

2.2.2. Open Line Tests – Track Circuits with TUs / ETUs

Confirmation of the source of the fault can be achieved by use of the track circuit tests next described. Some measurements can be made by using the Condition Monitoring System (CMS).

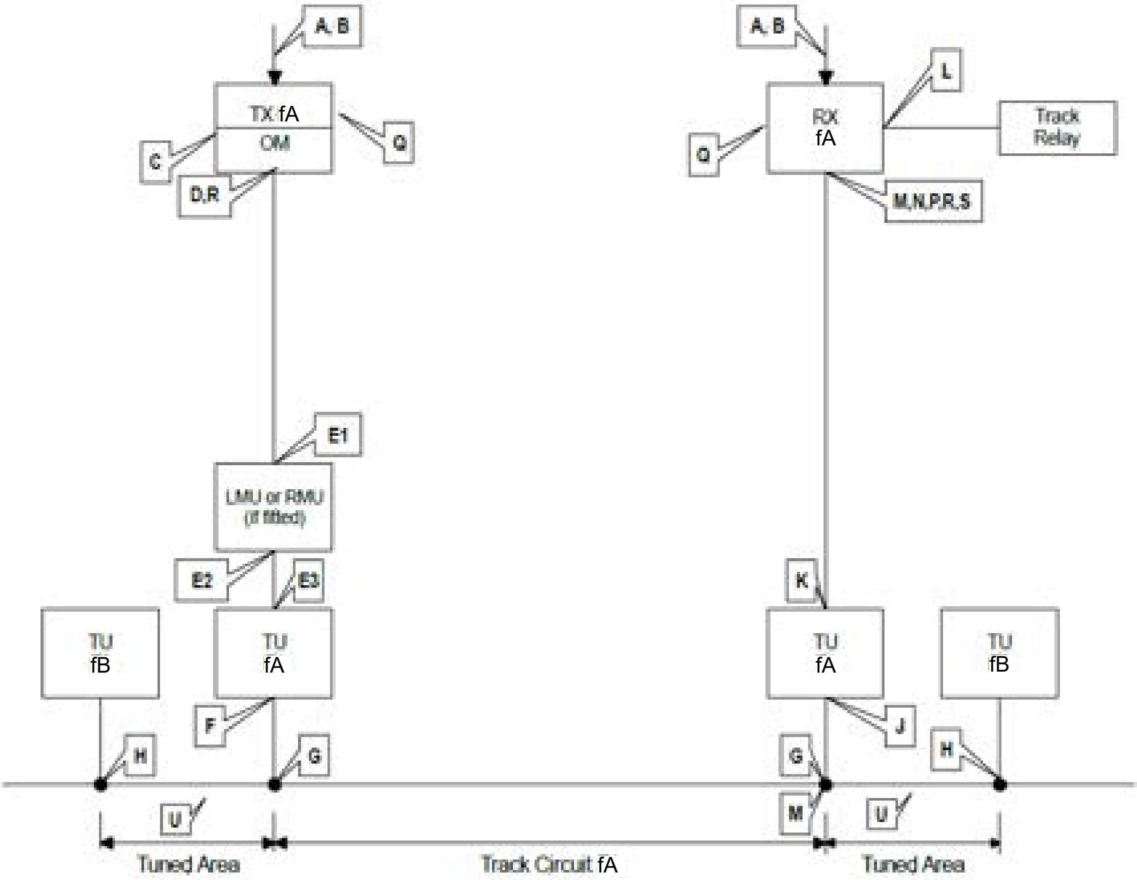


Figure 2 – Summary of Tests for track Circuits with TUs / ETUs

The Table 2 indicates the acceptable limits for each of the parameters measured at the above test points “A” to” H”.

Measurements can be taken by alternative methods as indicated.

- CMD= Condition Monitoring Display on Tx or Rx.
- DVM= Digital Multimeter.
- TTM = TI21 Track Circuit Meter.
- ETTCM = EBI Track Track Circuit Meter.

Test	Measurement	CMD	TTM or ETTCM	DVM	Normal Range
A	Tx 48V input current.	-	-	√	Depends on track and feed cable length, see Appendix C - Transmitter Current Consumption (Max).
A	Rx 48V input current. Relay down	-	-	√	Approx. 50mA DC
A	Rx 48V input current. Relay up	-	-	√	100mA to 150mA DC

Test	Measurement	CMD	TTM or ETTCM	DVM	Normal Range
B	Tx & Rx Power Supply Input voltage	"Vpsu"	-	√	47.5V to 48.5V DC
C	Tx Voltage out.		√	√ see note 1a	32V to 34V rms
D	Output Module output voltage	"Vout"	-	√ see note 1b	OM3 depends on switch setting see Appendix D - Output Module (OM3) Output Level v Step Setting. **0R switch shall be set to 0R**
	Output Module output power	"Pout"	-	-	"Pout" should be greater than 1.5W indicating that the Tx is supplying power to the line. "Pout" rises with Tx-to-track distances and track length up to a maximum of 200W.
E1	LMU(TU) Input Voltage	-	-	√ see note 1b	50V to 148V RMS (increases with Tx to TU feed length)
E2	LMU(TU) Output Voltage	-	√	√ see note 1a	0.6V to 15 V rms
E3	TU/ETU Input Voltage. Terminals 4 & 5	-	√	√ see note 1a	20m – 250m: 0.6V to 2.0V 250m – 1100m: 5V to 15V rms
F	TU Output Voltage	-	√	√ see note 1a	Values should be 5% to 10% Higher than Test G
G	Tx End Rail to Rail Voltage	-	√	√ see note 1a	Values should meet Appendix A - Typical Rail-to-Rail Voltages.
H	Tuned Area Voltage ratios. (see note 3)	-	√	-	Minimal acceptable ratios indicated in Appendix B. (See note 2).
J	Rx TU Input Voltage. Terminals T1 & T2	-	√	-	Values should meet Appendix A - Typical Rail-to-Rail Voltages.
K	Rx TU Output Voltage. Terminals 1 & 2	-	√	-	Lower than Test J. (See note 2).

Test	Measurement	CMD	TTM or ETTCM	DVM	Normal Range
L	Receiver output Voltage to Relay	√ “Vout”	√	√	50V relay version: 48 to 52VDC (Mod state 2 and later) 40 to 44VDC (Mod state 1) 24V relay version: 23 to 27VDC (Mod state 2 and later) 19 to 22VDC (Mod state 1)
M	Rx Drop Shunt at Rx end of TC. TC length > 250m	-	-	-	0.8 Ohm to 1.2 Ohm (see note 4.)
M	Rx Drop Shunt at Rx end of TC. TC length < 250m	-	-	-	1.3 Ohm to 1.7 Ohm (see note 4.)
N	Rx Input current	√ “Inow”	√	-	30-380mA. Value should be within ±20% of value recorded at last set up. See note 5.
P	Cross-talk and Feed-through test	√ “Inow”	√	-	Less than 8mA. (see note 6.)
Q	Earth Connection continuity	-	-	-	See note 7
R	Check that surge arrestor line terminals are isolated from earth.	-	-	√	>100kΩ
S	Total Wide-band current (3Hz-33kHz)	“ITot”	-	-	This level should be noted as it can be used to ascertain the bleed through and cross talk of the tuned zone. It shall be less than 500mA
T	Impedance Bond Test	-	√	-	The impedance of an impedance bond can be checked by measuring the voltage across the bond and the current through it at the track circuit frequency. To take the current measurements use a Rocoil connected to a TTM/ETTCM. • Check all rail connections and bonding are tightened to the correct torque. • Check the security and the fixing of the tuning module. • Place the Rocoil over the rail 1 metre before the Bond (TX side) and note the reading on the TTM/ETTCM (= amps, I_1). • Repeat the measurement 1 metre from the bond on the RX side (= amps, I_2).

Test	Measurement	CMD	TTM or ETTCM	DVM	Normal Range
					• Subtract I_2 from I_1 thus obtaining the current through the bond at the EBI Track 400 frequency. • If an ETU is connected directly to the bond, then a current clamp able to wrap around the ETU lead and feed into the TTM/ETTCM (eg a Fluke i3000s Flex-24) shall be used as follows. Place the current clamp around the ETU lead and note the reading on the TTM/ETTCM (= amps, I_3). This value will be subtracted from the previously calculated current, thus obtaining the current through the bond at the EBI Track 400 frequency. • Measure the rail to rail voltage (V) across the impedance bond. • Divide the voltage (V) by the current calculated above thus giving the impedance (Z), $Z = V / (I_1 - I_2)$. This value shall be greater than 8 Ω. If this is not the case, check that the correct tuning module has been fitted.
U	Spare Rail in the Tuned Zone Test	-	√	-	Measure the current flowing in the rail laid in the 4ft using a Rocoil. This should be Zero. If current is found to be flowing in the rail, then there is likely to be physical contact between the running rails and the spare rail. This should be rectified. Check the Tuned Zone Ratio (Test H) before and after the rail is laid in the 4ft. If the change in Ratio is less than 10%, there should not be any further problems. This check should be repeated when the rail is removed from the 4ft.

Table 2 – Summary of Tests for track circuits with TUs / ETUs

These notes and Test Letter references in Sections 2.2.3 to 2.2.6 to be read in conjunction with the Table above.

Note 1a. Use a TTM/ETTCM set to the appropriate voltage range and TC frequency. If a TTM/ETTCM is not available use a DVM that is suitable for measuring true rms voltages at frequencies up to 3kHz.

Note 1b. Use a DVM that is suitable for measuring true rms voltages at frequencies up to 3kHz or a ETTCM. Do not use a TTM. Do not allow the Output Module’s output to become short-circuited.

Note 2. To measure receive end voltage, the TU output terminals 1 and 2 shall be connected to the Receiver or short circuited - do not leave them open circuit.

Note 3. The voltage measured across the rail connections of the companion, or “Zero”, Tuning Unit should be lower than that across the “Pole“ Tuning Unit of area. All measurements are taken at the ‘Pole’ frequency. The voltage ratio is calculated as voltage at G divided by voltage at H.

Note 4. It is only necessary to carry out a drop shunt test at the receive end Tuning Unit rail connections since similar or higher values will be found elsewhere in the TC except within the tuned area which is a special case.

Under no circumstances shall a TC be left with a drop shunt less than 0.5 Ohm in the main part of the track circuit.

Note 5. As a cross check on the CMD measurement, the value of Receiver input current can also be measured by checking, with a TTM/ETTCM, the voltage developed across the 1Ω resistor (which is connected in series with the input of the Receiver). One mV so measured equates to One mA.

The minimum value of input current (the Threshold Current) necessary for an Rx to pick up its Track Relay can be read directly from the Rx display by accessing the quantity “Ith” since this is the value locked into the Rx during the automatic set-up process.

Note 6. Check that all track circuits which can cause interference to the TC under test are operational, including:

a) The next TC of the same frequency.
b) TCs connected to the TC under test by cross bonding.

Switch off the Tx associated with the TC under test and check that the Track Relay de-energises and that the Receiver input current is less than 8mA. An Rx input current higher than 8mA shall be investigated

Note 7. Confirm by continuity checks that the Tx, Rx and PSU cases are connected to the local earth. Also confirm that all lightning protection earth terminals are connected to earth. The earth connection resistance must not be greater than 50Ω.

WARNING

Do not use a TTM to measure the output from an Output Module and its corresponding LMU(TU) input (ETTCM can be used). Beware that the voltages on these units can exceed 150V RMS.

NOTE: *The 2mm Test leads have a rated maximum operating voltage of 30VAC and 60VDC.*

This voltage is high enough to endanger life; before fitting or removing these units, power shall be removed from the associated EBI Track 400 Transmitter.

2.2.3. OL Fault Finding - General

If adjacent track circuits fail together, then items common to them - power supplies, Tuning Units or interconnections - should be checked first.

The most vulnerable parts of the track circuit are the TU / ETU-to-rail and impedance bond-to-rail connections. It is prudent to check the integrity of these before beginning a systematic test through the circuit from the transmit end. It is also advisable to check that there is no fault in the wiring between the receiver output, track relay and the panel indication before proceeding to the trackside

Full details of the tests are given in Section 2.2.2. It is important not to simply overcome a fault by adjusting the receiver gain; the reason for a change in drop shunt value should be ascertained by performing the tests given in this section. The results of each test can be compared with the measurements taken at the last test / commissioning / setting-up that were logged on the record card; any major differences can be a guide to the possible fault area. Although the tests are presented to start from the transmit end of the track circuit, sometimes it can be more convenient to start from the receive end.

2.2.4. OL Fault Finding - Transmitter End

1. Check that the Transmitter and Tuning Unit / End Termination Unit are making a 'singing' noise (The volume of this will vary depending on cable and track length).

   Use the Condition Monitor to ascertain that the Tx and OM3 output are correct (i.e. display does not show 'ERR'). If the Transmitter is showing 'ERR' then press 'OK' and follow the CM menu structure to find the cause of the error.

   a) If the Transmitter is not 'singing' and the Tx Status indicates an internal or frequency fault, then the Transmitter is faulty and should be changed.

   b) If the Transmitter is not 'singing' and ''Vout' is zero, or very low then check the connections between the Output Module and the Tx. If these are OK, then the Transmitter is faulty and should be changed.

   c) If 'Vout' is in range but 'Pout' is zero, or very low, then this indicates that the Output Module is disconnected from its TU/ETU.

2. Test the integrity of the Tx to rail path by connecting a 1.0Ω shunt across the Transmitter TU rail connections. This should reduce the rail-to-rail voltage by approximately half if the transmit end is working properly. If this test is successful then the remainder of the Transmitter tests need not then be carried out.

3. Test the +48 power supply voltage and current to the Transmitter (Tests A and B), and the Transmitter and Output Module output voltage (Tests C and D). Results from these tests outside the normal range show that the power supply unit, Transmitter or Tuning Unit / End Termination Unit can be faulty. Further tests will help to indicate which has failed but only replacement of the most suspect unit can finally establish which is faulty.

4. Tuning Unit input and output voltages (Tests E3 and G) will show whether the interconnections are OK.

5. The results of Test D and E1 will indicate whether the inter-wiring between Tx/LMU(TU) is serviceable.

WARNING

Do not use a TTM to measure the output from an Output Module and its corresponding LMU(TU) input. ETTCM can be used. Beware that the voltages on these units can exceed 150V RMS.

NOTE: *The 2mm Test leads have a rated maximum operating voltage of 30VAC and 60VDC.*

This voltage is high enough to endanger life; before fitting or removing these units, power shall be removed from the associated EBI Track 400 Transmitter.

6. If the rail-to-rail voltage (Test G, step 4 above) is wrong, then either of the TUs, or the rail connections can be faulty.

   The companion TU voltage should be tested (Test H). If incorrect, then the companion TU can be faulty. The companion TU will be confirmed as faulty if the rail-to-rail voltage at the TU of the failed track becomes correct when terminal T1 is shorted to terminal T2 on the companion TU.

   If the transmit end appears to work normally, walk through the track checking bonds and insulation pads, and look for any metal debris that can be shorting it out.

   The rail current should fall only very slowly between the Transmitter and Receiver ends. During the walk through, it should be checked every 20m, or 50m if a long track, and the difference between any two consecutive readings should be about the same. Any sharp falls in current indicate a problem with the track itself. The place where the irregularity occurs can be used as a guide to the location of the track fault.

   See section 2.2.6 for further information on track faults.

2.2.5. OL Fault Finding - Receiver End

1. Check the voltage at the Tuning Unit rail connections (Test J). A low reading indicates that either TU can be faulty or that a connection has failed.

2. The voltage at the companion TU should be tested (Test H). If incorrect, then the companion TU can be faulty. The companion TU will be confirmed as faulty if the rail-to-rail voltage at the TU of the failed track becomes correct when terminal T1 is shorted to terminal T2 on the companion TU.

3. Measure the Receiver input current (Test N). If this is significantly lower than the clear track current recorded on the record sheet, i.e. more than 20% less, the Receiver TU is faulty. If it is adequate but there is insufficient relay supply voltage (Test L) with a satisfactory power supply (Tests A and B), then change the Receiver.

4. Check the connections to the relay, and that the voltage is available on the coil terminals. Change the relay if necessary.

2.2.6. OL Fault Finding - Track Related problems

If all the standard tests detailed in sections 2.2.3 to 2.2.5 do not reveal a fault and problems persist, then the fault is probably due to excessive leakage of track circuit signal current. The causes of leakage fall into three main groups:

Individual sleeper leakage paths	Chair bolts touching reinforcing in concrete sleeper and either no or failed insulation system (pads & biscuits between rail and chairs).
Localised. leakage paths	Track running through a ‘wet bed’ or over a road crossing where contamination has occurred (e.g. lorries carrying coal or minerals).
General ‘background’ leakage	Old track on wooden sleepers without insulation system between rails and chairs

In the case of localised leakage and individual sleeper problems, the most effective means of identifying the problem area is by use of a Rocoil Rail Current Transducer and TTM/ETTCM using the following method;

The Rail Current Transducer is connected to the TTM/ETTCM and the meter switched to the correct frequency for the track circuit under investigation. Current flowing onto the track circuit from the End Termination Unit should first be measured.

The current level in each rail should be the same; this should be checked since a difference of more than about 10% should be investigated. Differences in current between the two rails indicate that there is a third path through which some of the feed or return current is flowing. This could be a path through the ground (or ballast), but is more likely to be via traction bonding or other rails or tracks. Such paths should be eliminated as far as possible since they can only reduce the sensitivity of the track circuit to train shunts by providing alternative paths that are not shunted.

Areas where current can be significantly different in each rail are in points and crossings. It is sometimes the case that one rail splits to form two parallel paths, e.g. via the diamond of a crossing. In this case about half of the track circuit current will flow in each path, and it will not be possible to change this.

In areas of plain line, assuming the current in both rails is the same, it is not normally necessary to continue measuring in both rails. The current in the rail should be measured at convenient intervals, say 20m to 50m, until a larger than normal decrease is noted. The poor ballast area or shorting sleeper will be within this area. Further readings can now be taken to narrow down the precise area of leakage, or the shorting sleeper.

2.3. Station Area Frequency Tracks with SATU/CU

2.3.1. SA Track Circuit Tests - General

WARNING

High voltages can be present at the EBI Track 400 Transmitter Output Module terminals, tuning unit terminals and at Receiver output terminals. Before fitting or removing these units, power shall be removed from the associated Transmitter or Receiver. Personnel delegated to work on these units while in operation, shall be suitably competent.

Do not allow the output of the Output Module to become short-circuited.

Observe all Safety Procedures that are in force for track possession, and for working on or near the track. Note that high voltages can be present at rail connections due to traction currents.

IMPORTANT

It is important that, before disconnecting any tuning unit rail connections, both track circuits adjacent to the affected track are switched off. This is because the disconnected SATU could have formed the short circuit that prevented energy from one adjacent track feeding through to the other. There is a danger of false feeding a Track Circuit and causing a wrong side failure if this precaution is not observed and another tuning unit were to become disconnected.

Beware, also, that short circuiting connections to a SATU or disconnecting a Transmitter or Receiver from a SATU can cause a right side failure by dropping the companion track circuit.

Measurements of voltage and current of the EBI Track 400 frequency signal for a track can be corrupted by signals from the companion track and other AC sources. To overcome this problem, a MTM/ETTCM, set to the frequency of the Track Circuit under test, should be used for all readings. If a MTM/ETTCM is not available, to reduce the problem, the Transmitter of the companion track should be switched off as follows:

(1) Always switch off the companion Transmitter if it shares the tuned area being tested. Switch off by removing a power supply fuse, or dis-engage the TX frequency key - do not disconnect the Transmitter from the Tuning Unit as this will upset the "pole" tuning.

(2) When signal levels less than or equal to receive end rail voltages are being measured, switch off the companion Transmitter even if it is remote from the tuned area being tested.

Unless an MTM/EETCM is used, there is always a danger that interference from other tracks or 50 Hz mains can reduce the accuracy of measurements. In electrified areas measurements should not be made when a train is nearby on any line lest harmonics in the traction current at EBI Track 400 frequencies corrupt the readings. An MTM/ETTCM will not satisfactorily filter out other signals within ±100 Hz of that selected for measurement.

Note that the MTM/ETTCM could be influenced by strong magnetic fields. Consequently it is advisable that an MTM/ETTCM is not placed directly onto traction current carrying components, such as running rails, impedance bonds, traction return cables, etc. Also, on some schemes with concrete track beds there is the possibility of stray currents flowing in concrete reinforcements of the track bed.

2.3.2. SA Tests – Track Circuits with SATUs / CUs

Problems with Track Circuit operation can be indicated in a number of ways. The most common is nuisance dropping of the track relay when trains are not present. Some faults, e.g. Tx frequency out of specification, low power supply voltage or an internal logic fault in the Tx or Rx, are indicated directly on the Transmitter or Receiver Condition Monitoring Displays (CMD). Other problems require the source of the fault to be discovered by use of the Track Circuit tests in Figure 3.

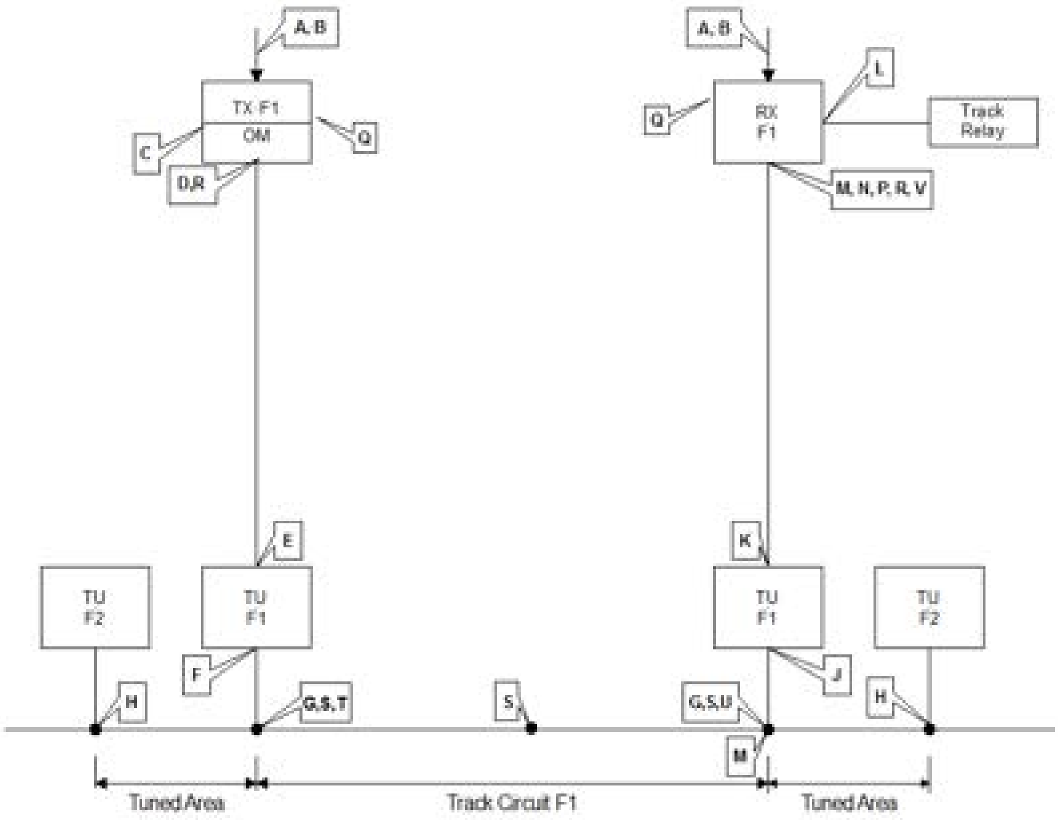


Figure 3 – Summary of Tests for track Circuits with SATUs / CUs

The Table 3 indicates the acceptable limits for each of the parameters measured at the above test points "A" to" H".

Measurements can be taken by alternative methods as indicated.

- CMD= Condition Monitoring Display on Tx or Rx.
- DVM= Digital Multimeter.
- MTM =TI21-M Track Circuit Meter.
- ETTCM = EBI Track Track Circuit Meter.

Test	Measurement	CMD	MTM or ETTCM	DVM	Normal Range
A	Tx 48V input current.	-	-	√	1.5A to 6A DC
A	Rx 48V input current. Relay down	-	-	√	Approx. 50mA DC
A	Rx 48V input current. Relay up	-	-	√	100mA to 150mA DC
B	Tx & Rx Power Supply Input voltage	"Vpsu"	-	√	47.5V to 48.5V DC

Test	Measurement	CMD	MTM or ETTCM	DVM	Normal Range
C	Tx Voltage out.		√	√ see note 1a	33V AC rms
D	Output Module output voltage	"Vout"	-	√ see note 1b	If resistor switch set to 0R; The OM3 output voltage depends on switch setting, see Appendix D - Output Module (OM3) Output Level v Step Setting. If resistor switch set to 48R; Resistor switch shall be set to 48R when a SATU or CU is used with a feed length less than 750m. The OM drive level shall be 13 or lower and the open circuit output voltage shall be less than 95V.
	Output Module output power	"Pout"	-	-	"Pout" should be greater than 1.5W indicating that the Tx is supplying power to the line. "Pout" rises with Tx-to-track distances and track length until the maximum SATU/CU input voltage is reached. The maximum SATU/CU input voltage shall be no more than $95V_{RMS}$.
E	SATU/CU Input Voltage at terminals LINE 1 & 2.	-	√	√ see note 1b	Line losses mean that this figure will be less than that measured in D. Voltage will rise with Tx-to-track distances and track length until the maximum level of 95V is reached. This level shall not be exceeded.
F	SATU/CU Output Voltage	-	√	√ see note 1a	Values should be 5% to 10% Higher than Test G (see note 4)
G	Tx End Rail to Rail Voltage	-	√	√ see note 1a	Values should meet Appendix A.
H	Tuned Area Voltage ratios. (see note 3)	-	√	-	Minimal acceptable ratios 3:1 for F1, F3, F4 & F5 5:1 for F2, F4, F6 & F8 (See note 2 & 4)
J	Rx SATU/CU Input Voltage at terminals T1 & T2	-	√	-	Record value for use in test K.

Test	Measurement	CMD	MTM or ETTCM	DVM	Normal Range
K	Rx SATU/CU Output Voltage. Terminals LINE 1 & 2	-	√	-	30% lower than Test J. (See note 2 & 4).
L	Receiver output Voltage to Relay	√ “Vout”	√	√	50V relay version: 48 to 52VDC (Mod state 2 and later) 40 to 44VDC (Mod state 1) 24V relay version: 23 to 27VDC (Mod state 2 and later) 19 to 22VDC (Mod state 1)
M	Rx Drop Shunt at Rx end of TC.	-	-	-	1.0Ω to 3.0Ω
N	Rx Input current	√ “Inow”	√	-	Should be within 25% of the Rx I/P current recorded during last set-up. See note 5.
P	Cross-talk and Feed-through test	√ “Inow”	√	-	Less than 10% of ‘Ith’ or 20mA whichever is the lower. A higher level shall be investigated (look for disconnected cable screens, SATU failure, etc). (See note 6)
Q	Earth Connection continuity.	-	-	-	See note 7
R	Check that surge arrestor line terminals are isolated from earth.	-	-	√	>100kΩ
S	Set a shunt box to 0.2Ω and carry out a shunt test at the following points in the track circuit: Tx pole, Mid-point, Rx pole and At the end of the deviation of a points track.	√ “Inow”	-	-	Track shall drop. Record Rx current at each point with the shunt in place.

Test	Measurement	CMD	MTM or ETTCM	DVM	Normal Range
T	Calculate the Tx TZ impedance: $TZimp = \left(\frac{CT}{Ish} - 1\right) xRsh$ CT = Receiver input current (Iav) Measured when track is clear Ish =Receiver input current (Iav) measured when a 1Ω shunt has been applied at the Tx end rail connections.	√ "Inow"	-	-	TZimp shall be >0.4Ω
U	Calculate the Rx TZ impedance: $TZimp = \left(\frac{CT}{Ish} - 1\right) x\ 1.5$ CT = Receiver input current (Iav) Measured when track is clear Ish = Receiver input current (Iav) measured when a 1Ω shunt has been applied at the Rx end rail connections.	√ "Inow"	-	-	TZimp shall be >0.4Ω
V	Total Wide-band current (3Hz to 33kHz)	"ITot"	-	-	"ITot" shall be less than 500mA. This level should be noted as it can be used to ascertain the bleed through and cross talk of the tuned zone.
Y	Impedance Bond Test	-	√		The impedance of an impedance bond can be checked by measuring the voltage across the bond and the current through it at the track circuit frequency. To take the current measurements use a Rocoil connected to a MTM/ ETTCM.

Test	Measurement	CMD	MTM or ETTCM	DVM	Normal Range
					• Check all rail connections and bonds are tightened to the correct torque. • Check the security and the fixing of the tuning module. • Place the Rocoil over the rail 1 metre before the Bond (TX side) and note the reading on the MTM/ETTCM (= amps, I_1). • Repeat the measurement 1 metre from the bond on the RX side. • Subtract I_2 from I_1 thus obtaining the current through the bond at the *EBI* Track 400 SA frequency. • If an CU is connected directly to the bond, then a current clamp able to wrap around the CU lead and feed into the MTM/ETTCM (eg a Fluke i3000s Flex-24) shall be used as follows. Place the current clamp around the CU lead and note the reading on the MTM/ETTCM (= amps, I_3). This value will be subtracted from the previously calculated current, thus obtaining the current through the bond at the *EBI* Track 400 SA frequency. • Measure the rail to rail voltage (V) across the impedance bond. Divide the voltage (V) by the current calculated above thus giving the impedance (Z), Z= V / (I1-I2). This value shall be greater than 8 Ω. If this is not the case, check that the correct tuning module has been fitted.

Table 3 - Summary of Tests for track Circuits with SATUs / CUs

These notes and Test Letter references in Sections 2.3.3 to 2.3.6 be read in conjunction with the Table above.

Note 1a. Use an MTM/ETTCM set to the appropriate voltage range and TC frequency. If an MTM/ETTCM is not available use a DVM that is suitable for measuring true rms voltages at frequencies up to 10kHz.

Note 1b. Use a DVM that is suitable for measuring true rms voltages at frequencies up to 10kHz. Do not use a MTM/ETTCM. Do not allow the Output Module's output to become shot-circuited.

Note 2. To measure receive end voltage, the SATU/CU LINE 1 & 2 shall be connected to the Receiver or short circuited-do not leave the open circuit.

Note 3. The voltage measured across the rail connections of the companion, or "Zero", Tuning Unit should be lower than that across the "Pole" Tuning Unit of area. All measurements are taken at the 'Pole' frequency. The voltage ratio is calculated as voltage at G divided by voltage at H.

Note 4. When taking test measurements at SATU terminals that have been coated with contact treatment grease, check that a good contact is made, if necessary clean the relevant terminals with a suitable cleaning agent and apply further grease after the measurements have been taken.

Note 5. As a cross check on the CMD measurement, the value of Receiver input current can also be measured by checking, with an MTM/ETTCM, the voltage developed across the 1 Ohm resistor (which is connected in series with the input of the Receiver). One mV so measured equates to one mA.

The minimum value of input current (the Threshold Current) necessary for an Rx to pick up its Track Relay can be read directly from the Rx display by accessing the quantity "Ith" since this is the value locked into the Rx during the automatic set-up process.

Note 6. Check that all track circuits which can cause interference to the TC under test are operational, including:

(a) the next TC of the same frequency.
(b) TCs connected to the TC under test by cross bonding.

Switch off the Tx associated with the TC under test and check that the Track Relay de-energises. The only suitable meter for this test is an MTM/ETTCM. A general purpose DVM shall not be used.

Note 7. Confirm by continuity checks that the Tx, Rx and PSU cases are connected to the local earth. Also confirm that all lightning protection earth terminals are connected to earth. The earth connection resistance must not be greater than 50Ω.

WARNING

Do not use an MTM/ETTCM to measure the output from an Output Module and its corresponding SATU or CU input. Beware that the voltages on these units can exceed 150V RMS.

This voltage is high enough to endanger life; before fitting or removing these units, power shall be removed from the associated EBI Track 400 Transmitter.

Do not allow the output of the OM3 to become short circuited.

2.3.3. SA Fault Finding – General

If adjacent track circuits fail together, then items common to them - power supplies, tuning units or interconnections - should be checked first.

The most vulnerable parts of the track circuit are the SATU / CU-to-rail and impedance bond-to-rail connections. It is prudent to check the integrity of these before beginning a systematic test through the circuit from the transmit end. It is also advisable to check that there is no fault in the wiring between the receiver output, track relay and the panel indication before proceeding to the trackside.

Full details of the tests are given in Section 2.3.2. It is important not to simply overcome a fault by adjusting the receiver gain; the reason for a change in drop shunt value should be ascertained by performing the tests given in this section. The results of each test can be compared with the measurements taken at the last test / commissioning / setting-up that were logged on the Record card; any major differences can be a guide to the possible fault area. Although the tests are presented to start from the transmit end of the track circuit, sometimes it can be more convenient to start from the receive end.

2.3.4. SA Fault Finding - Transmitter End

1. Check that the Transmitter and SATU / CU are making a 'singing' noise (the volume of this will vary depending on cable and track length).

   Use the Condition Monitor to ascertain that the Tx and OM3 output are correct (i.e. display does not show ‘ERR’). If the Transmitter is showing ‘ERR’ then press ‘OK’ and follow the CM menu structure to find the cause of the error.

   - If the Transmitter is not ‘singing’ and the Tx Status indicates an internal or frequency fault, then the Transmitter is faulty and should be changed.
   - If the Transmitter is not ‘singing’ and ‘’Vout’ is zero, or very low then check the connections between the output module and the Tx. If these are OK, then the Transmitter is faulty and should be changed.
   - If ‘Vout’ is in range but ‘Pout’ is zero, or very low, then this indicates that the output module is disconnected from its SATU/CU.

2. Test the integrity of the Tx to rail path by connecting a 2.0Ω shunt across the Transmitter SATU rail connections. This should reduce the rail-to-rail voltage by approximately 25% if the transmit end is working properly. If this test is successful then the remainder of the Transmitter tests need not then be carried out.

3. Test the +48 power supply voltage and current to the Transmitter (Tests A and B), and the Transmitter and Output Module output voltage (Test C and D). Results from these tests outside the normal range show that the power supply unit, Transmitter or Tuning Unit / Coupling Unit can be faulty. Further tests will help to indicate which has failed but only replacement of the most suspect unit can finally establish which is faulty.

4. Tuning Unit input and output voltages (Tests E and F) will show whether the interconnections are OK.

WARNING

Do not use an MTM/ETTCM to measure the output from an Output Module and its corresponding SATU or CU input. Beware that the voltages on these units can exceed 150V RMS.

This voltage is high enough to endanger life; before fitting or removing these units, power shall be removed from the associated EBI Track 400 Transmitter.

5. If the rail-to-rail voltage (Test G) is wrong, then either of the SATU/CU, or the rail connections can be faulty.

   The companion SATU voltage should be tested (Test H). If incorrect, then the companion SATU can be faulty. The companion SATU will be confirmed as faulty if the rail-to-rail voltage at the SATU of the failed track becomes correct when terminal T1 is shorted to terminal T2 on the companion SATU.

   If the transmit end appears to work normally, walk through the track checking bonds and insulation pads, and looking for any metal debris that can be shorting it out.

   The rail current should fall only very slowly between the Transmitter and Receiver ends. During the walk through, it should be checked every 20m or 50m and the difference between any two consecutive readings should be about the same. Any sharp falls in current indicate a problem with the track itself. The place where the irregularity occurs can be used as a guide to the location of the track fault.

   See Section 2.3.6 for further information on track faults.

2.3.5. SA Fault Finding - Receiver End

1. Check the voltage at the tuning unit rail connections (Test F). A low reading indicates that either SATU can be faulty or that a connection has failed.

2. The voltage at the companion SATU should be tested (Test H). If incorrect, then the companion SATU can be faulty. The companion SATU will be confirmed as faulty if the rail-to-rail voltage at the SATU of the failed track becomes correct when terminal T1 is shorted to terminal T2 on the companion SATU.

3. Measure the Receiver input current (Test N). If this is significantly lower than the clear track Rx input current recorded on the record sheet, i.e. reduced by more than 20%, the Receiver SATU is faulty. If it is adequate but there is insufficient relay supply voltage (Test L) with a satisfactory power supply (Tests A and B), then change the Receiver.

4. Check the connections to the relay, and that the voltage is available on the coil terminals. Change the relay if necessary.

2.3.6. SA Fault Finding - Track Related problems

If all the standard tests detailed in sections 2.3.3 to 2.3.5 do not reveal a fault and problems persist, then the fault is probably due to excessive leakage of Track Circuit signal current. The causes of leakage fall into three main groups:

Individual sleeper leakage paths	Chair bolts touching reinforcing in concrete sleeper and either no or failed insulation system (pads & biscuits between rail and chairs).
Localised. leakage paths	Track running through a ‘wet bed’ or over a road crossing where contamination has occurred (e.g. lorries carrying coal or minerals).
General ‘background’ leakage	Old track on wooden sleepers without insulation system between rails and chairs

In the case of localised leakage and individual sleeper problems, the most effective means of identifying the problem area is by use of a Rail Current Transducer and MTM/ETTCM using the following method.

The Rail Current Transducer (e.g.Rocoil) is connected to the MTM/ETTCM and the meter switched to the correct frequency for the Track Circuit under investigation. Current flowing onto the Track Circuit from the Coupling Unit should first be measured.

The current level in each rail should be the same; this should be checked since a difference of more than about 10% should be investigated. Differences in current between the two rails indicate that there is a third path through which some of the feed or return current is flowing. This could be a path through the ground (or ballast), but is more likely to be via traction bonding or other rails or tracks. Such paths should be eliminated as far as possible since they can only reduce the sensitivity of the Track Circuit to train shunts by providing alternative paths that are not shunted.

Areas where current can be significantly different in each rail are in points and crossings. It is sometimes the case that one rail splits to form two parallel paths, e.g. via the diamond of a crossing. In this case about half of the Track Circuit current will flow in each path, and it will not be possible to change this.

In areas of plain line, assuming the current in both rails is the same, it is not normally necessary to continue measuring in both rails. The current in the rail should be measured at convenient intervals, say 20m to 50m, until a larger than normal decrease is noted. The poor ballast area or shorting sleeper will be within this area. Further readings can now be taken to narrow down the precise area of leakage, or the shorting sleeper.

2.4. Impedance Bonds (Where Fitted)

Before checking the impedance bond(s) the TX equipment shall first be proved to be operating correctly.

1. Check that no corrosion, dirt oil or water is present in the terminal box and/or connection points.

2. Check the Advance plate to Centre Tap connection has be made using the bolted spreader plates in accordance with the Network Rail defined procedures.

3. Check the Impedance Bond has been installed and sitting on a rubber Conformance Pad.

4. Check the Impedance Bond has been installed with the appropriate insulating covers depending on the Impedance Bond type.

5. Measure the voltage across the auxiliary coil or tuning module (NOT applicable to B3 3000 and B3 500 bonds), check it is in the correct ratio with the rail-to-rail voltage (Appendix C). If it is correct the bond should be operating correctly, if it is incorrect proceed with the next step.

6. Check the tuning capacitor/module is correct for the style of bond and the track circuit frequency. Apply a short circuit across the tuning capacitor/module and measure the voltage.

7. Remove the short circuit and check the voltage rises. If there is not a dramatic rise in voltage replace the tuning capacitor/module. If it still does not improve matters consider replacing the bond.

Near ETU units this tuning capacitor/module test might not work.

For intermediate bonds only - the impedance of any impedance bond can be checked by following steps 7 to 11.

8. Place the Rocoil over the rail 1 metre before the Bond (TX side) and note the reading on the TTM/ETTCM (= amps, I1).

9. Repeat the measurement 1 metre from the bond on the RX side (I2).

10. Subtract I2 from I1 thus obtaining the current through the bond at the EBI Track frequency.

11. Measure the rail to rail voltage (V) across the impedance bond.

12. Divide the voltage (V) by the current calculated from step 9 above thus giving the impedance (Z),

$$Z = V / (I1 - I2)$$

This value should be greater than 8Ω. If less than 8Ω, check for traction imbalance before remedial action is taken with the impedance bond. (The Manufacturers specification is 12Ω when measured at the Capacitor frequency).

It is possible to verify the Impedance Bond is within the manufacturers specification by measuring the Bond inductance without the tuning capacitor connected. The value should be between 27.8 to 28.2 μHenries.

The value between the rail connections and the centre tap will be half these values.

2.5. Interference Test

To check the traction interference levels on the track the following tests are carried out on T1-T2 terminals of the ETU/TU/SATU/CU.

For traction areas only:

1. Remove the B24 fuse to the TX and check the correct track relay drops.

2. Measure the voltage across the track using a TTM/ETTCM set to AC 200mV range. Measure the frequency across the track using a multimeter.

3. Record both the voltage and frequency readings.

4. Readings greater than 100mV are un-acceptable, the track circuit shall be investigated and your SM(S) informed.

If there is a problem, this test can be repeated with the traction supply OFF as this can help to identify the source of the interference.

If all the readings appear to be correct but the track circuit remains failed then recheck all items above and check there are no problems arising from spare / scrap rail laid in the 4ft.

3. Appendix A - Typical Rail-to-Rail Voltages

TRACK LENGTH (m)	Tx to TRACK LENGTH (km)	MAX Tx END VOLTAGE (V)		MAX Rx END VOLTAGE (V)	
		A, C, E, G	B, D, F, H	A, C, E, G	B, D, F, H
100	<2	3.0	4.5	1.0	1.6
100	6	2.0	2.8	0.4	0.5
200	<2	4.0	6.0	1.0	1.6
200	6	2.6	3.6	0.4	0.5
400	<2	5.0	7.0	1.0	1.6
400	6	3.2	4.5	0.4	0.5
1000	<2	5.5	7.5	0.4	0.5
1000	6	-	-	-	-
Note: this table provides guidance only, intermediate distances shall be interpolated.					

Table 4 - Open Line Frequencies : Maximum TX and RX End Rail to Rail Voltages for Various Track and Feed Lengths

Track Circuit	**Volts (F1)**	**Volts (F2)**	**Volts (F3)**	**Volts (F4)**	**Volts (F5)**	**Volts (F6)**	**Volts (F7)**	**Volts (F8)**
Length (m)	Max	Max	Max	Max	Max	Max	Max	Max
<100	2.9	3.6	3.3	4	2.6	3.5	3.1	3.9
100 - 150	3.4	4.3	3.9	4.6	3.1	4.0	3.6	4.4
151 - 200	4.3	5.4	4.8	5.9	3.9	5.0	4.5	5.5
201- 250	5.1	6.5	5.9	7.1	4.8	6.1	5.5	6.8
251- 300	6.3	8	7.1	8.8	5.8	7.5	6.8	8.4

Table 5 - Station Area Frequencies : Maximum TX End Rail to Rail Voltages for Various Track Lengths

4. Appendix B - Tuned Zone Ratios

These ratios are the absolute **MINIMUM** values acceptable. The table below takes into account the latest installation standards and cable types.

If the Tuned Zone Ratio is not achievable, check the quality of the installation.

Tuned Area				
Pole	Frequency	Zero	Frequency	Ratio
Primary Frequencies				
Tx	AC	Rx	BD	12:1
Rx	AC	Tx	BD	12:1
Tx	AC	Tx	BD	11.1
Rx	AC	Rx	BD	12:1
Tx	BD	Rx	AC	18:1
Rx	BD	Tx	AC	18:1
Tx	BD	Tx	AC	15:1
Rx	BD	Rx	AC	18:1
Secondary Frequencies				
Tx	EG	Rx	FH	9:1
Rx	EG	Tx	FH	9:1
Tx	EG	Tx	FH	8:1
Rx	EG	Rx	FH	9:1
Tx	FH	Rx	EG	18:1
Rx	FH	Tx	EG	18:1
Tx	FH	Tx	EG	15:1
Rx	FH	Rx	EG	18:1

Table 6 - Tuned Zone Ratios : Open Line Frequencies

Ratio figures are calculated with voltages measured at the frequency of the POLE Tuning Unit, using a TTM/ETTCM.

Frequency	Ratio
F1, F3, F5, F7	3:1
F2, F4, F6, F8	5:1

Table 7 - Tuned Zone Ratios : Station Area Frequencies

Ratio figures are calculated with voltages measured at the frequency of the POLE Tuning Unit, using an MTM/ETTCM.

5. Appendix C - Transmitter Current Consumption (Max)

Tx to TU/ETUCable Length	Track Circuit Length			
	<250m	**250m – 499m**	**500m – 749m**	**750m – 1000m**
<1km	0.5A	1.8A	3.5A	4.65A
1km – 1.99km	0.75A	2.8A	4.65A	5A
2km – 3.99km	1A	3A	5A	5A
4km – 6km	1.5A	5A	5A	N/A

Table 8 - Transmitter Current Consumption (Max)

6. Appendix D - Output Module (OM3) Output Level v Step Setting

Step	Output Level (V)	Step	Output Level (V)	Step	Output Level (V)
1	30.40	10	73.60	19	116.80
2	35.20	11	78.40	20	121.60
3	40.00	12	83.20	21	126.40
4	44.80	13	88.00	22	131.20
5	49.60	14	92.80	23	136.00
6	54.40	15	97.60	24	140.80
7	59.20	16	102.40	25	145.60
8	64.00	17	107.20	26	150.40
9	68.80	18	112.00	27	155.20

Table 9 - Output Module (OM3) Output Level v Step Setting

7. Appendix E - Open Line Frequencies – Double Rail - Setup Configuration Routine

7.1. Open Line Frequencies Setup : Initial Configuration

Step	Transmitter	Receiver
0	Transmitter with no key inserted. Transmitter key of the correct frequency available for use. This key contains a unique code for any market area. The key colour shall be the correct one for the market area - blue With no key in place the display indicates "KEY?"	Receiver key starts off programmed for frequency only. The key colour shall be the correct one for the market area – blue. With no key in place the display indicates "KEY?" If an un-coded Rx key is inserted in the Rx the Rx will respond with BLNK
1	Adjust the Output Module to step 1 and the resistor to 0R. **Note The Resistor shall remain in the 0R position and is not be used to adjust the output level.**	
2	Configuration process starts by inserting the Tx key in the Tx. This configures Tx for code and frequency. The display will first confirm key frequency as"400X" for 1 second, where "X" = one of eight frequencies A to H, followed by the key serial no. for 1 second and "RUN" when fully active and emitting signals	
3	If Rx keys are required to be programmed, then remove Tx key. Display will again indicate "KEY?"	

Step	Transmitter	Receiver
4	Insert the Rx key to be coded (shall be the same frequency as the Tx key being copied)" The display will respond by indicating "CPY?" Press the "OK" pushbutton. Display responds "TxK?" Remove Rx key and replace with Tx key. Display responds with "RxK?" Remove Tx key and replace with Rx key. The display will change to "PASS" which indicates that the Rx key has been successfully programmed with the correct code.	
5	Repeat item 4 with subsequent Rx keys if multiple Rx are used.	
6	Remove last Rx key and re-fit the Tx code and frequency key. The display will first confirm key frequency as "400X" for 1 second where "X" = one of eight frequencies A to H, followed by "KEY S/N" for 1 second and "RUN" when fully active and emitting signals.	
7		Insert a programmed Rx key in Rx. The display will first confirm key frequency as"400X" for 1 second where "X" = one of eight frequencies A to H, followed by "KEY S/N" for 1 second and "NewK" when fully active. Rx can display "drop" or "PICK" when fully active if the Rx key was programmed and used for the track circuit previously. Rx now active and ready for set up.

Step	Transmitter	Receiver
8		Perform the TC set up routine as per section 7.2 - Open Line Frequencies Setup : Set-up Routine
Fault indications during the Initial Configuration Routine. If at any step of the initial configuration routine the Transmitter or Receiver displays differ from those indicated above then the table below shows the likely reasons.		
Note: Tx keys cannot be reprogrammed to a new code or frequency. Rx keys can be programmed to a new code, but cannot be reprogrammed to a new frequency.		

Table 10 - Open Line Frequencies Setup : Initial Configuration

Tx or Rx Display	Fault
Rx display “ERR” cycling with “drop” Tx display “ERR” cycling with “stop” On OK display changes to “STAT” On OK display changes to “INT”	Internal circuit fault with unit. See Note 1
Rx display “ERR” cycling with “PICK” or “drop” Tx display “ERR” cycling with “RUN” On OK display changes to ”TEMP”	Temperature has exceeded the temperature range -30°C to + 100°C. See Note 1
Rx display “ERR” cycling with “PICK” or “drop” Tx display “ERR” cycling with “RUN” or “stop” Display depends on the level at which the voltage is out of specification . On OK display changes to “Vpsu”.	PSU outside the specified voltage range. See Note 1
Tx / Rx display “WRNG”	Incorrect key inserted.
Tx / Rx display “BADK”	Corrupt key (Replace Key)
Tx / Rx display “BLNK”	Rx frequency key has not been coded with any Tx code

Table 11 – Initial Configuration Routine Fault Indications

NOTE 1: *If there are multiple faults then the fault which occurs first will be displayed first. The additional errors will then be displayed in turn.*

7.2. Open Line Frequencies Setup : Set-up Routine

Step	Transmitter	Transmitter TU/ETU	Receiver TU/ETU	Receiver
0	Switch on the Tx PSU. Check that the Transmitter is configured and emitting signals. Display indicates "RUN" Check that the Output Module is set to step 1 and the resistor is set to 0R. **Note The Resistor shall remain in the 0R position and is not be used to adjust the output level levels**			Switch on the Rx PSU. Check that the receiver has been configured and is displaying 'NewK'. Confirm that the DC supply voltage is within the range 46V to 50V by use of the display (Vpsu) or a TTM/ETTCM.
1	Confirm that the DC supply voltage is within the range 46V to 50V by means of the display (Vpsu) or a TTM/ETTCM. Adjust the OM drive level as described in Rx column.	After completing adjustment of the OM step setting, check that the rail voltage at the Tx end, is not more than the maximum stated in Table 2. If the rail voltage cannot be set up, do not proceed until cause of error is corrected.		Adjust the OM drive level to achieve an Rx input current of 50mA on the receiver display (IAV). Long tracks might not achieve 50mA, but shall achieve more than 30mA. In the case of short feed cables and short track circuit length, Rx input current can be more than 50mA with an OM step setting of 1. In this case Rx input current should be less than 380mA. In the case of tracks with more than 1 Rx the set up should done monitoring the Rx on the longest section of track. See **Note 1** below.

Step	Transmitter	Transmitter TU/ETU	Receiver TU/ETU	Receiver
2a		If the Tx and/or Rx end of the track circuit is part of a mixed tuned zone, the set up shunt is fixed at 1.5Ω. Adjust a Shunt Box, to 1.5Ω, and connect it across the rail connections of the Rx end TU/ETU then proceed to step 4. Do not perform steps 2b, 3a and 3b. If not, proceed to step 2b.		
2b		Measure rail currents at Tx end (I_{1a} and I_{1b}) as shown in Section 7.3 - Open Line Frequencies Setup : Irail Determination and Calculation. Select the highest value (I_1) and discard the other.	Measure rail currents at Rx end (I_{2a} and I_{2b}) as shown in Section 7.3 - Open Line Frequencies Setup : Irail Determination and Calculation. Select the lowest value (I_2) and discard the other.	
3a			Calculate the I_{Rail} Ratio in % by dividing I_2 x 100 by I_1. Look up the value of ballast impedance in the Section 7.3 Table 11 to Table 13 (use the correct table for the frequency of the track circuit is used). If the set up shunt is given as 'Special', then follow the **special measures** process described immediately below Section 7.3 Table 14.	

Step	Transmitter	Transmitter TU/ETU	Receiver TU/ETU	Receiver
3b			Using the value of ballast impedance, look up the value of set up shunt in Section 7.3 Table 14. Adjust a Shunt Box, to the value of the set up shunt, and connect it across the rail connections of the Rx end TU/ETU.	
WARNING	**If the I_{Rail} ratio measurement requires the use of higher shunt values, and the track is not very wet, then this indicates that there is severe loss of current down the track which should be investigated and correct**			
4				Replace frequency key with a set-up key. Display will respond with 'SET?' Press the 'OK' button to begin the automatic set up process.

Step	Transmitter	Transmitter TU/ETU	Receiver TU/ETU	Receiver
5				Display will show the legend 'WAIT', followed by 'PASS' or 'FAIL'. 'PASS' indicates that set up has been successful, and the new threshold setting has been locked into the unit. 'FAIL' cycling with "X", where "X" is the error code, indicates that set up was unsuccessful. See Section 10 - Appendix H - Receiver Set Up Error codes for interpretation of the error code. Faults shall be corrected before another set up is attempted. See **Note 2** below.
6				Rx will display threshold level "Ith", followed by key frequency as"400X" where "X" = one of eight frequencies A to H, followed by "KEY S/N" for 1 second and "drop".
7			Remove Shunt Box.	Check that Receiver display shows 'Pick'
8a			Replace Shunt Box, set to 0.7Ω, across the rails	Check that Receiver display shows 'drop'
8b		Connect Shunt Box, set to 0.7Ω, across the rails		Check that Receiver display shows 'drop'
9			Remove Shunt Box	
10	Carry out a Full Test			

Step	Transmitter	Transmitter TU/ETU	Receiver TU/ETU	Receiver
11	Using the record cards – examples shown in Sections 18, 19 & 20 - record track clear current and threshold level current and drop shunt on the record card. Also carry out and record the additional measurements since these can be valuable fault-finding aids. Finally, verify that the clear track current is approximately twice the threshold. This validates that the correct drop shunt was used to set up the track.			

Table 12 – Open Line Frequencies Setup : Set-up Routine

NOTE 1: *If the clear track current is less than 30mA then the track circuit is losing current and the cause of the current loss shall be determined and rectified otherwise the safety margin of the circuit can be eroded.*

NOTE 2: *The set-up failure code consists of 4 letters which are designed to focus the fault investigation. Two examples are:*

- H indicates that the input signal is too high suggesting the OM step should be reduced.
- L indicates that the input signal is too low suggesting open circuits / poor connections, or a wrong frequency.

Examples of fault codes are given in Section 10.

7.3. Open Line Frequencies Setup : Irail Determination and Calculation

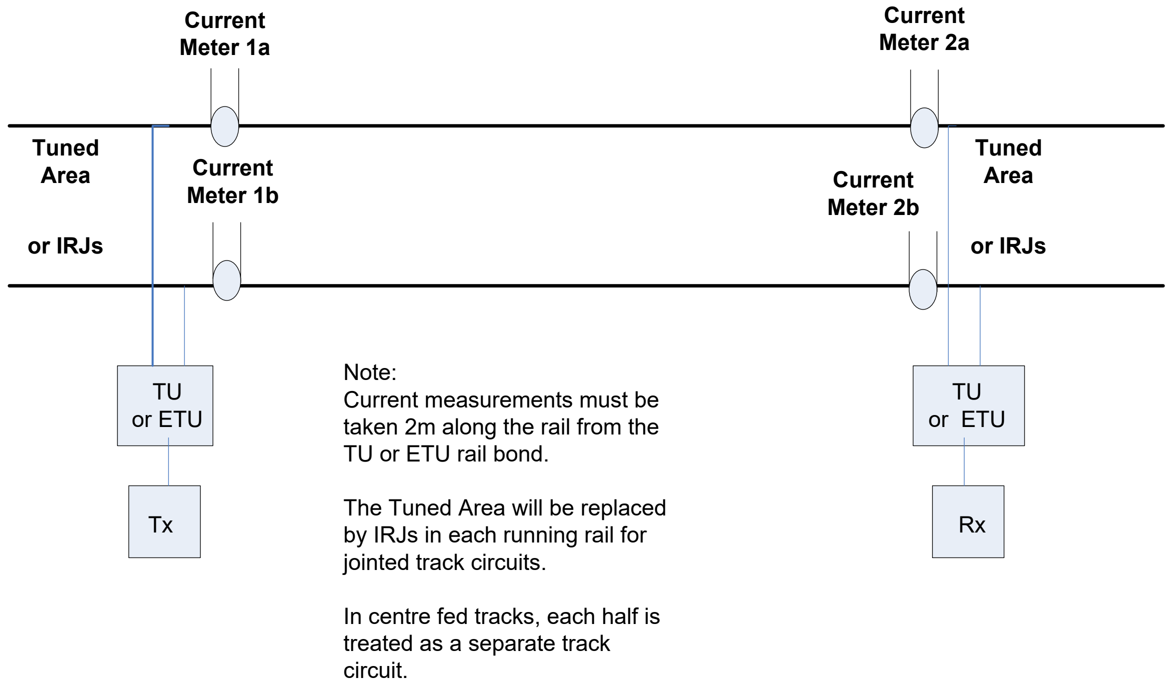


Figure 4 – Measurement Points for IRail Determination

7.3.1. Determination of Ballast Impedance from Irail ratio % for Various Track Lengths

When reading the Ballast Impedence from the Irail ratio %, the lower value shall be used. For example a 500m track length with a Irail ratio % of 77%, the Ballast Impedance is 3 Ωkm.

Track Length	**Frequencies A and E Ballast Impedance Ωkm**									
m	**2**	**3**	**4**	**5**	**6**	**8**	**10**	**15**	**20**	**200**
200-249	89	92	94	95	96	97	98	98	99	99
250-349	81	87	90	92	93	95	96	97	98	100
350-449	73	81	86	88	90	93	94	96	97	100
450-549	63	74	80	84	87	90	92	95	96	100
550-649	54	66	74	79	82	87	89	93	95	100
650-749	44	58	67	73	77	83	86	91	94	100
750-849	36	50	59	66	71	78	83	89	92	100
850-949	29	42	52	60	65	74	79	86	90	100
950-1049	24	36	45	53	59	68	74	83	88	100
1050-1100	19	30	39	47	53	63	70	80	86	100

Table 13 – Frequencies A and E, Ballast Impedance Ωkm

Track Length	**Frequencies B, C, F and G Ballast Impedance Ωkm**									
m	**2**	**3**	**4**	**5**	**6**	**8**	**10**	**15**	**20**	**200**
200-249	85	90	92	94	95	96	97	98	98	100
250-349	76	83	87	90	91	93	95	97	97	100
350-449	65	75	81	85	87	91	92	95	96	100
450-549	54	66	74	79	82	87	90	93	95	100
550-649	43	57	66	72	77	83	86	91	94	100
650-749	34	48	57	65	70	77	82	89	92	100
750-849	27	39	49	57	63	72	77	86	90	100
850-949	21	32	42	50	56	66	72	82	87	100
950-1049	17	27	35	43	49	59	67	78	84	100
1050-1100	13	22	30	37	43	53	61	74	81	100

Table 14– Frequencies B, C, F and G, Ballast Impedance Ωkm

Track Length	**Frequencies D and H Ballast Impedance Ωkm**									
m	**2**	**3**	**4**	**5**	**6**	**8**	**10**	**15**	**20**	**200**
200-249	81	87	90	92	93	95	96	97	98	100
250-349	71	80	84	87	89	92	94	96	97	100
350-449	60	71	78	82	85	88	91	94	96	100
450-549	48	61	70	75	79	84	88	92	94	100
550-649	38	52	61	68	73	79	84	89	92	100
650-749	30	43	53	60	66	74	79	86	90	100
750-849	23	35	44	52	58	68	74	83	88	100
850-949	18	28	37	45	51	61	68	79	85	100
950-1049	14	23	31	38	45	55	62	75	82	100
1050-1100	11	19	26	33	39	49	57	70	78	100

Table 15 – Frequencies D and H, Ballast Impedance Ωkm

7.3.2. Determination of Set Up Shunt from Ballast Impedance for Various Track Lengths

Track Length	**Set Up Shunt (Ω) for Normal Power All Frequencies Ballast Impedance Ωkm**							
m	**2**	**3**	**4**	**5**	**6**	**8**	**10**	**15 and above**
20 175	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
176-200	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
201-249	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
250-349	1.2	1.2	1.0	1.0	1.0	1.0	1.0	1.0
350-449	1.2	1.2	1.2	1.0	1.0	1.0	1.0	1.0
450-549	1.4	1.2	1.2	1.2	1.0	1.0	1.0	1.0
550-649	1.6	1.4	1.2	1.2	1.2	1.0	1.0	1.0
650-749	2.0	1.4	1.2	1.2	1.2	1.0	1.0	1.0
750-849	2.4	1.6	1.4	1.2	1.2	1.2	1.0	1.0
850-949	Special	1.8	1.4	1.4	1.2	1.2	1.0	1.0
950-1050	Special	2.2	1.6	1.4	1.2	1.2	1.0	1.0
1050-1100	Special	2.8	1.8	1.6	1.4	1.2	1.2	1.0

Table 16 – Set Up Shunt from Ballast Impedance for Various Track Lengths

Special Measures

If the set up shunt is given as 'Special' this indicates that the ballast is in a very poor condition. As an interim measure, until the ballast can be rectified, track circuits shall be set up at 3Ω. Affected track circuits shall be monitored weekly for increases in Rx clear track current (Inow on the Rx display). If Inow increases by more than 10% from the value at set up, then the track shall be re-set. If the ballast measurement of a track circuit in special measures does not return to normal levels and can be shown to be stable over several months, then a case can be made for reducing the set up shunt.

Example Set Up Shunt Determination

Frequency B track circuit, 757m long.
I1a = 1.012A   I1b = 1.023   Use 1.023A
I2a = 757mA   I2b = 782mA   Use 757mA
IRail Ratio = 757/1023 = 0.74 = 74%
Ballast (Table 12) = 8Ω (See Grey Cell – using the lower value)
Set Up Shunt (Table 16) = 1.2Ω (See Grey Cell)

8. Appendix F - Open Line Frequencies – Single Rail - Setup Configuration Routine

The Open Line commissioning procedure in Section 7 - Appendix E - Open Line Frequencies – Double Rail - Setup Configuration Routine can be used without alteration except that steps 0 and 1 of section 7.2 - Open Line Frequencies Setup : Set-up Routine is altered as shown below.

Step	Transmitter	Transmitter TU/ETU	Receiver TU/ETU	Receiver
0	Switch on the Tx PSU and confirm that the DC supply voltage is within the range 46V to 50V by means of the display (Vpsu) or a TTM/ETTCM. Display indicates "RUN" Check that the Output Module is set to step 1 and the resistor is set to 0R. **Note The Resistor shall remain in the 0R position and is not used to adjust the output level levels.**			Switch on the Rx PSU. Check that the receiver has been configured and is displaying 'NewK'. Confirm that the DC supply voltage is within the range 46V to 50V by use of the display or a TTM/ETTCM.
1	Adjust the OM drive level as described in Rx column	After completing adjustment of the OM step setting, check that the rail voltage at the Tx end, is not more than 2.3V. If the rail voltage cannot be set up, do not proceed until cause of		Adjust the OM drive level to achieve an Rx input current of 50mA on the receiver display (IAV). In the case of short feed cables and short track circuit length, Rx input current can be more than 50mA with an OM step setting of

Step	Transmitter	Transmitter TU/ETU	Receiver TU/ETU	Receiver
		error is corrected.		1. In this case Rx input current should be less than 380mA. In the case of tracks with more than 1 Rx, the set up should done monitoring the Rx on the longest section of track. See **Note 1** below.

Table 17 – Open Line Frequencies – Single Rail : Setup Configuration Routine

NOTE 1: *If the clear track current is less than 30mA then the track circuit is losing current and the cause of the current loss should be determined and rectified otherwise the safety margin of the circuit can be eroded.*

9. Appendix G – Station Area Frequencies – Setup Configuration Routine

9.1. Station Area Frequencies Setup : Initial Configuration

Step	Transmitter	Receiver
0	Transmitter with no key inserted. Transmitter key of the correct frequency available for use. This key contains a unique code for any market area. The key colour shall be the correct one for the market area - blue. With no key in place the display indicates "KEY?"	Receiver key starts off programmed for frequency only. The key colour shall be the correct one for the market area - blue. With no key in place the display indicates "KEY?" If an un-coded RX key is inserted in the Rx the Rx will respond with "BLNK"
1	The Output Module should be set to an initial drive level of 1. The resistor switch shall be set to 48R if the feed cable length is less than 750m, otherwise it shall be set to 0R position.	
2	Configuration process starts by inserting the Tx key in the Tx. This configures Tx for code and frequency. The display will first confirm key frequency as"400X" for 1 second where "X" = one of eight frequencies F1 to F8, followed by "KEY S/N" for 1 second and "RUN" when fully active and emitting signals.	
3	If Rx keys are required to be programmed, then remove Tx key. Display will again indicate "KEY?"	
4	Insert blank Rx key. The display will respond by indicating "CPY?" Press the "OK" pushbutton. Display responds "TxK?"	

Step	Transmitter	Receiver
	Remove Rx key and replace with Tx key. Display responds with “RxK?” Remove Tx key and replace with Rx key. After 1 second the display will change to “PASS” which indicates that the Rx key has been successfully programmed with the correct code.	
5	Repeat with subsequent Rx keys if multiple Rx used.	
6	Remove last Rx key and re-fit the Tx frequency key. The display will first confirm key frequency as”400X” for 1 second where “X” = one of eight frequencies F1 to F8, followed by “KEY S/N” for 1 second and “RUN” when fully active and emitting signals.	
7		Programmed Rx key inserted in Rx. The display will first confirm key frequency as”400X” for 1 second where “X” = one of eight frequencies F1 to F8, followed by “KEY S/N” for 1 second and “NewK” when fully active. Rx can display “drop” or “PICK” when fully active if the Rx key was programmed and used for the track circuit previously. Rx now active and ready for set up.
8		Perform the TC set up routine as per Section 9.2 - Station Area Frequencies : Track Circuit Set-up Routine.
Fault indications during the Initial Configuration Routine.		

Step	Transmitter	Receiver
If at any step of the initial configuration routine the Transmitter or Receiver displays differ from those indicated above then the table below shows the likely reasons.		
Note: Tx keys cannot be reprogrammed to a new code or frequency. Rx keys can be programmed to a new code, but cannot be reprogrammed to a new frequency.		

Table 18 – Station Area Frequencies Setup : Initial Configuration

Tx or Rx Display	Fault
Rx display “ERR” cycling with “drop” Tx display “ERR” cycling with “stop” On OK display changes to “STAT” On OK display changes to “INT”	Internal circuit fault with unit. See Note 1
Rx display “ERR” cycling with “PICK” or “drop” Tx display “ERR” cycling with “RUN” On OK display changes to ”TEMP”	Temperature has exceeded the temperature range -30°C to + 100°C. See Note 1
Rx display “ERR” cycling with “PICK” or “drop” Tx display “ERR” cycling with “RUN” or “stop” Display depends on the level at which the voltage is out of specification. On OK display changes to “Vpsu”	PSU outside the voltage range. See Note 1
Tx / Rx display “WRNG”	Incorrect key inserted.
Tx / Rx display “BADK”	Corrupt key (Replace Key)
Tx / Rx display “BLNK”	RX frequency key has not been coded with any TX code

Table 19 – Initial Configuration Routine Fault Indications

NOTE 1: *If there are multiple faults then the fault which occurs first will be displayed first. The additional errors will then be displayed in turn.*

9.2. Station Area Frequencies : Track Circuit Set-up Routine

Step	Transmitter	Transmitter TU/CU	Receiver TU/CU	Receiver
0	Transmitter configured and emitting signals. Display indicates "RUN". Confirm that the DC supply voltage is within the range 46V to 50V by use of the display or an MTM/ETTCM.			Receiver configured and displaying 'NewK'. Confirm that the DC supply voltage is within the range 46V to 50V by use of the display or an MTM/ETTCM.
1	Adjust the Output Module drive level to achieve an Rx input current of between 15 and 25mA while not exceeding 120W on the Tx output power 'Pout' reading[1]. The current should be set as close to 25mA as the 'Pout' and TU/CU voltage limit allows. If the track circuit is short, Rx input current may be more than 25mA with OM drive level 1. In this case RX input current should be less than 250mA.	Using a DVM/ETTCM on the AC range, check that the input voltage to the TU or CU does not exceed 95V RMS.		Read the Receiver current (IAV) on the Receiver display.

[1] Where these limits cannot be achieved, i.e. for long tracks and long Tx-to-track distances, the output power can be increased until 15mA is achieved, but a Tx end 0Ω shunt test must be carried out and the output power ('Pout') must be less than 180W with the shunt in place.

Step	Transmitter	Transmitter TU/CU	Receiver TU/CU	Receiver
	If the 48R resistor is in circuit, then than drive level must not exceed 13. Validate that the drive level does not exceed 13 by open circuiting the Output Module output (eg by opening the 6A track fuse) and checking that the output voltage is less than 95V.			
2		Measure the rail-to-rail voltage at the Tx tuning unit or coupling unit (pole). Using Table 3 - check that the correct rail voltage is obtained at the Tx end. If voltage is incorrect, do not proceed until cause of error is corrected. Typical causes are poor ballast, incorrect traction bonding, faulty impedance bonds (e.g. wrong tuning module for track frequency), or infrastructure faults.		
3		Measure the rail-to-rail voltage at		

Step	Transmitter	Transmitter TU/CU	Receiver TU/CU	Receiver
		companion tuning unit (zero) of the Tx tuned area. If the Tx is connected to a coupling unit or a mixed tuned zone omit this test. Divide the pole voltage (step 2) by this zero voltage (step 3) to determine the pole/zero ratio. Check that the ratio is in the correct range: 3 for F1, F3, F5 & F7. 5 for F2, F4, F6 & F8. If the ratio is lower than shown, then check that tuned area connections and the cable layout are in accordance with the installation drawings		
4			Using a shunt box, place a 1Ω shunt across the rails on the rail connections.	Replace the frequency key with a set-up key. Display will respond with 'SET?' Press the 'OK' button to begin the automatic set up process.
5				Display will show the legend 'WAIT',

Step	Transmitter	Transmitter TU/CU	Receiver TU/CU	Receiver
				followed by ‘PASS’ or ‘FAIL’. ‘PASS’ indicates that set up has been successful, and the new threshold setting has been locked into the unit. ‘FAIL’ cycling with “X”, where “X” is the error code, indicates that set up was unsuccessful. Faults must be corrected before set up is attempted again. See Note 1 below.
6				Replace set-up key with frequency key. Rx will display threshold level “Ith”, followed by key frequency as”400X” where “X” = one of eight frequencies F1 to F8, followed by “KEY S/N” for 1 second and “drop”.
7			Remove shunt box.	Check that Receiver display shows ‘PICK’ Verify that the clear track Rx input current is approximately 1.5 times the threshold level current (Ith). This validates that the correct drop shunt was used to set up the track.

Step	Transmitter	Transmitter TU/CU	Receiver TU/CU	Receiver
8			Connect a shunt box across the rails and determine the value at which the Receiver display shows 'drop' The shunt value must be ≥0.9Ω.	Check that Receiver display 'drop'
9			Remove shunt box	Check that Receiver display 'PICK'
10		Connect a shunt box across the rails and determine the value at which the Receiver display shows 'drop' The shunt value must be ≥0.9Ω.		Check that the Receiver displays 'drop'
11		Remove shunt box		Check that Receiver display shows 'PICK'
12a		Calculate Tx TZ Impedance as described in Test T. Tx TZ shall be more than 0.4Ω See Note 2 below		
12b			Calculate Rx TZ Impedance as described in Test U. Rx TZ Impedance shall be more than 0.4Ω.	

Step	Transmitter	Transmitter TU/CU	Receiver TU/CU	Receiver
			See Note 2 below.	
13	Set a shunt box to 0.2Ω and carry out a shunt test at the extremities of any points tracks which are not terminated by Receivers. In each case, ensure that the Track Relay drops and record the Rx input signal current			
14	Measure, and record, the supply voltage and current to the Transmitter and Receiver .*Use a suitable current clamp meter that has a 10A DC current range.*			
15	Using the record card in section 9, record the listed parameters on record card (see Note 2)			

Table 20 – Station Area Frequencies : Track Circuit Set-up Routine

NOTE 1: *The set-up failure code consists of 4 letters which are designed to focus the fault investigation. Two examples are:*

- H indicates that the input signal is too high suggesting that the OM setting should be reduced.
- L indicates that the input signal is too low suggesting open circuits / poor connections.

NOTE 2: *If the Tx end drop shunt or the TZ (Tuned Zone) impedance requirements are not met, then the TZ installation shall be thoroughly examined for compliance with the installation requirements. Rectification of installation deficiencies will correct these issues.*

10. Appendix H - Receiver Set Up Error codes

The automatic set-up failure code consists of 4 letters which are designed to focus the fault investigation:

- "H" indicates that the input signal is too high suggesting the Output Module is driving too much power.

- "L" indicates that the input signal is too low suggesting open circuits / poor connections.

Typical examples of fault codes are given in the following tables.

Typical Automatic Set-up Failure Codes

Message	Meaning of Code	Field Examples
C	Code does not match	Incorrect key or interference.
LC	Code does not match	Incorrect key or interference.
HC	Code does not match	Incorrect key or interference.
L	Input signal low.	Over-long TC. Poorly set-up tuned area. Loose connections.
H	Input signal high	TC too short.
HL	Input signal high and low	Internal Rx fault.
MSHL	All signals incorrect	Internal Rx fault.
Thld Tol	A-B mismatch between thresholds.	High level traction interference signal present.
Time Out	-	'OK' not pressed within 60 seconds.
Key Wrte	-	Faulty key or process corrupted.
WRNG	-	Set up key inserted before frequency key or incorrect frequency key inserted to finish the process.
BLNK		Rx frequency key has not been coded with any Tx code

Table 21 – Typical Automatic Set-up Failure Codes

11. Appendix I - Transmitter Operational Error Codes

Error Code	Quantity / Error Code	Test	Display	Mtce. Action Required
0	Internal Circuit Fault	Circuit monitoring tests failed. This test has highest priority	'ERR' cycling with 'RUN or stop' On 'OK' display routes to 'Stat' then 'OK' routes to 'INT'	Replace TX
1	Temperature	Error raised if the TFET is outside the range -30°C to +100°C *OR* The Transmitter is running *AND* the TTRN is outside the range -30°C to +100°C	'ERR' cycling with 'RUN' On 'OK' display routes to 'Temp'	Check Internal temperature of enclosure. If within temp. range then consider replacing TX
2	PSU Voltage	Error raised if PSU voltage outside the range 46V to 50V	'ERR' cycling with 'RUN or stop' On 'OK' display routes to 'Vpsu'	Check PSU setup.
3-8	Not used			
9	Power Up		Not an error as such, used to make a log entry.	Not an error code. Timestamp of last power up.
10-13	Not used			
14	Output Power	Error raised if Output Power exceeds 200W.	'ERR' cycling with 'RUN' On 'OK' display routes to 'Pout'	Check TX wiring, if no fault found check the OM3 is correctly set for tail cable length & track length. Otherwise change TX &/or OM3.
15	IR Comms Failure	Error raised if no comms with Output Module.	'ERR' cycling with 'RUN' On 'OK' display routes to 'Stat' then 'OK' routes to 'COMM'	Check the IR port between the TX and OM has not become obstructed. Otherwise change TX &/or OM3.

Error Code	Quantity / Error Code	Test	Display	Mtce. Action Required
17	Checksum	Error raised if config memory checksum error.	'ERR' cycling with 'PICK' or 'drop' On 'OK' display routes to 'Stat' then 'OK' routes to 'INT'	Replace TX
-	Corrupt Key	Corrupt key detected upon initial insertion.	BADK	Replace TX frequency key, copy the CODE to RX keys and carry out an Autoset
-	Assertion Error	Assertion Error occurs during normal operation	ErSW (Note: this error is not logged)	Replace the TX key as it could be a latent logging problem and cycle the unit's power. It will be necessary to copy the CODE to RX keys and carry out an Autoset If ErSW appears again replace the unit and carry out an Autoset.

Table 22 – Transmitter Operational Error Codes

These errors are not latched, i.e. if the quantity causing the error returns to normal, the 'ERR' display will be cleared and the fault relay energised. Note that the error is recorded in the error log.

The errors have a priority, 0 being the highest. If multiple errors exist then the only the highest priority error is shown. When it is cleared the next highest priority error is shown.

The last error generated will be stored and made available as one of the data items over the serial link.

12. Appendix J - Receiver Operational Error Codes

Error Code	Quantity / Error Code	Test	Display	Mtce. Action Required
0	Internal Circuit Fault	Circuit monitoring tests failed. This test has highest priority	‘ERR’ cycling with ‘PICK’ or ‘drop’ On pressing <OK> display routes to ‘Stat’ then pressing <OK> routes to ‘INT’	Replace digital RX
1	Temperature	Error raised if internal temperature outside the range -30°C to +100°C	‘ERR’ cycling with ‘PICK’ or ‘drop’ On <OK> display routes to ‘Temp’	Check Internal temperature of enclosure. If within temp. range then consider replacing digital RX
2	PSU Voltage	Error raised if PSU voltage outside the range +22V to +50V	‘ERR’ cycling with ‘PICK’ or ‘drop’ On <OK> display routes to ‘Vpsu’	Check PSU setup.
3	Not used			
4	Relay Voltage	Error raised if Relay Voltage below 10V and output is ON.	‘ERR’ cycling with ‘PICK’ On <OK> display routes to ‘Vout’	Check for a fault in the TR wiring, if no fault found change the Digital Rx
5	Relay State	Error raised if relay voltage > 10V and relay state = drop.	‘ERR’ cycling with ‘drop’ On <OK> display routes to ‘Vout’	Check for a fault in the TR wiring, if no fault found change the Digital Rx
6	Code Error	Error when QUAL < 90%	‘ERR’ cycling with ‘PICK’ or ‘drop’ On ‘OK’ display routes to ‘Stat’ then ‘OK’ routes to ‘CODE’	Check TC installation
7	Not used			

Error Code	Quantity / Error Code	Test	Display	Mtce. Action Required
8	Over-range Signal	Input current exceeds 500mA	'ERR' cycling with 'PICK' or 'drop' On <OK> display routes to 'Stat' then <OK> routes to 'OVR'	Check TC installation as this is not likely to be a digital RX fault. Check TU/ETU setting is on correct power mode.
9	Power Up			Not an error code. Timestamp of last power up.
10	Relay Power Trip	Relay power exceeds 6.25W	'ERR' cycling with 'drop' On <OK> display routes to 'Stat' then <OK> routes to 'TRIP'	Check TR wiring, if no fault found and TR is operating correctly, change the Digital RX.
11	FPGA Fail	One or both FPGA test flags are clear.	'ERR' cycling with 'drop' On <OK> display routes to 'Stat' then <OK> routes to 'INT'	Replace digital RX
12	Autoset	An Autoset has successfully occurred.		Not an error code. Time stamp of that last Autoset.
13	Relay Current	Error raised if Relay Current exceeds 260mA.	'ERR' cycling with 'PICK' or 'drop' On <OK> display routes to 'Pout'	Check TR wiring, if no fault found and TR is operating correctly, change the Digital RX.
17	Checksum	Error raised if config memory checksum error.	'ERR' cycling with 'PICK' or 'drop' On 'OK' display routes to 'Stat' then 'OK' routes to 'INT'	Replace digital RX
18	Logging fail	Error raised if logging has been disabled.	'ERR' cycling with 'PICK' or 'drop' On 'OK' display routes to 'Ekey'	Cycle the unit's power. If the Logging Fail error persists, Replace the RX

Error Code	Quantity / Error Code	Test	Display	Mtce. Action Required
None	Corrupt Key	Error raised if a corrupt key is detected upon initial insertion.	BADK	Replace frequency key and carry out an Autoset
None	Assertion error	An assertion error occurs during normal operation.	'ErSW' displayed (Note: this error is not logged).	Replace the key as it could be a latent logging problem and cycle the unit's power. If ErSW appears again replace the unit and carry out an Autoset.

Table 23 – Receiver Operational Error Codes

These errors are not latched, i.e. if the quantity causing the error returns to normal, the 'ERR' display will be cleared and the fault relay energised. Note that the error is recorded in the error log.

The errors have a priority, 0 being the highest. If multiple errors exist then the only the highest priority error is shown. When it is cleared the next highest priority error is shown. The last error generated will be stored and made available as one of the data items over the serial link.

13. Appendix K - Torque Settings

New or loose connections shall be Torqued to the install value defined in this Appendix. Where an existing connection is checked using the Check Torque value it is critical the fixing does not move when the Check Torque is applied.

Where a loose connection is identified or the fixing moves when checked to a "Check Torque" value; Slacken and check the components and then retighten to the Installation torque.

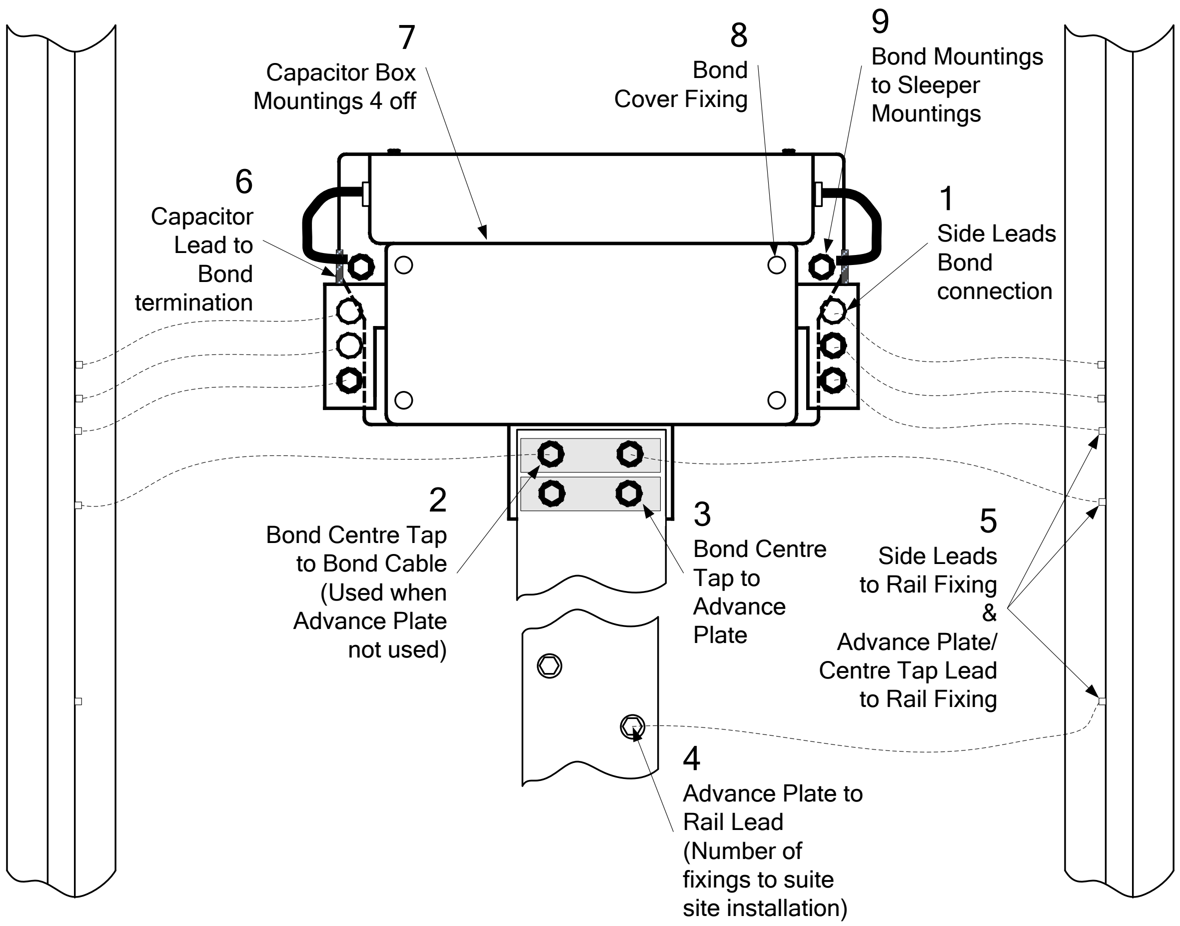


Figure 5 – Installation Positions requiring Torque settings

Equipment	Reference	Fixing Size	Torque Nm
Impedance Bond	Side Leads Bond connection (Copper crimps) Ref 1	M16	Install : 110 Check : 90
	Side Leads Bond connection (Aluminium crimps) Ref 1	M16	Install : 90 Check : 70
	Bond Centre Tap to Bond cable (Copper Crimp) Ref 2	M16	Install : 110 Check : 90
	Bond Centre Tap to Bond cable (Aluminium Crimp) Ref 2	M16	Install : 90 Check : 70
	Bond Centre Tap to Advance Plate (Aluminium) Ref 3 Note the correct installation procedure shall be used incorporating the spreader plates for all new installations.	M16	Install : 115 Check : 90
	Bond Centre Tap to Advance Plate (Aluminium) Ref 3 Non-Preferred Solution	M16	Install : 90 Check : 70
	Capacitor Box Mountings 4 off Ref 7	M6	7
	Capacitor Lead to Bond termination (Copper crimp) Ref 6	M10	Install : 35 Check : 25
	Advance Plate to Rail Lead Connection (Copper crimp) Ref 4	M16	Install : 90 Check : 70
	Advance Plate to Rail Lead Connection (Aluminium crimp) Ref 4	M16	Install : 90 Check : 70
	Advance Plate to Rail Lead Connection (Copper crimp) Ref 4	M12	Install : 72 Check : 60
	Advance Plate to Rail Lead Connection (Aluminium crimp) Ref 4	M12	Install : 72 Check : 60

Equipment	Reference	Fixing Size	Torque Nm
	Side Leads to Rail Fixing and Advance Plate / Centre Tap Leads to Rail Fixing (Copper crimp) Ref 5	M12 Uses Cembre or Glenaire rail fixings	Install : 72 Check : 60
	Side Leads to Rail Fixing and Advance Plate / Centre Tap Leads to Rail Fixing (Aluminium crimp) Ref 5	M12 Uses Cembre or Glenaire rail fixings	Install : 72 Check : 60
	Side Leads to Rail Fixing and Advance Plate / Centre Tap Leads to Rail Fixing (Copper crimp) Ref 5	Bolt	Install : 110 Check : 90
	Bond Cover Fixing (Uses lifting bolt holes) Ref 8	M10	Tighten manually using best judgement
Impedance Bond	Bond to concrete sleeper fixing including Bond Bottom Packing Covers. Ref 9	M16	110 Nm to fix bolt. 80 Nm to fix Bond #1
	Bond to timber sleeper fixing including Bond Bottom Packing Covers. Ref 9	M16 / $^5/_8$ inch coach screw with gimlet point.	60 #2
	Bond to steel sleeper including Bond Bottom Packing Covers. Ref 9	M12 Blind Bolt #3, Jam nut, Philidas nut	Jam Nut 17 Nm Philidas nut 50Nm
TU / ETU / SPETU	T1 & T2 (Copper crimp)	M10	Install : 25 Check : 20
	Rail connections (Cembre, Glenair or Hilti Stud, copper crimp)	M6	10
	Terminal block (Brass)	2BA (as supplied)	4.5 #4
	TU/ETU/SPETU to track mounted adapter plate or to mounting stake	M8 (as supplied)	24

Equipment	Reference	Fixing Size	Torque Nm
	Track mounted adapter plate to concrete sleeper (if used)	M16 Expanding bolt	120
	Track mounted adapter plate to timber sleeper (if used)	M16 / $^5/_8$ inch coach screw with gimlet point	60
	Track mounted adapter plate to steel sleeper (if used)	M10 Hilti stud	10
	Track mounted TU/ETU/SPETU protection cover.	M8	24
SATU / CU / Z Bond	T1 & T2 (Copper crimp)	M10	Install : 35 Check : 25
	Rail Connections (Cembre or Glenair, Copper Crimp)	M12 Rail Bonds	Install : 80 Check : 70
	Terminals Block	2BA	4.5 #4
	SATU/CU to Adaptor Plate / mounting unit or to mounting stake	2 x M8 min	24
	Adaptor plate to concrete sleeper (if used)	2 x M8 expanding or chemically locked bolt.	24
TX / OM / RX / PSU	Mounting	2BA / M5 (as supplied)	6 #4
LMU-TU	Terminals (Brass)	2BA	4.5 #4

Table 24 – Installation Torque Values

Traction Bonding connections are not covered in this table.

#1 M16 bolt or stud. Expanding metal sleeve type e.g. Expanding Hilti, RawlBolt.

Expanding bolt/stud shall be fixed to sleeper using following procedure:

- Fix bolt/stud to sleeper with torque of 110 Nm.
- Remove nut/washer, install bond/ Bond Bottom Packing Covers and replace with new Face Washer / Spring Washer / Full Depth Nut.
- Torque Full Depth Nut to 80 Nm.

#2 Use special M16 (5/8”) coach screws with gimlet point.
Intermediate Bond Cover bottom packing covers shall be installed between sleeper and Bond.

#3 Supplied by The Blind Bolt Company or accepted equivalent.

#4 If not able to torque, tighten manually using best judgement

14. Appendix L - EBI Track 400 Frequencies

Track	Open Line Track Circuits		Station Area Track Circuits	
	Frequency Identifier	Nominal Frequency	Frequency Identifier	Nominal Frequency
1	A	1699Hz	F1	6100Hz
	B	2296Hz	F2	7700Hz
2	C	1996Hz	F5	5700Hz
	D	2593Hz	F6	7300Hz
3	E	1549Hz	F3	6900Hz
	F	2146Hz	F4	8500Hz
4	G	1848Hz	F7	6500Hz
	H	2445Hz	F8	8100Hz

Table 25 – EBI Track 400 Frequencies

15. Appendix M - Impedance Bond Voltage Ratios

Impedance Bond Style	Voltage Ratio
DE	40:1
MR	56:1
P3	45:1
S	56:1
WH3	56:1
B3 500	Not applicable
B3 3000	Not applicable

Table 26 – Impedance Bond Voltage Ratios

16. Appendix N - EBI Track 400 B3 3000 Impedance Bond Information

Frequency	Capacitance µF	Tolerance
A	308.23µF	± 1.5%
B	167.22µF	± 1.5%
C	222.07µF	± 1.5%
D	130.79µF	± 1.5%
E	373.41µF	± 1.5%
F	191.80µF	± 1.5%
G	259.76µF	± 1.5%
H	147.29µF	± 1.5%
F1	23.90µF	± 1.5%
F2	15.00µF	± 1.5%
F3	18.70µF	± 1.5%
F4	12.30µF	± 1.5%
F5	27.40µF	± 1.5%
F6	16.70µF	± 1.5%
F7	21.00µF	± 1.5%
F8	13.50µF	± 1.5%

Table 27 – Capacitor Box capacitance values

The Inductor in the Impedance Bond should be between 27.8µH – 28.2µH

17. Appendix O - EBI Track 400 Mixed Tuned Zone : Open Line Tuned Area Capacitor values

Frequency	Capacitance µF
A	129.6 – 133.6 µF
B	70.8 – 73.0 µF
C	90.7 – 93.5 µF
D	61.1 – 63.0 µF
E	150.8 – 155.6 µF
F	79.3 – 81.9 µF
G	106.1 – 109.3 µF
H	62.4 – 64.4 µF

Table 28 – Mixed Tuned Zone Open Line Tuned Area Capacitor values

18. Appendix P - An alternative method for setting up the track circuit after a failed Transmitter, LMU-TU, OM or TU/ETU/SPETU/SATU/CU

The SM(S) should risk assess the ability to gain safe site access and the competence of Maintenance staff attending the track circuit equipment and should satisfy themselves that the use of the procedure is appropriate and authorise its use.

A full test shall be carried out as soon as practicable.

Deferral of testing, up to a limit of 48 hours, can be permitted on the basis of safety if this setup procedure is used.

1. Remove the faulty unit and replace with the new one.

   For an OM this shall be installed with the same settings as the failed unit. The settings shall also match the last settings on the record card. If they do not proceed to Step 8.

2. Note the clear track and threshold current values recorded on the track circuit record card.
3. Check that the threshold value on the receiver (Ith) is the same as that entered on the record card.

   For track circuits with multiple receivers, all thresholds shall be checked.
   If the thresholds have changed then proceed to Step 8.

4. Check that the clear track current is within ±10% of the original value.

   If the clear track current is not within ±10% of the original value proceed to Step 6 unless track access is not available to perform drop shunt testing, in which case proceed to Step 8.

   If the clear track current is not within ±20% of the original value proceed to Step 8.

5. Fill in the record card noting alternative setup procedure used. Set up completed. Do not carry out steps 6, 7 or 8.
6. Check that all receivers drop with 0.8Ω across their rail connections, and that 0.8Ω at the transmitter rail connections drops all receivers in the track circuit. If the drop shunt tests fail proceed to Step 8.

7. Complete the record card noting alternative setup procedure used.

   The setup has been completed. Do not proceed to Step 8.

8. The criteria for using this alternative set up procedure have not been met. A Full Test shall be performed before the equipment is handed back.

19. Appendix Q - An alternative method for setting up the Receiver after a Failed Transmitter Key, Failed Reciever or Failed Reciever Key

The SM(S) should risk assess the ability to gain safe site access and the competence of Maintenance staff attending the track circuit equipment and should satisfy themselves that the use of the procedure is appropriate and authorise its use.

A full test shall be carried out as soon as practicable.

Deferral of testing, up to a limit of 48 hours, may be permitted on the basis of safety if this setup procedure is used.

This procedure is to be completed regardless of whether the unit has been previously used or not.

1. If the Transmitter (TX) Key is not being replaced, start at Step 2.

   Replace the TX Key. The Reciever(RX) Key will now need to be programmed to the new TX Key. Refer to the initial configuration in this appendix for instructions to complete this and return here to complete the test.

   NOTE: If the track has multiple RXs then each RX Key needs to be re-coded.

   If the TX Key has been replaced and Step 1 completed, go to Step 4.

2. Power up the Receiver. The display will respond with ‘KEY?’.

3. Fit the correct frequency key for the track circuit under test.

   The display will echo back the frequency in the format, for example ‘400A’ for frequency A, and then display the relay state (‘PICK’ or ‘drop’) or ‘NewK’.

4. Confirm that the RX has a supply voltage within the range 47V to 49V.

5. Check the *Inow AV* current displayed on the RX.

   Note this value.

6. Using the Average Current value (*Inow AV*) from the test above, confirm that it is the same as recorded on the track record card or within ±10% of that value.

   If the clear track current is more than ±10% outside the required level, or is fluctuating by more than 5mA. This indicates that the track circuit is losing current and is not a receiver problem.

   In this case the cause of the current loss should be determined and rectified otherwise the safety margin of the circuit can be eroded.

   NOTE: *Items such as Ballast or Equipment degradation and Environmental Conditions (Temperature Extremes, Heavy Rainfall) etc. should all be considered.*

   Variations are permitted under exceptional circumstances depending on ballast and environmental conditions.

7. Using the 2mm test lead adaptors, attach a Shunt Box across the IPC and IP1 (Open Line) or IPC and IP2(Station Area) terminals, or at the equivalent point on the surge arrestor terminals.

   Adjust the shunt resistance so that the average track current reads as close as possible to the threshold current value recorded on the test record card.

8. Leaving the Shunt Box in place, remove the frequency key and replace it with the set-up key.

   The display will respond with 'SET?'.

   Press the 'OK' button to begin the automatic set-up process.

   The condition monitoring display will show the legend 'WAIT', followed by 'PASS' or 'FAIL'.

   'PASS' indicates that set-up has been successful, and the new gain settings have been locked into the unit.

   'FAIL' indicates that set-up was unsuccessful.

9. In the case of 'FAIL', the display will cycle with the reason for failure shown as a code. The track circuit shall be investigated, and any faults corrected before the set-up is attempted again.

10. Leaving the shunt box applied. Remove the set-up key and replace with the frequency key. Confirm that the INOW AV current is the same as Step 7.

    If not, then the set-up procedure needs to be repeated.

11. If Step 10 passes then remove the shunt and confirm that the track relay picks.

12. Check that the clear track current is within ±10% of the original value. If this is the case, then proceed to Step 13.

    If the clear track current is more than ±10% of the original value a Full Test is required.

13. Check the Inow QUAL is 100%.

    If it is not, this shall be investigated and corrected and the process re-started from Step 5.

14. Check that all receivers drop with 0.8Ω across their connections which go out to the rails, and that 0.8 Ω at the transmitter connections which go out to the rails, drops all receivers in the track circuit.

    If the drop shunt tests pass, then proceed to Step 15.

15. Record all values as required on the track record card, noting the alternative setup used.

16. Where there are multiple RXs and a TX Key has been replaced, repeat Steps 4 to 15 for each RX.

END

Introduction

This appendix contains additional information relating to the Westlock Interlocking system. It contains the following sections:

1. Westlock and WTS Healthy Indicators.
2. Periodic Task 01.
3. Periodic Task 02.
4. Periodic Task 03.
5. Equipment Replacement Processes.

1. WESTLOCK and WTS Healthy Indicators

Technicians' Workstation or Control System Gateway (where fitted) Compact PCI based equipment.

The System `healthy' indicators are illuminated as shown as follows:

Card	Indication	Status
Processor Card	Run LED	Green steady
PMC Card	Power LED	Green steady
PSUs	Status LED	Green steady

<u>WESTLOCK Cubicle</u>

The **CIP** system 'healthy' indicators are illuminated as shown as follows:

Unit	Indication	Normal State
MP modules	Pass	Green steady
	Fault	Off
	Active	Green flashing
CM modules	Pass	Green steady
	Fault	Off
	Active	Green steady
DI modules	Pass	Green steady
	Fault	Off
	Active	Green steady if on- line, off if on standby
	Field Power	Off

The **TIF** system `healthy' indicators are illuminated as shown as follows:

Unit	Indication	Normal State
MP modules	Pass	Green steady
	Fault	Off
	Active	Green flashing
CM modules	Pass	Green steady
	Fault	Off
	Active	Green steady
SCM modules	Pass	Green steady
	Fault	Off
	Active	Green steady
	Ext Alarm	Off
DLM	Power	Red steady
LDT	Power	Red steady
	System	Red steady
	PCM Tx Clock	Red steady
	PCM Rx Clock	Red steady
	PCM Rx Line	Red steady
	Data From SSI	Red steady
	Data To SSI	Red steady
	Data To PCM	Red steady

NOTE: *Depending on which variant the TIF is, it is fitted with either DLMs or LDTs.*

The **FEP** system `healthy' indicators are illuminated as follows:

Indication	Active PM	Inactive PM
24V	Green steady	Green steady
Active	Green flashing	Off
Standby OK	Green steady	Green steady
Fault	Off	Off
Alphanumeric Display	Off	Off
SMB A, B, C & D	Off (not used)	Off (not used)
Processor A Run	Green flashing	Green flashing
Processor B Run	Green flashing	Green flashing
Processor D Run	Green flashing	Green flashing
Processor A Ready	Green steady	Green steady
Processor B Ready	Green steady	Green steady
Processor D Ready	Off (not used)	Off (not used)
Processor A PM-PM	Green steady	Green steady
Processor B PM-PM	Green steady	Green steady
Processor A PM-PM	Yellow flashing	Yellow flashing
Processor B PM-PM	Yellow flashing	Yellow flashing
Ethernet A Link	Green steady	Green steady
Ethernet B Link	Green steady	Green steady
Ethernet A Activity	Yellow flashing	Yellow flashing
Ethernet B Activity	Yellow flashing	Yellow flashing

The shared **Ethernet and Power Supply** ‘healthy’ indicators are illuminated as follows. For single CIP or TIF cubicles these are:

Unit	Indication	Normal State
Ethernet Switches	DC1	Green steady
	DC2	Green steady
	ON	Green steady
	1 to 8	Flash (used ports only) to show
PSUs	DC-ON	Green steady

For Du**al Cubicles (managed)** these are:

Unit	Indication	Normal State
Ethernet Switches	DC-A	Green steady
	DC-B	Green steady
	SYS	Green steady
	Ports	Flash (used ports only) to show
PSUs	DC-ON	Green steady

For **Dual Cubicles (unmanaged)** these are:

Unit	Indication	Normal State
Ethernet Switches	PWR1	Green steady
	PWR2	Green steady

The **RSA** system 'healthy' indicators are illuminated as follows:

Indication	RSA A	RSA B
24V	Green steady	Green steady
Active	Green flashing	Green flashing
Fault	Off	Off
Alphanumeric Display	Off	Off
SMB A	Green flashing	Off (not used)
SMB B	Off (not used)	Green flashing
SMB C & D	Off (not used)	Off (not used)
Ethernet A Link	Green steady	Green steady
Ethernet B Link	Green steady	Green steady
Ethernet A Activity	Yellow flashing	Off (not used)
Ethernet B Activity	Off (not used)	Yellow flashing

The **SOM110** system 'healthy' indicators are illuminated as follows:

Common Indications	State
24V	Green steady
Fault	Off
SMB A	Green flashing
SMB B	Green flashing

The state of other indications on each SOM110 might vary with the state of the railway.

2. Periodic Task 1

2 Year Maintenance - TF or CSG (where fitted) BlueChip PC based equipment

BlueChip PC based TFs and CSGs - Replacing a Lithium Battery

Removal

1. Isolate the power from the PC.
2. Unscrew the thumb screw on the front of the PC and lower the access door.
3. Unscrew the two thumb screws securing the fan assembly and carefully pull the fan assembly clear of the PC casing, see Figure 1.
4. Carefully pull the battery holder out of the retaining clip.
5. Remove the old battery.

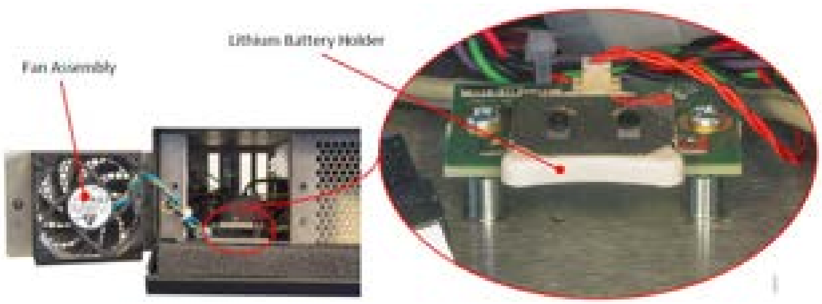


Figure 1 – Lithium Battery Location

Replacement

1. Check the new battery is the same type as the one removed.
2. Insert the new battery, + side up into the holder.
3. Carefully insert the holder into the retaining clip, see Figure 2.

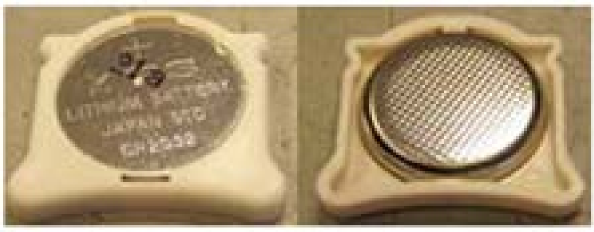


Figure 2 – Lithium Battery Holder

4. Insert the fan into the PC and secure with the two thumb screws.
5. Close the access door and secure using the thumb screw.
6. Reapply power to the PC.
7. Reset the BIOS as detailed below.

Setting TF BIOS

When a TF-S or TF-R PC is replaced, or the lithium battery is replaced the PC's BIOS shall be set as follows:

1. Reset to Default Setting

To set the BIOS to the default settings.

a) During boot-up, press the <Delete> key to enter the BIOS menu.

b) Press the <F3> key to select Optimal Defaults and select the OK.

c) On main screen set Date and Time.

2. Power On Self-Test/Power Button Configuration

To set the PC to perform a full range of self-tests when powered up, to enable the BIOS output to be visible on the console and to configure the power button to perform a delayed power down.

a) Select the Advanced tab.

b) Select Boot Feature.

c) Set value of Quiet Boot to Disabled.

d) Set Value of Power Button Function to 4 Seconds Override.

e) Press the <Esc> key to return to the main BIOS screen.

3. Disable Intel AMT

The Intel AMT technology is disabled on the PC motherboard. To prevent hardware conflicts the AMT shall be disabled in the BIOS as follows:

a) Select the Advanced tab.

b) Select AMT Configuration.

c) Set value of AMT Support to Disabled.

d) Press the <Esc> key to return to the main BIOS screen.

4. Enable All Graphic Adaptors

All graphic adaptors fitted shall be enabled as follows:

a) Select the Advanced tab.

b) Select Chipset Configuration.

c) Select System Agent Configuration.

d) Set value of Initial Graphic Adaptor to IGD.

e) Set value of IGD Multi-Monitor to Enable.

f) Press the <Esc> key twice to return to the main BIOS screen.

5. Set SATA to Windows Mode

__NOTE:__ Windows does not configure itself to load the AHCI driver upon boot if the SATA-drive controller was in IDE mode and not in AHCI mode at the time of OS installation. So, the PC does not boot up if the SATA controller is later switched to AHCI mode or the OS image was installed in IDE mode. The drive controller should be changed to AHCI before installing the operating system".

The SATA Mode shall be set to operate with Windows as follows:

a) Select the Advanced tab.

b) Select IDE/SATA Configuration.

c) Set value of SATA Mode to IDE Mode or AHCI Mode.

d) Press the <Esc> key to return to the main BIOS screen.

6. Super I/O Configurations

As Port 3 and Port 4 are not used, these ports need to be disabled as follows:

a) Select the Advanced tab.

b) Select Super I/O Configuration.

c) Set value of Serial Port 3 to Disabled.

d) Set value of Serial Port 4 to Disabled.

e) Press the <Esc> key to return to the main BIOS screen.

7. Boot Option Priority

Configure the PC to boot off the correct drive as follows:

a) Select Boot tab.

b) Select Boot Options Priority.

c) Set value of Boot Option 1 to STAT: WDC xxxxxxxxxx (see note below).

d) Set value of Boot Option 2 to Disabled.

e) Press the <F4> key to save and exit, the PC continues to boot.

3. Periodic Task 2

10 Year Maintenance - TW or CSG (where fitted) Compact PCI based equipment

Failure to replace the battery periodically can result in the loss of BIOS parameters in the event of a computer black start. This results in increased start up time due to loss of BIOS parameters and can also cause reduced or incorrect operation while operating.

1. To replace a RAM battery:

   a) Re-boot computer and press F2 to enter BIOS Setup when prompted on VDU.

   b) Using the arrow keys and the help menu to navigate the screens and menu items, note all parameters for all menu items on all screens.

   c) Remove Processor module.

   d) Replace coin cell BR 2032 and check correct polarity.

   e) Replace Processor module.

   f) Turn on computer power and press F2 when prompted on the VDU to enter BIOS set up.

   g) Check all screens and menu items are set as noted in step 3 above.

   h) When BIOS set up complete, Press F4 to save and exit BIOS set up.

   i) Select 'Yes' to confirm BIOS settings on the confirmation screen.

The computer now reboots, load and run the program without further operator intervention.

It is recommended to prolong battery life that batteries are only fitted to spare modules immediately prior to being put into service. The shelf life of a battery in its original packing is in excess of 10 years. When fitted it is considerably shorter.

4. Periodic Task 3

14 Year Maintenance - WESTLOCK CIP and TIF Main Processors

The CIP, TIF and SIF Main Processors (MPs) contain a Lithium battery which shall be replaced periodically to maintain the MP's backup memory. Each MP has a label showing the date of manufacture; use this information to calculate service date. The format of the serial number is shown as yy.ww.nnnn, where yy is the year and ww is the week of manufacturer.

All MPs held as spares shall be serviced as above.

To prevent any interruption to service, it is recommended to replace only one MP at a time with a serviceable spare.

These batteries are not user serviceable, and the MP shall be returned to the factory for servicing, including all spares.

5. Equipment Replacement Processes

5.1 Replace a WESTLOCK Interlocking Module

a) On the WESTLOCK module to be removed, rotate the Lock lever counter clockwise through 270° until the module ejects from the baseplate.

b) Insert the replacement WESTLOCK module with the lock lever in the 6 o'clock position and rotate the lock lever clockwise to draw the module into the baseplate.

c) Continue rotating the Lock lever until it is in the 3 o'clock position. This might require firm pressure.

d) Check the lock indicator (red LED) is Off. If the indicator is on, the module is incorrectly seated.

5.2 Replace a WESTLOCK Ethernet Switch

a) Remove the input supply from the switch by unplugging the screw terminal block from the top of the switch.

b) Note the positions of the data cables connected to the switch ports. Check the cables and wires are correctly labelled.

c) Unplug the data cables from the switch ports.

d) Unclip the switch from the DIN rail and label it.

e) Fit the replacement switch onto the DIN rail.

f) Connect the cables to the switch ports in the positions noted at c.

g) Plug the input supply screw terminal into the socket on the top plate of the switch.

h) On the front panel of the switch, check that DC1, DC2 and On LEDs are lit.

i) After a short pause, check the port activity indicators begin flashing (used ports only).

j) At the TW(L), check the fault list to confirm correct operation of the network.

5.3 Replace a WESTLOCK Power Supply Unit (PSU)

a) Positively identify the power supply unit to be removed. The front panel of the PSU has a DC on status indicator, lit when the output is present.

NOTE: *If one power supply unit is faulty, powering down the remaining PSU removes the DC supply from the cubicle equipment.*

b) Positively identify the input and output power fuses for the PSU to be removed.

c) Remove the fuses and check on the PSU input terminals that the 110V AC is absent.

d) Note the positions of the input and output wires on the PSU terminals. Check the cables and wires are correctly labelled.

e) Remove the wires from the PSU terminals, insulating them using insulating tape.

f) Remove the PSU from the DIN rail and label it.

g) Fit the serviceable replacement PSU onto the DIN rail, in the same position as the original PSU.

h) Connect the input and output wires in the positions noted at step d. If in doubt, refer to the site records.

i) Re-fit the fuses removed at step b.

j) On the front panel of the PSU, check the DC On status indicator is lit.

k) At the TW(L), check the fault list to confirm correct operation of the PSU.

5.4 Replace a WESTLOCK CSG or TW(L) Module

a) At the rear of the housing, set the input power switches for both PSUs to the off (O) position.

b) Disconnect any data cables from the card.

c) Undo the single securing screw at the left and right of the card.

d) Release the card from the backplane connector by pressing the left and right card handles apart.

e) Carefully slide the card from the housing and place it in an anti-static bag.

f) At the rear of the housing, set the power input switch supplying the failed PSU to the off (O) position.

g) At the front of the housing, undo the screws securing the PSU to the housing and remove the PSU.

h) Isolate power to the KVM by disconnecting the mains cable feeding the KVM power supply. Check cables are correctly labelled.

i) Disconnect the connectors from the rear of the KVM unit.

j) Unscrew the four screws securing the KVM to the rack and withdraw the complete KVM.

k) Check the replacement card is correct type (the same type as the one removed and has been supplied by WRSL specifically for this type of installation).

l) Insert the card into its correct position and secure using the two front panel screws.

m) Reconnect the data cables as necessary, check each cable is fitted into the correct connector. If in doubt, refer to the site records.

n) Set the input power switches to on (I). Wait for the processor to boot up.

o) If the replaced card was a Rear Transition Module (which contains the hard disk drive), load the operating program.

p) Only competent personnel shall perform this task by inserting a USB memory stick containing the correct version and application, then selecting the application (TW(L), CSG ‘A’ or CSG ‘B’) using the keyboard/VDU field (input) fault and a module fault, resolve the field fault first.

q) Check all indications are correct and the equipment works correctly.

r) Check the replacement PSU is correct type (the same type as that removed).

s) Check the PSU is the correct way up, and then carefully align the PSU with the guides within the housing before sliding the PSU fully into the housing.

t) Apply firm pressure on the PSU front panel to fully insert the PSU into the housing.

u) Secure the PSU with the front panel screws.

v) Restore the mains input supply and check the Status indicator on the front panel illuminates.

w) Check that the replacement KVM unit is correct type (the same type as the one removed).

x) Slide the KVM housing into the rack and secure with the four screws.

y) Reconnect the cables at the rear of the KVM housing.

z) Restore power to the KVM.

aa) Test for correct operation.

5.5 Replace a WESTLOCK Baseplate

a) At the baseplate to be replaced, remove the modules. For each module, rotate the lock lever counterclockwise through 270° until the module ejects from the baseplate.

b) Disconnect any cables or wires from the baseplate. Note that on the DI baseplate the complete connector might be unplugged.

c) At the top and bottom of the baseplate to be removed, identify the crosshead screws securing the interconnect assemblies (4 screws) or cover assembly (2 screws) to the baseplate. Undo the securing screws and remove the interconnect / cover assemblies.

d) Undo and remove the four crosshead screws and associated lock washers securing the baseplate to the rear panel of the cubicle. Retain the screws and washers.

e) Carefully withdraw the baseplate from the cubicle.

f) Remove the address plug from the baseplate and plug it into the replacement baseplate.

g) Check the replacement baseplate is correct type (same type as the one removed and has been supplied by WRSL).

h) Fit the replacement baseplate into its correct position and secure using the four crosshead screws and associated lock washers.

i) Visually Check the interconnect assemblies for damaged connector pins. If damaged pins are present, replace the interconnect assembly.

j) Fit the interconnect assemblies / cover assembly and secure by tightening the four crosshead screws (interconnect assembly) or two crosshead screws (cover assembly).

k) Reconnect the cables or wires as necessary, check each cable is fitted into the correct connector. If in doubt, refer to the site records.

l) Insert each module into the baseplate with the lock lever in the 6 o'clock position and rotate the lock lever clockwise to draw the module into the baseplate. Continue rotating the lock lever until it is in the 3 o'clock position. This might require firm pressure.

5.6 Removal of CIP or TIF Module

a) If CIP or TIF module is to be removed, rotate the Lock lever counterclockwise through 270° until the module ejects from the baseplate (it is recommended to use a screwdriver).

b) Insert the replacement CIP or TIF module with the lock lever in the 6 o'clock position and rotate the lock lever clockwise to draw the module into the baseplate.

c) Continue rotating the Lock lever until it is in the 3 o'clock position. This might require firm pressure (it is recommended to use screwdriver).

d) Check the lock indicator (red LED) is Off. If the indicator is on, the module is incorrectly seated.

Removal of an PM from a FEP

a) Loosen the captive lock screw in each handle at the top and bottom of the module.

b) Press the red button in the lower handle. This shuts down the module and releases the lower handle.

c) Wait one second after depressing the red button to allow the module to shut down. This prevents damage to module components and proves the integrity of the backplane supply voltage during removal.

d) Swing both handles outwards to release the module and slide the module out of the housing along its guides.

e) Align the rails on the left top and bottom edge of the replacement module with the tracks at the top and bottom of the slot.

f) Push the module in until the levers start to engage.

g) Do not use excessive force: it's possible to bend terminals or break polarising pegs if the connectors and sockets are misaligned, or if the module is of the wrong type.

h) Pull up on the bottom lever and press down on the top lever at the same time to ease the module into the backplane, until the red power switch in the bottom lever clicks into place.

i) Tighten captive screws.

5.7 Replacing Westermo Lynx L106 and Cisco IE2000 and Amplicon EX43008-00-1-A

a) Power down the affected Ethernet switch by opening the fuse carriers on the power distribution rail. Note that there are two power supplies to each switch.

b) Unplug the screw terminal connector block or blocks from the switch. (Westermo Lynx L106 switches have one connector block. Cisco IE2000 switches have two connector blocks, one for each power supply).

c) Note the positions of the cables before unplugging from the switch ports.

d) Unclip the switch from the DIN rail by pulling down on the movable tab at the bottom of the unit then label it.

e) Fit the replacement switch onto the DIN rail.

f) Connect the cables to the switch ports in the positions noted at Step c).

g) Plug the input supply screw terminal connector block(s) into the switch.

5.8 Replace MP, CM, DI and SCM Baseplates

a) At the baseplate to be replaced, remove the modules. For each module, rotate the lock lever counterclockwise through 270° until the module ejects from the baseplate.

b) Disconnect any cables or wires from the baseplate. Note that on the DI baseplate the complete connector might be unplugged.

c) At the top and bottom of the baseplate to be removed, identify the crosshead screws securing the interconnect assemblies (4 screws) or cover assembly (2 screws) to the baseplate. Undo the securing screws and remove the interconnect / cover assemblies.

d) Undo and remove the four crosshead screws and associated lock washers securing the baseplate to the rear panel of the cubicle. Retain the screws and washers.

e) Carefully withdraw the baseplate from the cubicle.

f) Remove the address plug from the baseplate and plug it into the replacement baseplate.

g) Fit the replacement baseplate into its correct position and secure using the four crosshead screws and associated lock washers removed at Step c).

h) Visually check the interconnect assemblies (removed at step b) for damaged connector pins. If damaged pins are present, replace the interconnect assembly.

i) Fit the interconnect assemblies / cover assembly removed at Step b). and secure by tightening the four crosshead screws (interconnect assembly) or two crosshead screws (cover assembly).

j) Reconnect the cables or wires as necessary.

k) Insert each module into the baseplate with the lock lever in the 6 o'clock position and rotate the lock lever clockwise to draw the module into the baseplate. Continue rotating the lock lever until it is in the 3 o'clock position. This might require firm pressure.

5.9 Replace a WESTLOCK FEP Housing Backplane

a) Remove the two PMs from the FEP housing following the procedure in NR/SMTH/Part04/WL01 (Replace a WESTLOCK Interlocking Module).

b) Disconnect the four Ethernet cables and two power connections from the front panel of the FEP housing.

c) Disconnect the earth strap connecting the housing to the rear panel of the cubicle.

d) On each side of the FEP housing to be removed, identify and remove the crosshead screws securing the housing to the rear panel of the cubicle. Retain the screws and washers.

e) Carefully withdraw the housing from the cubicle.

f) Remove the panel in front of the Addressing Plug from the front of the housing to improve access to the Addressing Plug.

g) Remove the seals covering the Addressing Plug retaining screws, release the two screws and pull the Addressing Plug forward and out of the housing.

h) Disconnect the power connectors from the connections labelled 24V-A and 24V-B on the rear of the housing.

i) Remove the six SMB terminators from the SMB connections on the rear of the housing.

j) Remove and retain the six screws from the top and bottom of the cover plate and remove the cover.

k) Carefully mark the position of the backplane on the housing to check the connectors on replacement backplane align correctly with the rails supporting the processor modules.

l) Remove and retain the remaining four screws holding the backplane on to the housing and remove the backplane.

m) Align the backplane to the alignment marks made.

n) Note the position of the four slots in the protective cover and attach the backplane to the housing using the screws removed at Step j) so that the screws align with the slots in the protective cover.

o) Fit the protective cover plate using the six screws removed.

p) Re-fit the six SMB terminators to the SMB connectors.

q) Visually check cables for damaged connector pins. If necessary, replace the cable with a serviceable spare.

r) Reconnect the power connections.

s) Check wiring and cables are replaced as labelled.

t) WIRE COUNT replacement unit to diagram.

u) Fit the Addressing Plug removed from the failed backplane into the replacement backplane and secure it using the retained fixings.

v) Fit new red seals covering the retaining screws on the Addressing Plug.

w) Place the removed backplane in the transit packaging and return it to Siemens Rail Automation for repair.

x) Fit the housing into its correct position and secure using the four crosshead screws and associated lock washers removed.

y) Visually check cables for damaged connector pins. If damaged pins are present, replace the cable with a serviceable spare.

z) Reconnect the Ethernet cables and power connections, checking each cable is fitted into the correct connector.

aa) Insert each Processor Module (PM) into the housing following the procedure in NR/SMTH/Part04/WL01 (Replace a WESTLOCK Interlocking Module).

5.10 Replace a Siemens Zone Controller module

a) Loosen the captive lock screw in each handle at the top and bottom of the module.

b) Press the red button in the lower handle. This shuts down the module and releases the lower handle.

c) Wait one second after depressing the red button to allow the module to shut down. This prevents damage to module components and maintains the integrity of the backplane supply voltage during removal.

d) If the module to be replaced is a MAU, disconnect the optical fibre connections from the front of the MAU taking care to protect the ends.

e) Swing the handles outwards to release the module and slide the module out of the housing along its guides.

f) Align the rails on the left top and bottom edge of the module with the tracks at the top and bottom of the slot.

g) Push the module in until the levers start to engage.

h) Do not use excessive force: it’s possible to bend terminals or break polarising pegs if the connectors and sockets are misaligned, or if the module is of the wrong type.

i) If the module being replaced is a MAU, connect the optical fibre connections removed at Step d).

j) Pull up on the bottom lever and press down on the top lever at the same time to ease the module into the backplane, until the red power switch in the bottom lever clicks into place.

k) Tighten the captive lock screw in each handle at the top and bottom of the module.

5.11 Replace a Siemens Zone Controller Housing Backplane

a) Disconnect the power connectors from the connections labelled 24V-A and 24V-B on the rear of the housing.

b) Remove the panel in front of the Addressing Plug from the front of the housing to improve access to the Addressing Plug. It might be necessary to remove one or more modules or blanking plates to improve access.

c) Remove the seals covering the Addressing Plug retaining screws, release the two screws and pull the Addressing Plug forward and out of the housing.

d) Remove the six SMB cables or terminators from the SMB connections on the rear of the housing.

e) Remove and retain the eight screws from the top and bottom of the cover plate and remove the cover.

f) Carefully mark the position of the backplane on the housing to check the connectors on the replacement backplane align correctly with the rails supporting the modules.

g) Remove and retain the remaining twelve screws holding the backplane on to the housing and remove the backplane.

h) Check the replacement 10-Slot plus Addressing Plug backplane is the same type as the one removed.

i) Align the backplane to the alignment marks made in Step f).

j) Note the position of the slots in the protective cover and attach the backplane to the housing using the twelve screws removed at Step g) so that the screws align with the slots in the protective cover.

k) Fit the protective cover plate using the eight screws removed in Step e).

l) Visually check the cables removed for damaged connector pins. If necessary, replace the cable with a serviceable spare.

m) Re-fit the SMB cables and terminators to the SMB connectors.

n) Reconnect the power connections and SMB connections, checking each cable is fitted to the correct connector. If in doubt, refer to the site records.

o) Fit the Addressing Plug removed from the failed backplane into the replacement backplane and secure it using the retained fixings.

p) Fit new red seals covering the retaining screws on the Addressing Plug.

q) Replace any modules removed.

5.12 Replace a Siemens Zone Controller PM Backplane

a) Power down the RSA which is plugged into the affected backplane by pressing the red button in the lower handle.

b) Disconnect the Ethernet cable and loopback connector from the connections labelled Ethernet A and Ethernet B.

c) Remove and retain the three screws from the top and bottom of the cover plate and remove the cover.

d) Carefully mark the position of the backplane on the housing so that the connectors on replacement backplane align correctly with the rails supporting the RSA modules.

e) Remove and retain the remaining three screws holding the backplane on to the housing and remove the backplane.

f) Two solder links are provided on the PM backplane to select if the PM is the Primary or Secondary PM. These are not used by the RSA and can be left open.

g) Align the backplane to the alignment marks made in Step d).

h) Note the position of the slots in the protective cover and attach the backplane to the housing using the three screws removed at Step e) so that the screws align with the slots in the protective cover.

i) Fit the protective cover plate using the three screws removed in Step c).

j) Visually check the Ethernet cable and loopback connector for damaged connector pins. If damaged pins are present, replace the cable or loopback connector with a serviceable spare.

k) Reconnect the Ethernet cable and loopback connector, checking they are in the correct socket. Refer to the site records.

5.13 Replace a Siemens Zone Controller Surge Interface Board

a) Power down the SOM110 which is plugged into the affected interface board by pressing the red button in the lower handle.

b) Disconnect the I/O connection cable at the back of the housing from the affected interface board.

c) Remove and retain the four screws and washers from the top and bottom of the cover on the lower half of the interface board and remove the cover.

d) Carefully mark the position of the interface board on the housing so that the connectors on the replacement interface board align correctly with the rails supporting the modules.

e) Remove and retain the socket head screws holding the connector spacers and interface board on to the housing and remove the spacers and interface board. Spacers for 16HP width modules retained with six screws. Spacers for 8HP width modules retained using four screws.

f) Check the replacement interface board is the same type as the one removed.

g) Align the backplane to the alignment marks made in Step d).

h) Attach the backplane to the housing using the screws and spacers removed at step e. The screws pass through the top half of the upper spacer and through the bottom half of the lower spacer.

i) Fit the protective cover plate to the bottom half of the interface board using the four screws and washers removed in Step c).

j) Visually check the I/O connection cable for damaged connector pins. If damaged pins are present, replace the cable with a serviceable spare.

k) Reconnect the interface cable.

Replace a WESTLOCK FEP PM Backplane

a) Remove the two PMs from the FEP housing following the procedure in NR/SMTH/Part04/WL01 (Replace a WESTLOCK Interlocking Module).

b) Disconnect the four Ethernet cables and two power connections from the front panel of the FEP housing.

c) Disconnect the earth strap connecting the housing to the rear panel of the cubicle.

d) On each side of the FEP housing to be removed, identify and remove the crosshead screws securing the housing to the rear panel of the cubicle. Retain the screws and washers.

e) Carefully withdraw the housing from the cubicle.

f) Disconnect the Ethernet cables from the connections labelled Ethernet A and Ethernet B.

g) Disconnect the PM-PM Data Cable and PM-PM Status Cable connecting the two PM backplanes.

h) Remove and retain the screws from the top and bottom of the cover plate and remove the cover.

i) Carefully mark the position of the backplane on the housing to check the connectors on replacement backplane align correctly with the rails supporting the processor modules.

j) Remove and retain the remaining screws holding the backplane on to the housing and remove the backplane.

NOTE: *Two solder links are provided on the PM backplane to select if the PM is the Primary or Secondary PM.*

- The PM Backplane fitted to Slot 1 has LK1 closed and LK2 open.
- The PM Backplane fitted to Slot 2 has LK1 open and LK2 open.

k) Check the solder links on the new backplane are set correctly.

l) Align the backplane to the alignment marks made in Step i).

m) Note the position of the slots in the protective cover and attach the backplane to the housing using the three screws removed at Step j) so that the screws align with the slots in the protective cover.

n) Fit the protective cover plate.

o) Visually check the cables for damaged connector pins. If damaged pins are present, replace the cable with a serviceable spare.

p) Reconnect the Ethernet cables and status connections to the two PM backplanes.

q) Check each cable is fitted into the correct connector and replaced as labelled.

r) Fit the housing into its correct position and secure using the four crosshead screws and associated lock washers removed in Step d).

s) Visually check cables (removed at Step b) for damaged connector pins. If damaged pins are present, replace the cable with a serviceable spare.

t) Reconnect the Ethernet cables and power connections to the front of the FEP Housing, checking each cable is fitted into the correct connector. If in doubt, refer to the site records.

u) Insert each processor module into the housing following the procedure in NR/SMTH/Part04/WL01 (Replace a WESTLOCK Interlocking Module).

5.14 Replace a Siemens FEP/ZC Addressing Plug

a) Disconnect the power connectors from the connections labelled 24V-A and 24V-B on the rear of the housing.

b) Remove the panel in front of the Addressing Plug from the front of the housing to improve access to the Addressing Plug. It might be necessary to remove one or more modules or blanking plates to improve access.

c) Remove the seals covering the Addressing Plug retaining screws, release the two screws and pull the Addressing Plug forward and out of the housing.

d) Check the replacement Addressing Plug is the same type as the one removed.

5.15 Configuring an Addressing Plug

If a pre-configured spare Addressing Plug has been supplied for the Housing, move to Step 5.16).

a) Dismantle the new Addressing Plug by removing and retaining the four screws from the top and bottom and remove the cover.

b) All links in the new Addressing Plug are made. Links are cut to set the Housing and Installation addresses and configure the SMB communications.

c) Identify the links to be removed by reference to the drawing in the site-specific documentation.

d) Cut each link to be removed at both ends. Check all cut ends are removed from the module.

e) Re-check the Addressing Plug against the drawing.

f) Re-assemble the Addressing Plug.

g) Fit red seals to the Addressing Plug and apply the correct labelling.

5.16 Installing a new Addressing Plug

a) Fit the Addressing Plug into the FEP/ZC and secure it using the retained fixings.

b) Fit new red seals covering the retaining screws on the Addressing Plug.

c) Replace any front panels or modules.

d) Place the removed Addressing Plug in the transit packaging.

5.17 Replace a Siemens FEP/ZC Power Supply Module

a) Disconnect the plug couplers on the rear of the Power supply module (at the rear of the housing).

b) Release the four captive screws retaining the Power supply module located on the front panel.

c) Using the handles, slide the Power supply module out of the housing.

d) Slide the new Power supply module into the rack (checking correct orientation).

e) Locate and tighten the four cassette retaining screws.

f) Replace the plug couplers on the rear of the cassette (plug couplers are physically different and only plugs into one place).

5.18 Replace a Siemens Zone Controller Power Buffer Unit

a) Disconnect the Buffer Unit plug coupler on the rear of the power supply module.

b) Extract the Buffer Unit cable from any cable management.

c) Mark the Buffer Unit’s position on the DIN rail.

d) Detach the Buffer Unit from the DIN rail. The release mechanism is located underneath the buffer unit and is operated with a flat blade screwdriver.

e) Attach the new Buffer Unit to the DIN rail in the same position as the previous one.

f) Route the buffer cable via the cable management.

g) Plug the buffer unit plug coupler into the rear of the power supply module.

5.19 Replace a Siemens Zone Controller TPWS Circuit Breaker

a) Disconnect the wires from the faulty circuit breaker.

b) Remove the circuit breaker fixings.

c) Remove the finger guard and faulty circuit breaker.

d) Align the replacement circuit breaker and finger guard to the fixing holes in the plate.

e) Refit the circuit breaker retaining fixings.

f) Check the new circuit breaker lever operates correctly, before returning it to the off position.

g) Reconnect the wires to the circuit breaker.

h) Refit finger guard.

5.20 Replace a Siemens Ethernet Switch Power Supply

a) Disconnect the wires from the Power Supply Unit.

b) Mark the Power Supplies position on the DIN rail.

c) Detach the Power Supply from the DIN rail. The release mechanism is located underneath the unit and is operated with a flat blade screwdriver.

d) Attach the new Power Supply to the DIN rail in the same position as the previous one.

e) Connect the wiring.

5.21 Replace a Siemens Ethernet Switch Power Buffer Unit

a) Disconnect the Buffer Unit from the Power Supply Unit.

b) Disconnect the output from the buffer unit one wire at a time to check the two wires cannot short the capacitors as they are withdrawn.

c) Mark the Buffer Unit’s position on the DIN rail.

d) Detach the Buffer Unit from the DIN rail. The release mechanism is located underneath the buffer unit and is operated with a flat blade screwdriver.

e) Attach the new Buffer Unit to the DIN rail in the same position as the previous one.

f) Connect the output from the buffer unit one wire at a time to checking the two output wires do not short the capacitors.

g) Connect the buffer unit to the power supply.

5.22 Replace a Siemens AMI-SRA Modular Technicians Facility PC

a) Isolate the power supply using the MCB.

b) Unplug the cables from the PC.

c) Remove and retain the Removable Drives and compact flash card (if used).

d) Remove and retain the fixing securing the PC to the bracket and withdraw the PC.

e) Insert the retained Removable Drives and compact flash card (if used) into the replacement PC.

f) Secure the PC in position using the retained fixings.

g) Check the cables are in the correct position and then re-connect.

h) Re-apply the power supply using the associated MCB.

5.23 Replace a Siemens Zone Controller MAU Backplane

a) Disconnect the power connectors from the connections labelled 24V-A and 24V-B on the existing MAU backplane on the rear of the housing.

b) Remove the two SMB cables or terminators from the SMB connections on the MAU backplane.

c) Remove and retain the four screws from the top and bottom of the cover plate and remove the cover.

d) Carefully mark the position of the backplane on the housing so the connectors on replacement backplane align correctly with the rails supporting the modules.

e) Remove and retain the remaining four screws holding the backplane on to the housing and remove the backplane.

f) Check the replacement WESTRACE MAU backplane is the same type as the one removed and has been supplied by Siemens Rail Automation.

g) Align the backplane to the alignment marks made in Step d).

h) Note the position of the slots in the protective cover and attach the backplane to the housing using the four screws removed at Step e) so that the screws align with the slots in the protective cover.

i) Fit the protective cover plate using the four screws removed in Step c).

j) Visually check the cables or terminators (removed at Step b) for damaged connector pins. If necessary, replace the cable with a serviceable spare.

k) Reconnect the power connections, SMB connections and terminators, checking each cable is fitted to the correct connector. If in doubt, refer to the site records.

l) Place the removed backplane in the transit packaging and return it to Siemens Rail Automation for repair.

5.24 Replace a Siemens Zone Controller Housing

a) Power down the modules in the housing by pressing the red button in the lower handle on each module.

b) Disconnect the power connectors from the connections labelled 24V-A and 24V-B on the rear of the housing.

c) Remove the six SMB cables or terminators from the SMB connections on the rear of the housing.

d) If an RSA is fitted to the housing, disconnect the Ethernet cable and loopback connector from the connections labelled Ethernet A and Ethernet B.

e) If a MAU is fitted, disconnect the optical fibre connections from the front of the MAU taking care to protect the ends.

f) Disconnect the I/O connection cable at the back of the housing from each interface board.

g) To reduce the weight of the housing, remove the modules by swinging the handles outwards and slide the module out of the housing along the guides.

h) Remove the panel in front of the Addressing Plug from the front of the housing to improve access to the Addressing Plug.

i) Remove the seals covering the Addressing Plug retaining screws, release the two screws and pull the Addressing Plug forward and out of the housing.

j) Remove and retain the eight screws holding the housing into the rack located on the front of the housing.

k) Using the handles, slide the housing out of the rack (the housing is supported by runners).

l) Slide the new housing into the rack (checking correct orientation).

m) Refit the four housing retaining screws.

n) Fit the modules to the new housing and check the backplanes are fitted in the correct position behind the modules.

o) Remove the housing backplane from the redundant housing and fit it to the new housing following the procedure in NR/SMTH/Part04/WL08 (Replace a Siemens Zone Controller Housing Backplane).

p) Remove any PM backplanes from the redundant housing and fit them to the new housing following the procedure in NR/SMTH/Part04/WL09 (Replace a Siemens Zone Controller PM Backplane).

q) Remove the Surge Interface Boards from the redundant housing and fit them to the new housing following the procedure in NR/SMTH/Part04/WL10 (Replace a Siemens Zone Controller Surge Interface Board).

r) Remove any MAU backplanes from the redundant housing and fit them to the new housing following the procedure in NR/SMTH/Part04/WL11 (Replace a Siemens Zone Controller MAU Backplane).

s) Fit the Addressing Plug removed from the redundant housing into the new housing and secure it using the retained fixings. It might be necessary to remove one or more modules to improve access.

t) Fit new red seals covering the retaining screws on the Addressing Plug.

u) Replace any front panels or modules.

v) Press the red button in the lower handle of each RSA, MAU and LOM110 or SOM110 module to check the modules are switched off.

w) Re-connect the cables.

5.25 Replace a Siemens Zone Controller Power Distribution Housing

a) Disconnect the plug couplers on the rear of the Power Cassettes (at the rear of the housing).

b) Remove and retain the four screws holding the housing into the rack located on the front of the housing.

c) Using the handles, slide the housing out of the rack (the housing is supported by runners).

d) Slide the new housing into the rack (checking correct orientation).

e) Refit the four housing retaining screws removed at Step b).

f) Replace the plug couplers on the rear of the cassettes (plug couplers are physically different and only plugs into one place within a cassette).

g) Turn on the upstream circuit breakers.

h) Turn on each circuit breaker on the front panel of the cassettes.

i) If the Power Cassette is a 24VDC cassette part number C52986/1, verify the green “DC Ok” status indicator on the front of the Power Cassette illuminates.

5.26 Replace a Siemens Zone Controller I/O Cable

a) Power down the IOM which is plugged into the affected I/O Connection Cable by pressing the red button in the lower handle.

b) Disconnect the I/O Connection Cable from the back of the housing from the affected interface board.

c) Extract the I/O Connection Cable from any cable management.

d) Disconnect the I/O Connection Cable from the Wago terminals.

e) Route the new I/O Connection Cable via the cable management.

f) Connect the new I/O Connection Cable to the Wago terminals according to the site-specific documentation.

g) Connect the new I/O Connection Cable to the back of the housing.

END

1. GENERAL

1.1 A BR Western Region coded track circuits fundamentally differ from a conventional steady energy DC track circuit in that the voltage, supplied to both rails at the feed end, is broken up into a code comprising alternate periods of positive and negative impulses (Figure 1).

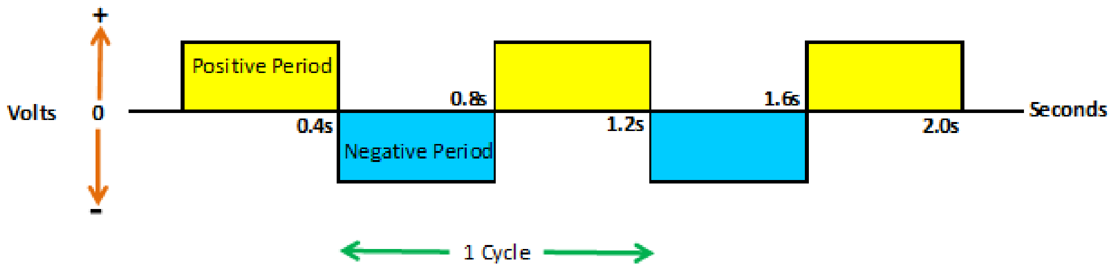


Figure 1 – 75 CPM Code

1.2 The code is produced by a coded transmitter (CT). It's oscillating contacts interrupt and alternate, a 2v Lead Acid battery supply at the feed end of the track circuit.

1.3 At the relay end of the track circuit the code is received by a 2 ohm Polar Biased code following relay (CFR). When working correctly, the CFR follows exactly the alternate code produced by the CT, and this produces the distinctive "tick-tock" at the CFR, at a rate of 75 cycles per minute.

The advantages arising from the use of DC Coded Tracks are:

a) Longer track circuits can be operated for a minimum ballast resistance.

b) The track cannot be falsely energised by an extraneous DC source.

c) There is no "battery storage effect" in poor ballast conditions.

1.4 Due to the DC coded track circuits alternating polarities, in order to interface with the signalling and provide contacts for signalling control and TPRs etc, a slow-release DC neutral shelf type relay is employed.

1.5 Under track clear conditions the TR is maintained in a steady energised state by means of a decoding transformer (DT). As long as the correct 75 cycles per minute are received by the CFR, the DT will provide a unidirectional current through the TR.

Any interruption or distortion of the 75 CPM code will not only cause the CFR to stop oscillating, but also the TR to be de-energised. It is the TR contacts that are then used in the conventional manner.

1.6 Although the relay is called the TR it is NOT the TR that is shunted as it has no direct connection to the rails, and the independent power supply via the DT. It is the CFR that is tested. (Figure 2)

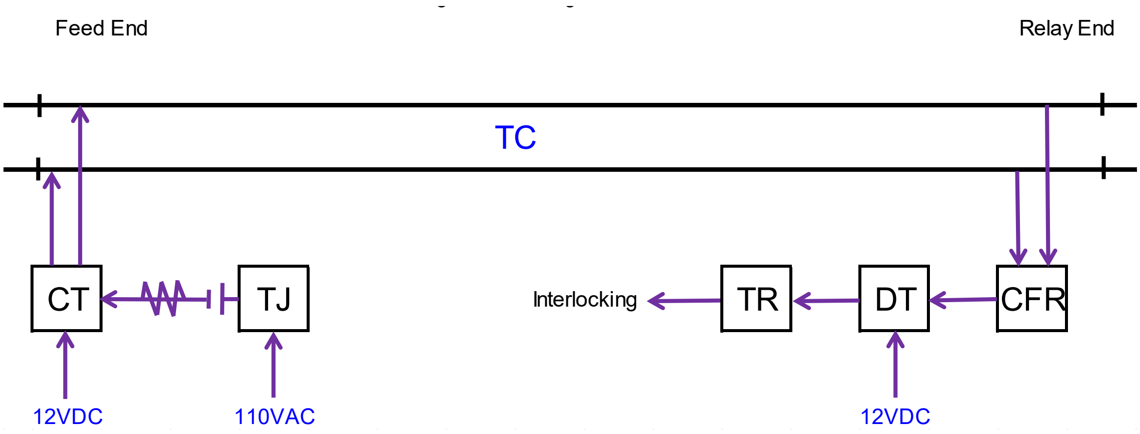


Figure 2 – Block Diagram

END

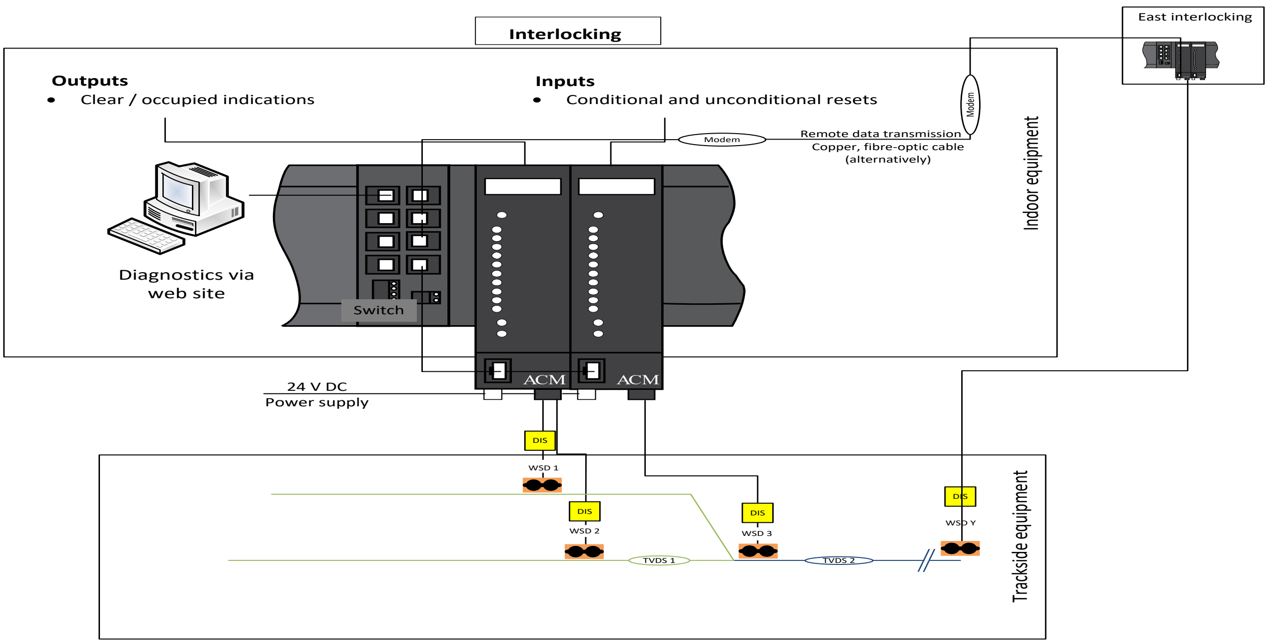
Includes:	Siemens ACM100 System
Excludes:	All other Axle counter systems

Abbreviation	Meaning
AC	Alternate current
ACM	Axle Counting Module
COM	Communication
DC	Direct Current
DIS	Connection box
RA	Reset acknowledgement
RR	Reset restriction
RST	Reset button
RST-RR1	Reset button for reset restriction 1
RST-RR2	Reset button for reset restriction 2
SRI	Safety related information
TVDS	Track Vacancy Detection System
WDME	Wheel Detection Monitoring Error
WSD	Wheel sensor double

Table 1 – List of Abbreviations

Track Vacancy Detection with an Axle Counting System

The ACM100 system (figure 1) is used for automatic monitoring of open-line and station tracks. Clear and occupied indications are transmitted to the interlocking or to subsystems for track sections and points. The ACM100 system consists of two sets of equipment, Trackside and Indoor equipment.



ACM – axle counting module
DIS – disconnection box
TVDS – track vacancy detection section
WSD – wheel detector

Figure 1 – ACM100 overview

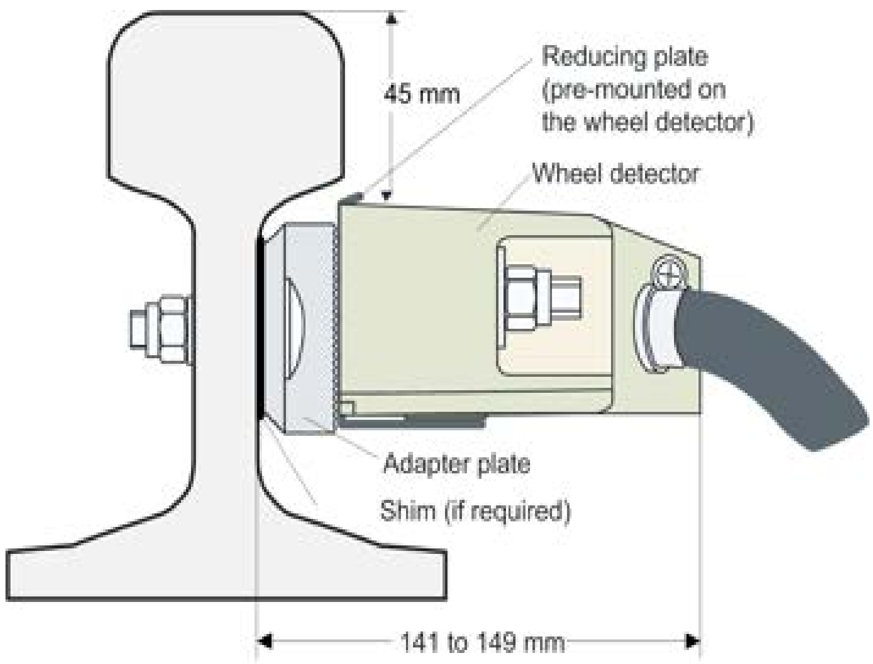
Wheel detection components are placed at the beginning and end of each track vacancy detection section (TVDS) to be monitored. To determine whether there is a vehicle in a TVDS, the system compares the number of axles entering it with the number leaving it.

WSD Wheel Detector

The WSDs (figure 2) are installed at the limits of a TVDS. A WSD consists of two independent detector subsystems (double wheel detector) installed in a glass-fiber reinforced plastic housing. The WSD requires a periodic (six monthly) recalibration and functional test. The recalibration process once triggered operates automatically, with no user serviceable components within the WSD housing. The WSD is mounted in the track on the gauge side of the rail. The wheel detector is connected to a trackside connection box (cable distribution box) by a four-core cable (two cores per detector subsystem). The cable is 5 m (optionally 10m or 15m) long. The WSD wheel detector is either bolted to the rail web or clamped to the base of the rail.

Figure 2 – Wheel Sensor Double (WSD)

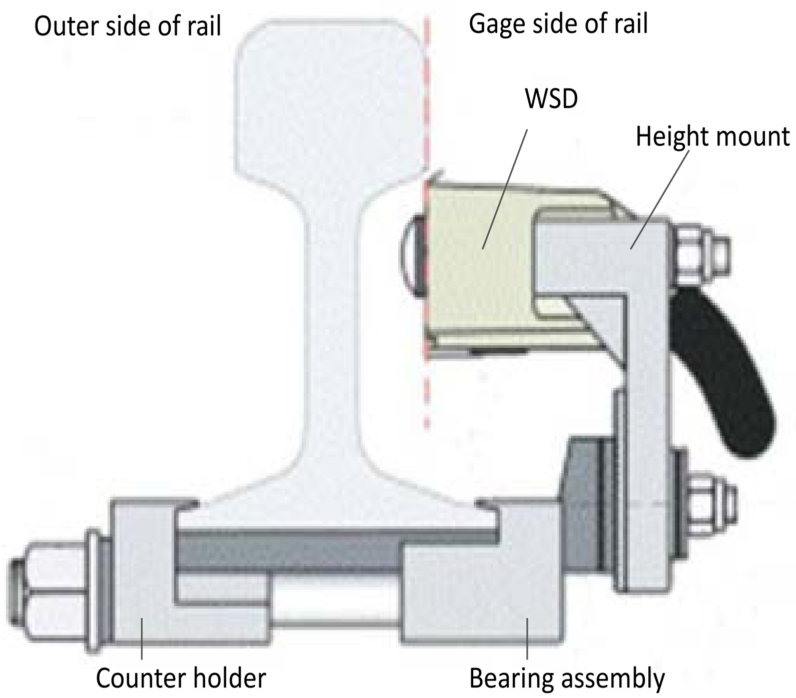
Planning stipulates whether rail web or rail base attachment is to be used. The rail base attachment is rail specific. The correct rail base bracket is to be used with the correct rail type. Both types of mountings are shown in figures 3 and 4.



The rail web mount consists of:

Adapter plate
Fastening bolts
Washers
Prevailing torque-type nuts
Shim (if required)

Figure 3 – Rail Web Mounting of WSD



The rail base mount consists of:

Wheel detector
Fastening bolts
Washers
Prevailing torque type nuts
Counter holder
Damping plate
Studs
Height Mount
Seperator
Bearing assembly
Nuts
Bearing plate
Courugated plate
Reducing plate

Figure 4 – Rail Base Mounting of WSD

Special Tools Required (Web and Base Mounting)

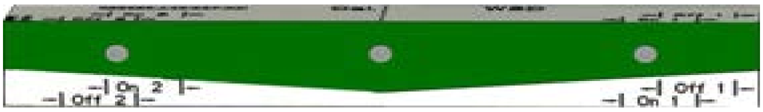
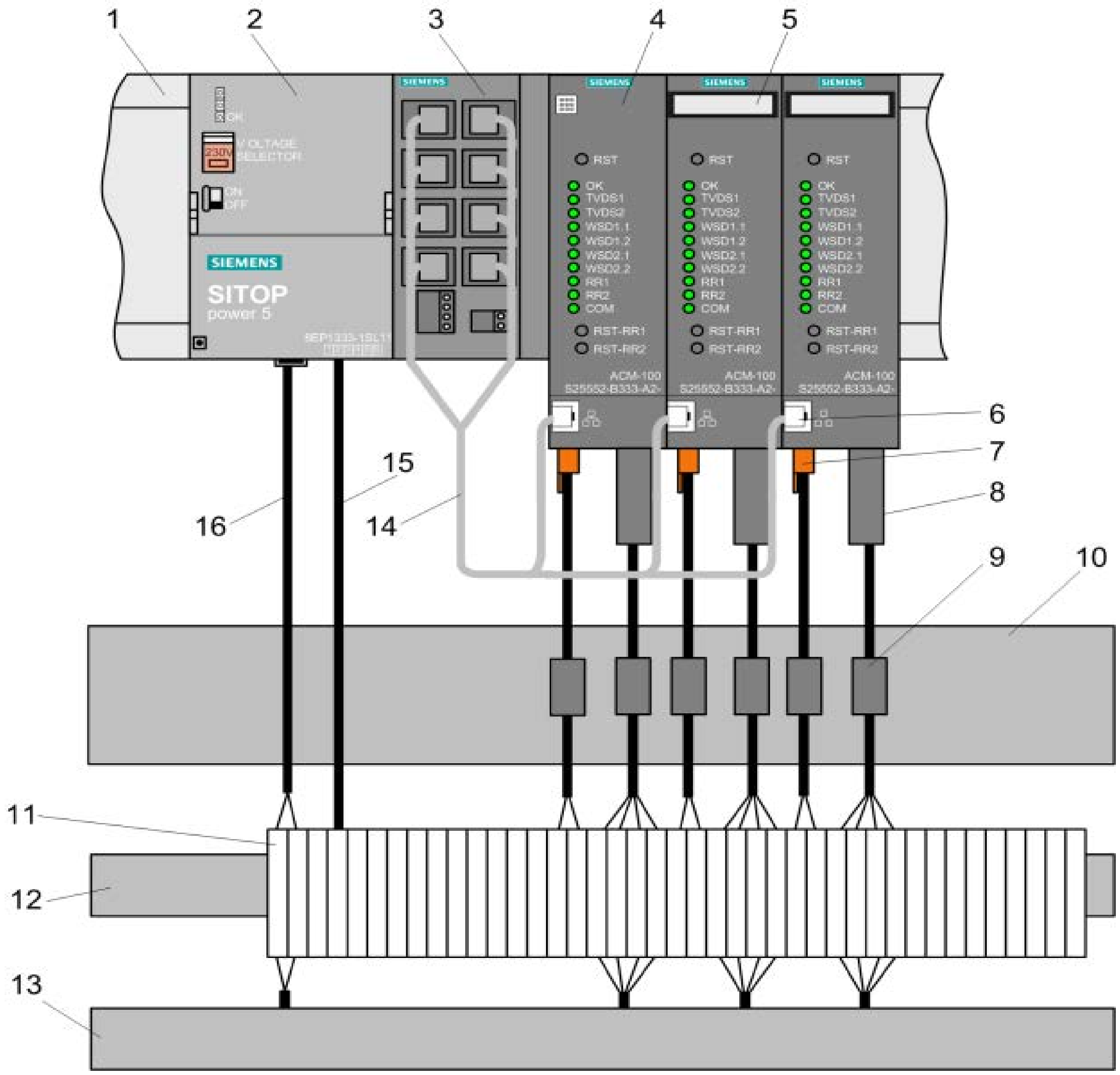


Figure 5 –Adjustment gauge C25326-A43-B27

How to Calibrate

For a full description of this process, see NR/SMS/Test/038.

Indoor Equipment



1	122 mm mounting rail		9	Surge protection
2	Power supply board		10	Mounting rail
3	Switch		11	Terminal
4	ACM100 (axle counter module)		12	Terminal strip
5	ID plug		13	Cable duct
6	Ethernet socket		14	Ethernet cable
7	Power supply connector		15	Power supply (24 V DC)
8	Process connector		16	Power supply (230 V AC)

Figure 6 – Indoor Equipment

ACM100 Evaluator

The Indoor equipment consists of a combination of standard modules (ACM100) which form an axle counting system. The ACM100, see above, has the following functions:

- Evaluation of the signal pulses transmitted by the wheel detection components
- Comparison of the number of axles counted into a track vacancy detection section with the number of axles counted out.
- Monitoring of the track vacancy detection sections and output of the clear and occupied indications.
- ACM100 has a 2-out-of-2 computer configuration, based on the fail-safe Simis principle.
- The process data (passage of a wheel) is detected by the WSD, processed and transmitted to the assigned ACM100. The ACM100 processes and evaluates the WSD signals and indicates the results to the interlocking.

Figure 7 – ACM100 Evaluator

Conditional and unconditional resets can be realised as inputs from the interlocking. The reset restriction can be cancelled from the interlocking using an optional dual-channel auxiliary axle count reset (AZGH) operation. This is also possible directly on the ACM100.

Front Panel

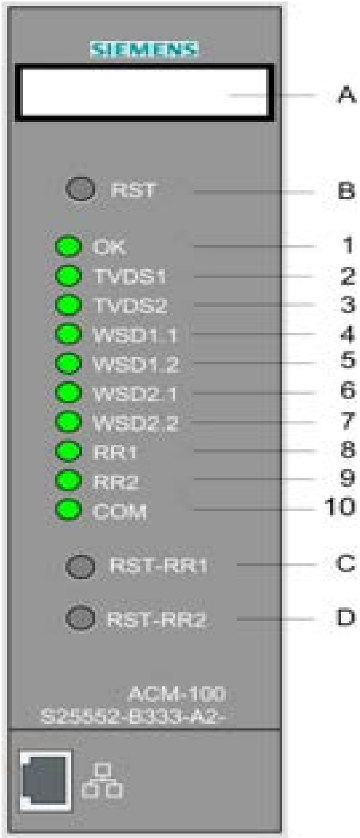


Figure 8 – ACM100 Front Panel

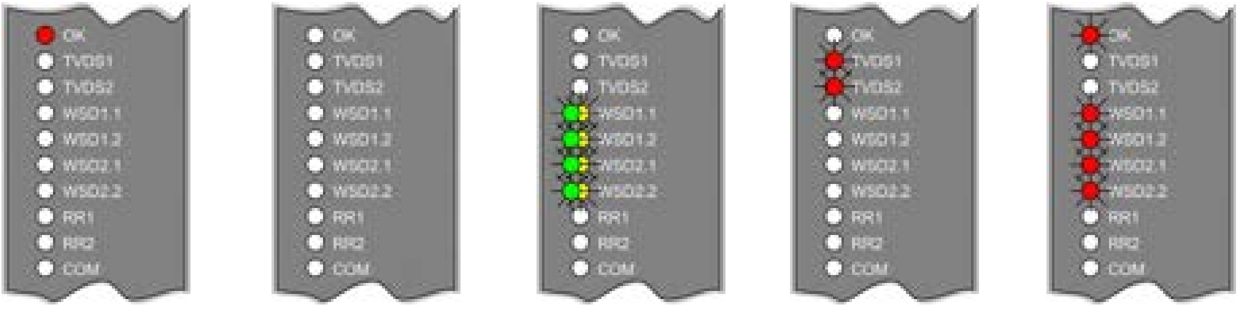
Item	Element	LED Condition	Meaning
A	ID plug		Configuring connector with lettering field
B	RST		Reset button (resets the ACM100)
1	OK LED	Steady green	ACM100 OK
		Flashing green	Configuration acceptance mode
		Flashing yellow	Configuration mode
		Flashing red	ACM100 faulty
		Steady red	Safety cut-off
2	TVDS1 LED	**Track vacancy detection section 1**	
		Steady green	Clear
		Flashing green	Clear and WDME
		Steady yellow	Occupied
		Flashing yellow	Occupied and WDME
		Steady red	Occupied (restart, commissioning); axle count reset required
		Flashing red	Occupied (faulty, e.g. minus axle), axle count reset required
		For safety-related information	
		Steady green	Safety-related information active
		Steady yellow	Safety-related information inactive
		Flashing red	Connection failure
		For WSD "pulse detected" indication	
		Steady green	Pulses
		Steady yellow	Pulse-free

Item	Element	LED Condition	Meaning
3	TVDS2 LED	**Track vacancy detection section 2**	Refer to TVDS1
4	WSD1.1 LED	**WSD wheel detector 1 (channel 1)**	
		Steady green	Pulse-free (No wheel detected)
		Flashing green	Pulse-free & WDME (No wheel detected with diagnostic information)
		Steady yellow	Pulses (Wheel detected)
		Flashing yellow	Pulses & WDME (Wheel detected with diagnostic information)
		Flashing red	Fault detected
		Steady red	WSD or cable faulty
5	WSD1.2 LED	**WSD wheel detector 1 (channel 2)**	Refer to WSD1.1
6	WSD2.1 LED	**WSD wheel detector 2 (channel 1)**	Refer to WSD1.1
7	WSD2.2 LED	**WSD wheel detector 2 (channel 2)**	Refer to WSD1.1
8	RR1 LED	**Reset restriction 1 (RR indication for TVDS 1)**	
		Steady yellow	Reset restriction
		Flashing red	Button fault and reset restriction
		For safety-related information and WSD "pulse detected" indication	
		Steady green	No button fault
		Steady red	Button fault
		For no TVDS and no safety-related information	
		Steady red	Button fault
9	RR2 LED	**Reset restriction 2 (RR indication for TVDS 2)**	Refer to RR1
10	COM LED	**Communication**	
		Steady green	All fail-safe connections OK
		Steady yellow	≥ 1 fail-safe connection has failed
		Steady red	Fault in computer unit
		Flashing red	No physical connection
C	RST-RR1	Reset button for reset restriction 1	Cancelation of reset restriction for TVDS 1 (AZGH) As from ERL 6, for confirmation after replacement of an ACM100
D	RST-RR2	Reset button for reset restriction 2	Cancelation of reset restriction for TVDS 2 (AZGH) As from ERL 6, for confirmation after replacement of an ACM100

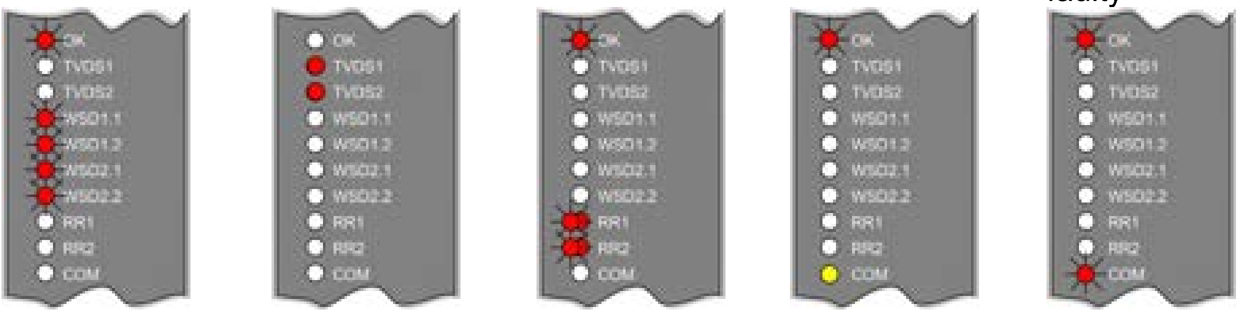
Table 2 – LED Indications and Meaning

Diagnostic Overview

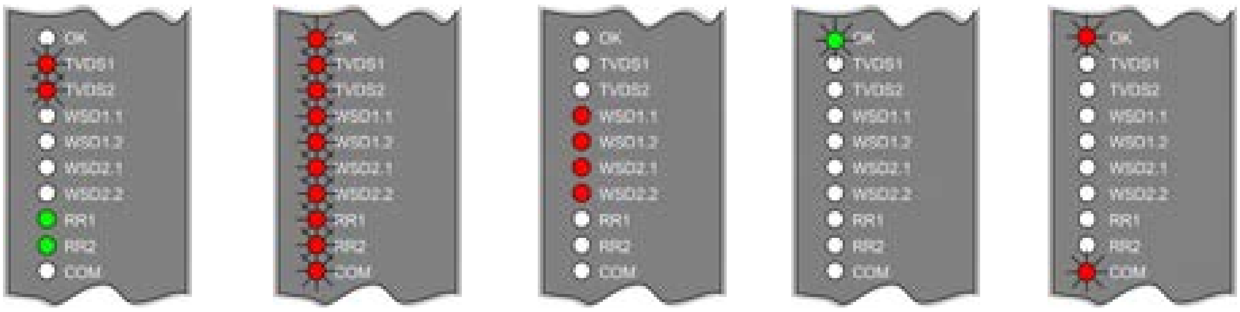
Figure 9 shows the LED fault indication status.



ACM100 has failed | Power supply board has failed | WSD wheel detector faulty | Track vacancy detection section faulty | ERL 4: ACM100 blocked or faulty



As from ERL 5:ACM100 faulty) | Track vacancy detection section permanently occupied | Button fault | Connection to partner ACM100 has failed | Ethernet connection interrupted



SRI has failed | ID plug faulty | WSD wheel detector(s) or cable faulty | Configuration acceptance mode | Replacement of ACM100

Key - LED representation:

A: LED shows a steady red light
B: LED shows a flashing red light
C: LED shows a steady or flashing red light
D: LED shows a flashing green or yellow light
(all indications with other colours are possible)

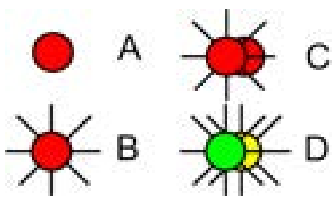


Figure 9 – LED fault indication status

Reset Procedure

The resetting of the Siemens ACM100 axle counter is performed by the signaller.

The reset procedure shall be performed when:

a) An axle counter section remains occupied after the passage of a train when the track section is 'clear'.

b) Requested by the technician after faults.

Power Supply

The power supplies from the Simatic S7-300 range supply the power required for the ACM100 system. From the input voltage, they generate a supply voltage of 24 V DC. Different types of power supplies are used depending on the application variant. The green LED on the front panel indicates that an output voltage is present.

Figure 10 – Power Supply

Figure 11 – Front Panel

Item	Element	Meaning / function	State in normal operation
1	DC 24 V LED	24 V DC output voltage is present	On
2	ON / OFF switch	On / off switch for 24 V DC	-
3	Terminals	Connection of mains voltage and protective earth conductor	-
4	Terminals	Connection for 24 V DC	-
5	Terminal	Strain relief for cables	-

Table 3 – Front Panel (flap open)

Diagnostic Indicators

See ACM diagnostic overview for LED indication.

c) If …	d) Then …
all LEDs on other ACMs are off as well,	The power supply board is faulty. • Check the power supply board
all LEDs on only one ACM are off,	The ACM has failed or the cable connection is interrupted. First: • Replace the ACM.
the LEDs still remain off after ACM replacement,	The cable connection is interrupted. Check the cable connection between the ACM and the power supply board. • Check the connectors and check them for a secure fit. • Perform a visual inspection to see if there is any damage (kinks, cable jammed, insulation damaged). • Replace any faulty parts.

Table 4 – Diagnostic Indicators

Battery Module

Weight	3.2 kg / 7 lbs.
Overall dimensions	W 190 mm H 151 mm D approx. 82 mm
Battery	2 pcs, maintenance free AGM batteries 12V/3,2Ah
Type	Yuasa NP3, 2-12 or B. B. Battery BP3, 6-12
Fuse	Blade fuse 15A

Table 5 – Battery Details

Figure 12 – Battery Module

Permitted temperature	Operation -15...+50°C storage/ transport -20...+50°C. Operating conditions acc. to EN 60721-3-3, climate model 3K3, no condensation
Self-discharge	The self-discharge rate of the batteries is approx. 3% per month at a temperature of 20°C. This value depends on temperature and gets worse with increasing temperature and, resp., better with falling temperature.
Class of protection	III acc. to IEC 536; VDE 0106 Part 1 Preferably, the natural protective conductor connection through the fittings should be used. Degree of protection: IP00 acc. to IEC 529

Table 6 – Battery Operating Conditions

Uninterruptable Power Supply (UPS)

The DC-UPS module 6 is DIN rail mounted. If the 24V DC supply voltage fails or drops below the set cut-in threshold, the battery module, which is maintained at full charge in continuous supply mode, is connected in to supply the loads. The battery cut-in threshold, end-of-charge voltage, charging current and the buffering time are set via DIP-switches. A switch is provided for setting a defined buffering (stored energy) time with subsequent disconnection of the battery.
The operating states of the DC-UPS module 6 are signalled by four LEDs:

- Normal Operation (Green)
- 85% Charge (Green)
- Floating Operation (Yellow)
- Battery Not Ready (Red)

Figure 13 – UPS Module

"Normal operation" indicates the input voltage at the DC-UPS module is higher than the set cut-in threshold. The loads are being fed by the line-side power supply. If a battery module is connected, it is fully charged.

“>85% charge”, indicates the battery is charged more than 85% of its available capacity.

"Floating operation", indicates the input voltage is lower than the set cut-in threshold and the ACM100 equipment is being supplied by the battery module.

"Battery not ready" indicates one of the following, all of which require corrective maintenance:

- defective battery (battery voltage < 18.5V) or open circuit between battery and UPS module
- no battery module connected,
- reversed polarity

The interval for polling the operating state for "Battery not ready" is 20 seconds during normal operation. If a fault is rectified, the LED can remain lit for up to 20 seconds until updated at the next polling.

If the LED flashes in a 2s cycle, this indicates that the battery is defective, but still capable of floating operation. The specified hold-up times cannot be kept in such cases. **The battery module shall be replaced.**

The LED lit in **floating operation** means that the battery voltage has dropped to <20.4V and automatic disconnection to protect the battery is imminent.

When the battery has been disconnected due to overload, short circuit, exhaustive discharge protection or buffering timeout, all LEDs will switch off however the relay contact X2.4 – X2.5 will remain closed.

DIP Switch Settings

Note: L = switch positioned left (on) and R = switch positioned right (off).

Top DIP1, 2 & 3: Sets the cut-in threshold such that if the input voltage drops below this threshold the UPS module switches to the battery supply. The setting range is 22.0 to 25.5V DC in 0.5V steps -

Cut-in Voltage (V)	22.0	22.5	23.0	23.5	24.0	24.5	25.0	25.5
DIP1	R	R	R	R	L	L	L	L
DIP2	R	R	L	L	R	R	L	L
DIP3	R	L	R	L	R	L	R	L

Table 7 – DIP Switches (1)

Top DIP4, 5, 6, 7, 8 & 9: Sets the end of charge voltage threshold above which the battery stops charging. The setting range is 26.3 to 29.2V DC in 0.1V steps -

End of Charge Voltage (V)	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.2	27.3
DIP4	R	R	R	R	R	R	R	R	R	R	R
DIP5	R	R	R	R	R	R	R	R	R	R	L
DIP6	R	R	R	R	R	L	L	L	L	L	R
DIP7	R	R	R	R	L	R	R	R	R	L	R
DIP8	R	R	L	L	L	R	R	L	L	L	R
DIP9	R	L	R	L	R	R	L	R	L	R	R

Table 8 – DIP Switches (2)

End of Charge Voltage (V)	27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	28.4
DIP4	R	R	R	R	R	R	R	R	R	L	L
DIP5	L	L	L	L	L	L	L	L	L	L	L
DIP6	R	R	R	R	L	L	L	L	L	R	R
DIP7	R	R	R	L	R	R	R	R	L	R	R
DIP8	R	L	L	L	R	R	L	L	L	R	R
DIP9	L	R	L	R	R	L	R	L	R	R	L

Table 9 – DIP Switches (3)

End of Charge Voltage (V)	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2	29.3
DIP4	L	L	L	L	L	L	L	L	L
DIP5	L	L	L	L	L	L	L	L	L
DIP6	R	R	R	L	L	L	L	L	L
DIP7	R	R	L	R	R	R	R	L	L
DIP8	L	L	L	R	R	L	L	L	L
DIP9	R	L	R	R	L	R	L	R	L

Table 10 –DIP Switches (4)

Top DIP10: Sets the constant charging current for the battery module. Refer to the specific battery module documentation so the optimum setting is used. The settings are 0.2A DC (DIP10 = L) or 0.4A DC (DIP10 = R)

Bottom DIP1: During the battery supply output, sets if the time on battery is until its exhaustive discharge threshold or for a predetermined time (see below). The settings are predetermined time (DIP1 = L) or exhaustive (DIP1 = R).

Bottom DIP2, 3, 4, 5, 6 & 7: Sets the maximum time the battery supply output is on. The setting range is 5 seconds to 635 seconds in 10 second steps -

Time (seconds)	5	15	25	35	45	55	65	75	85	95	105	115	125	135
DIP2	R	R	R	R	R	R	R	R	R	R	R	R	R	R
DIP3	R	R	R	R	R	R	R	R	R	R	R	R	R	R
DIP4	R	R	R	R	R	R	R	R	L	L	L	L	L	L
DIP5	R	R	R	R	L	L	L	L	R	R	R	R	L	L
DIP6	R	R	L	L	R	R	L	L	R	R	L	L	R	R
DIP7	R	L	R	L	R	L	R	L	R	L	R	L	R	L

Time (seconds)	145	155	165	175	185	195	205	215	225	235	245	255	265	275
DIP2	R	R	R	R	R	R	R	R	R	R	R	R	R	R
DIP3	R	R	L	L	L	L	L	L	L	L	L	L	L	L
DIP4	L	L	R	R	R	R	R	R	R	R	L	L	L	L
DIP5	L	L	R	R	R	R	L	L	L	L	R	R	R	R
DIP6	L	L	R	R	L	L	R	R	L	L	R	R	L	L
DIP7	R	L	R	L	R	L	R	L	R	L	R	L	R	L

Time (seconds)	285	295	305	315	325	335	345	355	365	375	385	395	405	415
DIP2	R	R	R	R	L	L	L	L	L	L	L	L	L	L
DIP3	L	L	L	L	R	R	R	R	R	R	R	R	R	R
DIP4	L	L	L	L	R	R	R	R	R	R	R	R	L	L
DIP5	L	L	L	L	R	R	R	R	L	L	L	L	R	R
DIP6	R	R	L	L	R	R	L	L	R	R	L	L	R	R
DIP7	R	L	R	L	R	L	R	L	R	L	R	L	R	L

Time (seconds)	425	435	445	455	465	475	485	495	505	515	525	535	545	555
DIP2	L	L	L	L	L	L	L	L	L	L	L	L	L	L
DIP3	R	R	R	R	R	R	L	L	L	L	L	L	L	L
DIP4	L	L	L	L	L	L	R	R	R	R	R	R	R	R
DIP5	R	R	L	L	L	L	R	R	R	R	L	L	L	L
DIP6	L	L	R	R	L	L	R	R	L	L	R	R	L	L
DIP7	R	L	R	L	R	L	R	L	R	L	R	L	R	L

Time (seconds)	565	575	585	595	605	615	625	635
DIP2	L	L	L	L	L	L	L	L
DIP3	L	L	L	L	L	L	L	L
DIP4	L	L	L	L	L	L	L	L
DIP5	R	R	R	R	L	L	L	L
DIP6	R	R	L	L	R	R	L	L
DIP7	R	L	R	L	R	L	R	L

Table 11 – DIP Switches (5)

Bottom DIP8: Sets if the battery supply output maximum time is reduced by 5 seconds. The settings are 5 second reduction (DIP8 = L) or no reduction (DIP8 = R).

Bottom DIP9: Sets the operational state of the battery when supplying the output. The settings are fully functional (DIP9 = L) or no battery output (DIP9 = R).

Ethernet Switch

The ACMs are connected using the Scalance Ethernet switches. ACMs are connected to the switch via RJ45 sockets. For diagnostic purposes, a service PC or laptop can be connected to the switch. The power supply is connected via terminals.

The operating and display elements (LEDs, buttons) depend on the type of switch used. Detailed information may be found in the documentation for the relevant switch.

See ACM diagnostics overview for LED indication.

Figure 14 – Ethernet Switch

End

Includes:	All Thales Axle Counter Systems
Excludes:	All other types and makes of Axle Counter System

GENERAL

Thales equipment was previously known as Alcatel Systems.

1. Test Equipment (Where required)

There are certain items of specialist equipment required to complete all the testing on axle counter equipment; these are as follows:

a) Dummy Wheel (for the type of system to be tested).
b) Counting Test Unit (Not Essential).
c) Thales Test Unit.
d) Wago Termination Tool (do not use a screwdriver).
e) ISDN Dataline Tester.
f) Lineside Test Switch Box (silver suitcase, use with electronic meter).
g) Axle Counter Test Box (AzLM series).
h) Diagnostic PC.

2. Detection points (ZP)

A Thales detection point (ZP) is comprised of 2 field elements. A rail contact (count head), which is mounted to the rail, and a line side junction box (EAK) which is usually mounted in the cess of sometimes the 10ft. The 2 elements are connected via tail cables and together for the detection point (ZP).

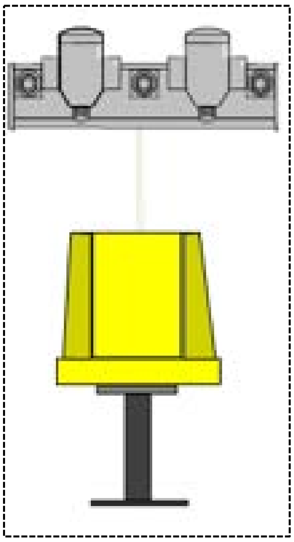


Figure 1 – ZP 30H Style

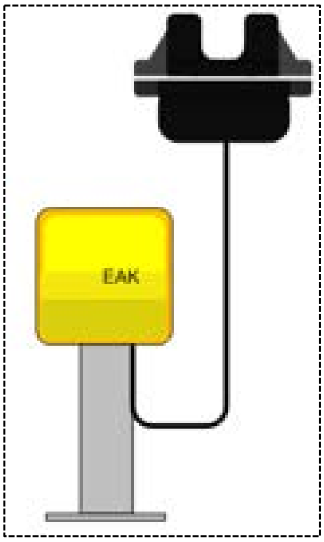


Figure 2 – ZP 30K Style

3. Rail Contacts (Count Heads)

Single rail contact systems are fitted with SK11 count heads and double rail contact systems with SK30. The latest types are the SK30H & SK30K types, which are backward compatible with the SK30 but with different voltage tolerances (MESSAB and PEGUE).

If SK30, SK30H & SK30K heads are fitted to bullhead rail a flux plate should also be fitted with them to obtain the correct phase reversal voltages (Where fitted).

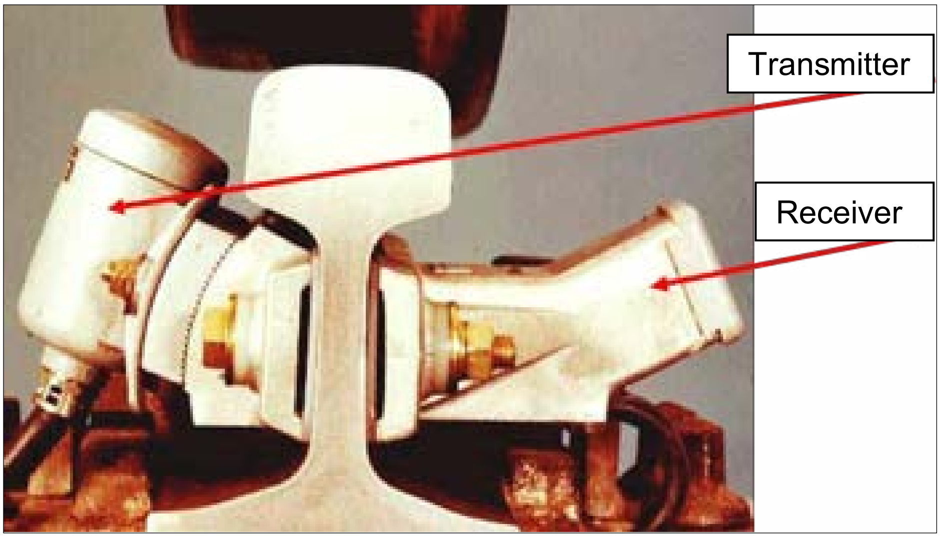


Figure 3 - View of Thales count heads (SK30H)

Figure 4 - View of Thales count heads (SK30K)

4. Lineside Junction Boxes (EAK)

The cable cores (from the rail contact cables) from the cable clamp to the terminations in the EAK are to be twisted together between these points. This is to reduce signal loss.

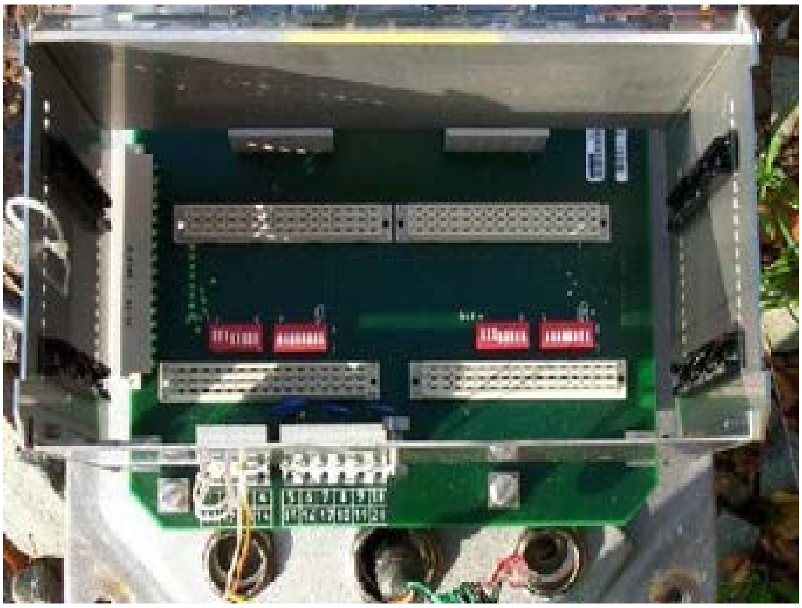


Figure 5 - Top View of the EAK30H Lineside Junction Box

The evaluator batteries and the EAK30H local power supply batteries (where provided) are ‘sealed for life’ and therefore apart from cleaning do not require maintenance.

Figure 6 - Top View of the EAK30K Lineside Junction Box

5. AzL70 Series

There are four versions of the AzL70 axle counters; they all work on the principle of counting in at one set of count heads and counting out at another. The count in and out information is processed in the evaluator, which feeds an output to a TPR. The different types are listed below:

AzL70 Single Rail Contacts:

This is the earliest type of the AzL70 series and is a two rail system (SK11 rail contacts on the 6ft and cess rails) with a stagger between the two rail contacts.

The stagger distance is chosen by the manufacture to enable the system to detect trains travelling at the highest specified speed.

This distance must not be altered from its original setting, if due to rail creep the stagger distance alters; arrangements must be made to correct it.

The rail contacts are connected to the evaluator via a four wire cable, the TX frequencies for each count head are the same thus the signals are sent back on separate wires to an AzL70 evaluator.

The lineside junction box is an EAK unit that does not have pluggable circuit cards.

AzL70 Double Rail Contacts:

This is a one rail version with SK30 rail contacts. Both of the rail contacts fixed to one rail (usually the cess). Again they are staggered but with both attached to one mounting plate the distance between them is pre-defined therefore rail creep is not a problem.

The lineside junction box is an EAK30 unit having pluggable cards. This unit enables signals of different frequencies to be sent along a common cable pair (a two-wire transmission system) to an AzL70 evaluator with amended configuration strapping.

AzL70/30 High Frequency Double Rail Contacts:

This is a single rail version with SK30 rail contacts. It uses an EAK30 lineside junction box with a two-wire transmission system to an AzL70/30 evaluator which has a different card configuration to the previous types.

AzL70/30S Voice Frequency Double Rail Contacts:

This is similar to the previous system but the outputs from the EAK30 units are at a lower frequency, therefore some of the cards in the EAK30 and evaluator are slightly different.

Because of the variations in type and updates that have occurred it is important that you check the part codes on any cards before replacing them.

Although the cards might look the same and have the same name, if the codes are different they are not inter changeable.

Evaluators

Before removing any card from an evaluator rack, it is necessary to power-down the rack equipment to avoid damage. This is done by removing the fuse feeding the rack.

On all evaluators the count indicator board (ZIANZG) provides indication only, it is not required for operation of the axle counter system therefore you may find that not all evaluators at a site are fitted with them.

AzL70 Evaluator

This evaluator is used on both the AzL70 one and two rail versions. Because of the EAK30 unit on the one rail contact system the evaluator although the same type for both systems has a different strapping configuration to handle the different frequencies involved.

AzL70/30 Evaluator

This type of evaluator differs from the AzL70 type by having a combined input set (LTV-E count in and LTV-A count out). The reset restrictions have also been revised (GRDFR in place of FRMKTR). The other cards in the system perform similar functions as in the AzL70.

6. AzLM Series

AzLM consists of the Axle Counter Evaluator (ACE) and one or more detection points.

There are two variants of the detection point which can be used electively within the AzLM; Zp30H or Zp30K.

The ACE is available with a 2oo2 (Parallel) or 2oo3 (WNC) architecture.

The ACE architecture can be centralised or distributed. A centralised solution can use the Convertor ISDN / Ethernet (CIE).

A detection point DP consists of an Electronic Junction Box (EAK) and rail contacts Sk with cable:

a) Detection point Zp30H with rail contacts Sk30, Sk30H and Sk30K (with new analogue card).

b) Detection point Zp30K with rail contacts Sk30K

Up to 32 sections can be supervised from one ACE. An ACE reports the state of a section via a parallel relay interface to a relay interlocking.

7. AzLE Series

This type of evaluator unit can be used with either ZP30H or ZP30K type detection points. It can be located either in an axle counter REB or a trackside location case.

The unit is the same size as an AzLM 2-10 and manages up to 8 sections and 12 detection points.

Although still a 2 out of 2 evaluator with relay interface, it differs to the AzLM by using modem and section boards as opposed to serial, CPU and parallel boards.

Interface to the detection point is achieved via 2 x copper wire ISDN, however no PDCU is required as surge/lightening protection is built into the modem boards. Site specific data is stored on a programme plug as opposed to a compact flash card.

Detection point power supply: The AzLE subrack can accommodate up to 3 detection point power supply boards. Each detection point power supply board can remotely supply a maximum of 4 detection points (ZPs)

Internal power supply board: The AzLE subrack can accommodate up to 2 internal power boards to supply the modem and section boards. The number of required in internal power boards is dependent on how many section and modem boards are to installed.

Section board: The AzLE subrack can accommodate up to 4 section boards. Each section board performs as a 2 out of 2 system and can supervise up to 2 sections dependant on configuration. The section board can be configured for 2 or 3 vital relay outputs and has vital inputs similar to the AzLM. Non vital outputs are also available and configurable.

Modem board: The AzLE subrack can accommodate up to 3 modem boards which perform the interface to the detection point (ZP) via ISDN. Each modem board can connect up to 4 detection points and is configurable to forward the information of 1 of these detection points to another subrack.

Reset procedures are similar to that of AzLM.

Subrack:

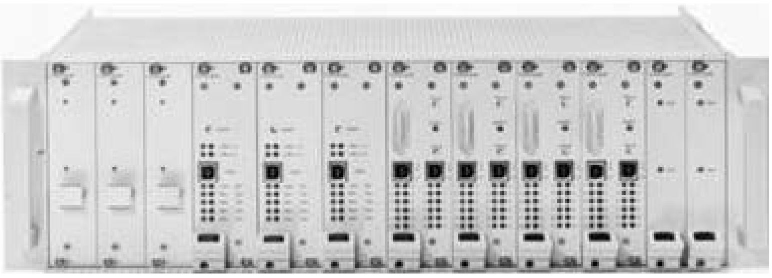


Figure 7 - Subrack

Figure 8 – Modem Board

Figure 9 – Section Board

Figure 10 - Detection Point Power Supply Board

Figure 11 - Internal Supply Board

8. Abbreviations Found in AzL Axle Counters

Abbreviation	Meaning
2oo2	2 out of 2
2oo3	2 out of 3
ACE	Axle Counter Evaluator
AZA	
AzLM	Multi Section Axle Counter
BG	Printed Circuit Board (PCB)
BGT	Sub rack
CPU	Central Processing Unit
DC	Direct Current
DP	Detection Point
E/A	Input/Output
EAK	Electronic Junction Box
E-Es	Electronic Module
I/O	Input/Output
KL	Terminal
S/E	Transmitter/Receiver
SK	Rail Contact
SSI	Solid State Interlocking
SV	Power Supply
VCC	Supply Voltage
Zp	Detection Point
ZpR	CPU in the detection Point

This list is not exhaustive; reference should be made to the appropriate system manuals for abbreviations not listed.

9. AzL70/30 EAK30 Junction Box Cards

Viewed left to right:

Card	Function
SE01	Tx/Rx for Count Head SK1
SE02	Tx/Rx for Count Head SK2
LtAnp	Cable Adaptor
SV	Power Supply

10. AZL70 Evaluator Rack Cards

Viewed left to right:

Card	Function
FRMKTR	Reset Restriction
ANP	Part Input Set
EV	Part Input Set
DIS	Part Input Set
	Repeat of above 3 cards for each input
ZST	Counter Control
Biz	Binary Counter
Biz	Binary Counter
UMO	Translator
KTR	Checking
AS	Output
ZIANZG	(If Fitted) Count Indication
WDH	Repeater
BUPL	Test Points
SIPL	Fuses
SVB	Power Supply B
SVA	Power Supply A
SBG	Filters

11. AzL70/30 Evaluator Rack Cards

Card	Function
GDRFR	Reset Restriction
LTV-E	Line Amplifier Count In
Dis	Discriminator
LTV-A	Line Amplifier Count Out
Dis	Discriminator
	Space (see note)
ZST	Counter Control
Biz	Binary Counter
Biz	Binary Counter
UMO	Translator
KTR	Checking
AS	Output
ZIANZG	(If Fitted) Count Indication
WDH	Repeater
BUPL	Test Points
SIPL	Fuses
SVB	Power Supply B
SVA	Power Supply A
SBG	Filters

If extra count heads for counting out are fitted (e.g. over a set of points) the LTV-A and Dis cards for this count head are fitted here.

12. LED Indications : SK30H

PCB	LED Position	LED Colour Status	What The Led Status Is Indicating	Normal Operating Led Status Without Wheel Influence
Analogue Card (Anpassung)	H1/1	Red	Wheel on Sk1	Off
	H1/2	Green	MESSAB1 in tolerance of PEGUE 1	Flashing
	H2/1	Red	Wheel on Sk2	Off
	H2/2	Green	MESSAB2 in tolerance of PEGUE 2	Flashing
	H3/1	Red	H24V out of tolerance	Off
	H3/2	Green	H5V O.K. / available	On
Digital Card (Auswertung)	H1/1	Green	Transmitting data, connection to ACE available	Flashing
	H1/2	Green	Self-test of CPU 1 not successful	Off
	H2/1	Green	Transmitting data, connection to ACE available	Flashing
	H2/2	Green	Self-test of CPU 2 not successful	Off

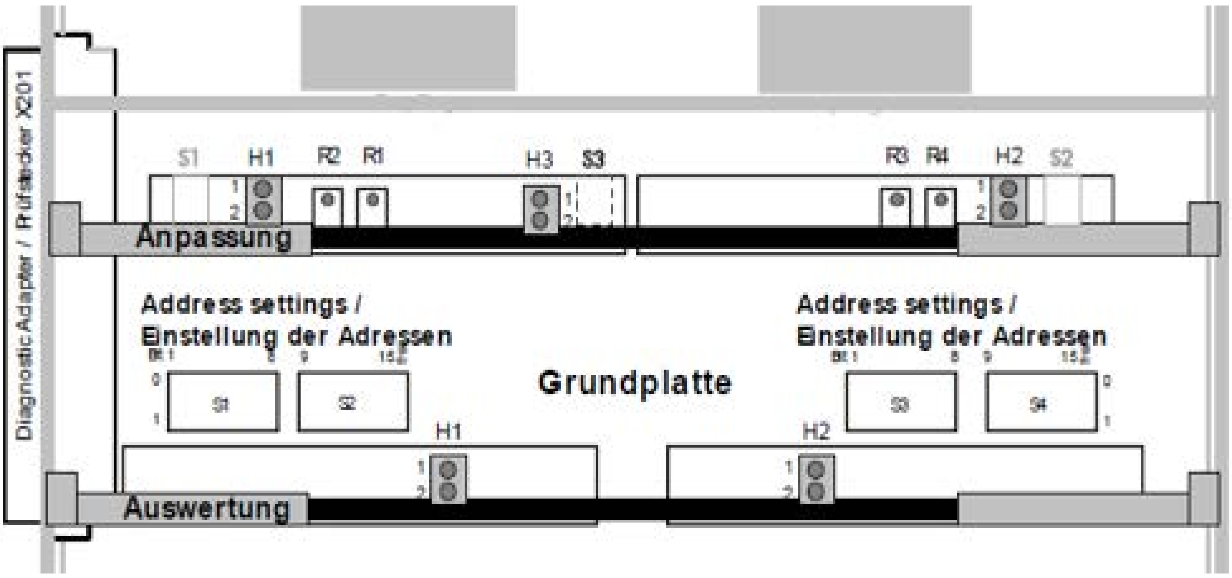


Figure 12 - Position of SK30H LED’s

13. LED Indications : SK30K

PCB	LED Position	LED Colour Status	What The Led Status Is Indicating	Normal Operating Led Status Without Wheel Influence
Analogue Part	H11	Red	wheel on Sk1	Off
	H1	Green	MESSAB1 in tolerance of PEGUE 1	Flashing
	H8	Red	Illuminate during fault conditions (Short circuit on Sk1)	Off
	H12	Red	wheel on Sk2	Off
	H2	Green	MESSAB2 in tolerance or PEGUE 2	Flashing
	H9	Red	Illuminate during fault conditions (Short circuit on Sk2)	Off
	H3	Red	H24V out of tolerance	Off
	H10	Green	H5V o.k. / Available	On
Digital Part	H4	Green	Transmitting data, connection to ACE available	Flashing
	H14	Red	Self-test of CPU 1 not successful	Off
	H6	Green	Transmitting data, connection to ACE available	Flashing
	H16	Red	Self-test of CPU 1 not successful	Off

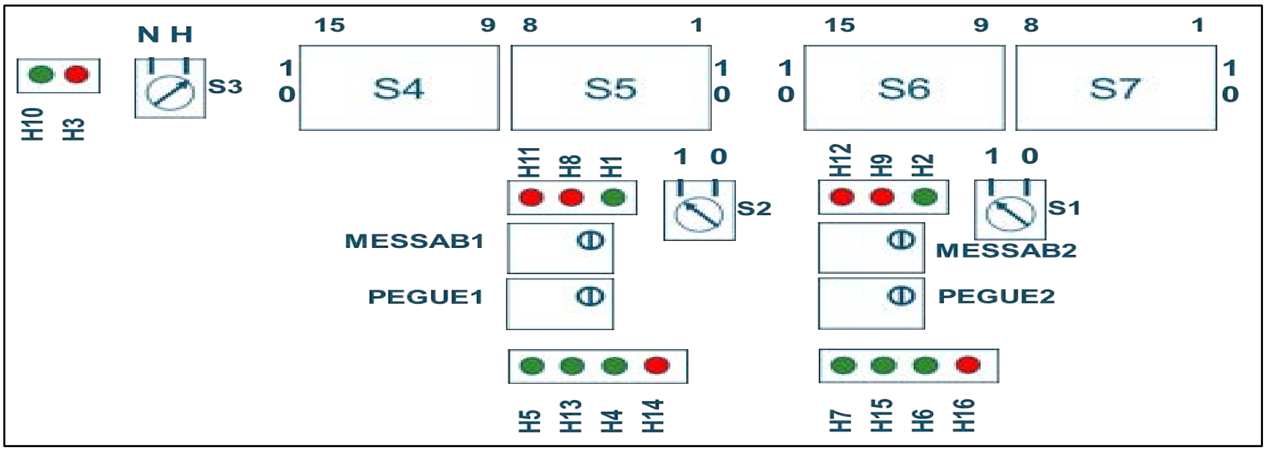


Figure 13 - Position of SK30K LED's

The switch positions on this card should be S1=1, S2=1, S3=H

14. LED Indications : Evaluator Serial I/O Card (Zp-Vorrechner)

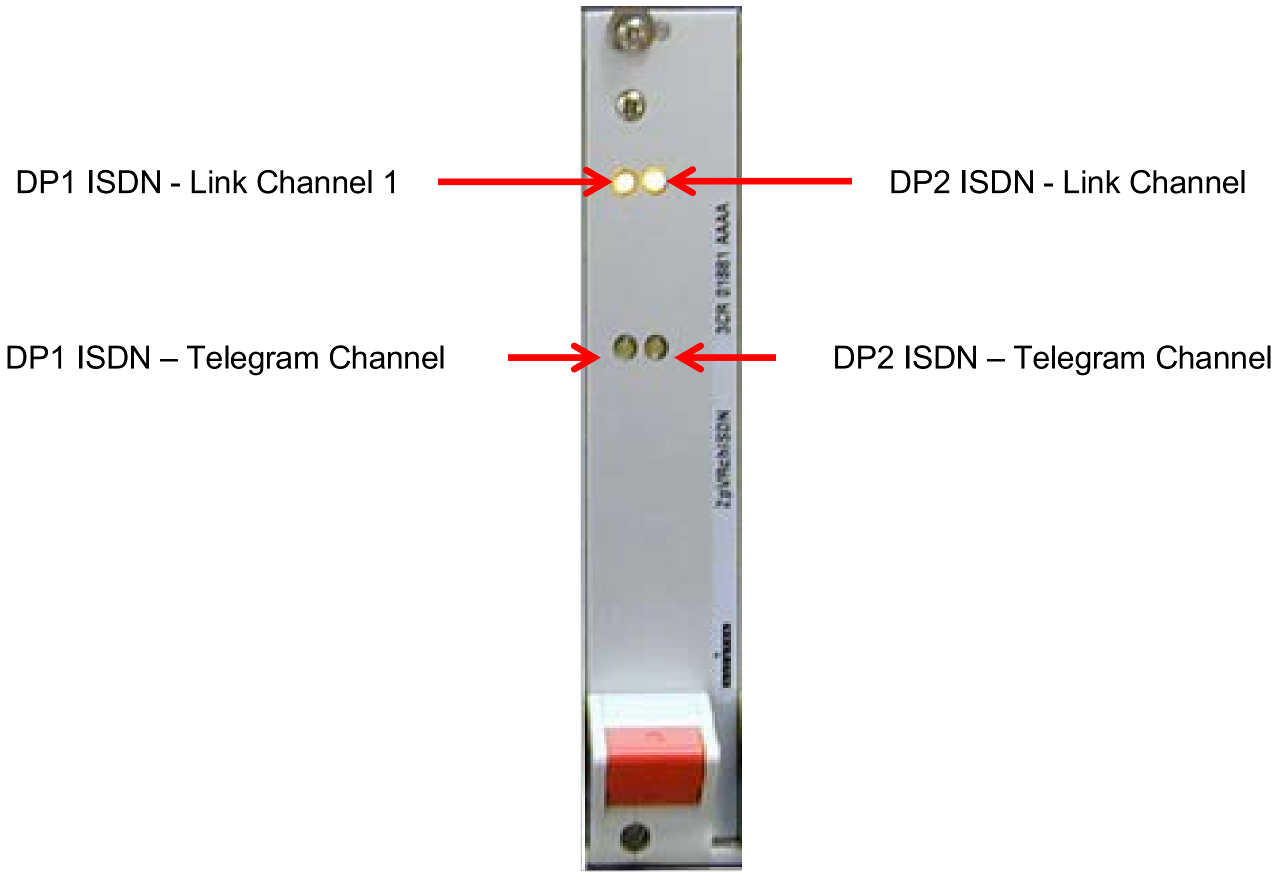


Figure 14

LED	Colour	State	Meaning
DP1 ISDN - Link Channel	**Yellow**	Extinguished	No ISDN link from Zp
		Illuminated	ISDN link operational
DP2 ISDN - Link Channel	**Yellow**	Extinguished	No ISDN link from Zp
		Illuminated	ISDN link operational
DP1 ISDN – Telegram Channel	**Yellow**	Illuminated / Extinguished	No valid telegram from Zp
		Pulsing	Valid telegram from Zp
DP2 ISDN – Telegram Channel	**Yellow**	Illuminated / Extinguished	No valid telegram from Zp
		Pulsing	Valid telegram from Zp

15. LED Indications : Evaluator Parallel I/O Card

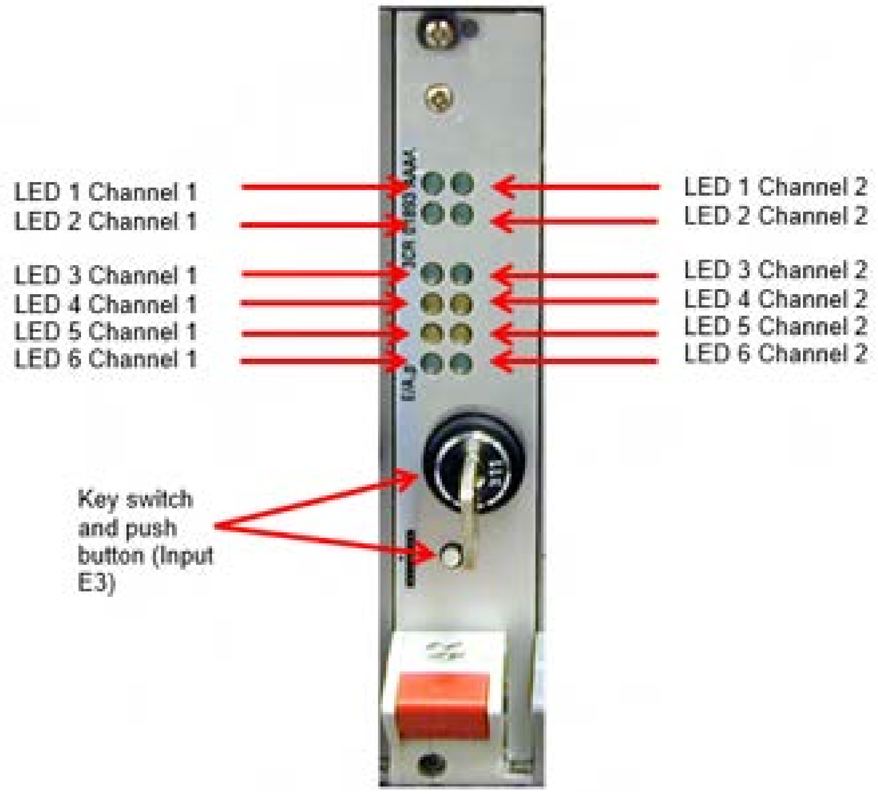


Figure 15

LED	Channel	Colour	State	Meaning
1	1 + 2	**Green**	Extinguished	External Input 1 not active
			Illuminated	External Input 1 active
2	1 + 2	**Green**	Extinguished	External Input 2 not active
			Illuminated	External Input 2 active
3	1 + 2	**Green**	Extinguished	Associated section is occupied
			Illuminated	Associated section is clear
4	1	**Yellow**	Illuminated	Non Vital Output 1 Energised
	2	**Yellow**	Illuminated	Non Vital Output 2 Energised
5	1	**Yellow**	Illuminated	Non Vital Output 3 Energised
	2	**Yellow**	Illuminated	Non Vital Output 4 Energised
6	1 + 2	**Yellow**	Illuminated/ Extinguished	Incorrect Polling of Input/Output
			Polling	Correct Polling of Input/Output

On earlier cards (V1.0.3) the only difference is rows 5 and 6, row 5 is polling and row 6 when illuminated indicates that the key switch and push button is active, its normal state should be extinguished.

Key switch/push button E3 can be configured as external input 3. The use of the function is controlled via Local Instruction. Interference with this key switch/button can cause locking of the inputs/outputs of the parallel card.

LED Indications: ACE DC to DC Power Cards

There are variants of this card in use at his time.

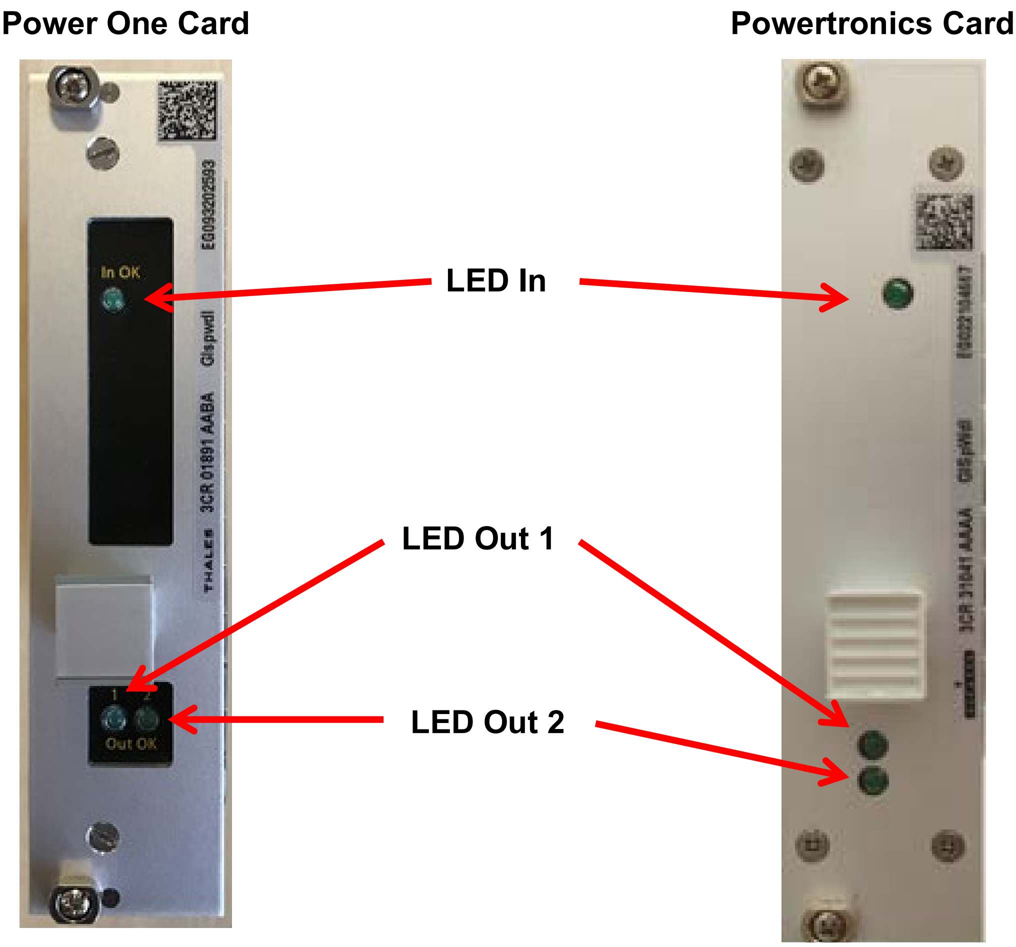


Figure 16

LED In	LED Out 1	LED Out 2	Function
Green	**Green**	**Green**	Normal Operation
Green	**Off**	**Green**	Temperature too high, over-load, over voltage output 1 or under voltage output 1
Green	**Green**	**Off**	Temperature too high, over-load, over voltage output 2/3 or under voltage output 2/3
Off	**Green**	**Green**	Not possible or “LED In” has failed
Off	**Off**	**Off**	No input voltage, input voltage too low, input open/high or voltage too high

If the PowerOne version of the DC/DC converter card is used it should be supplier version V106 or greater.

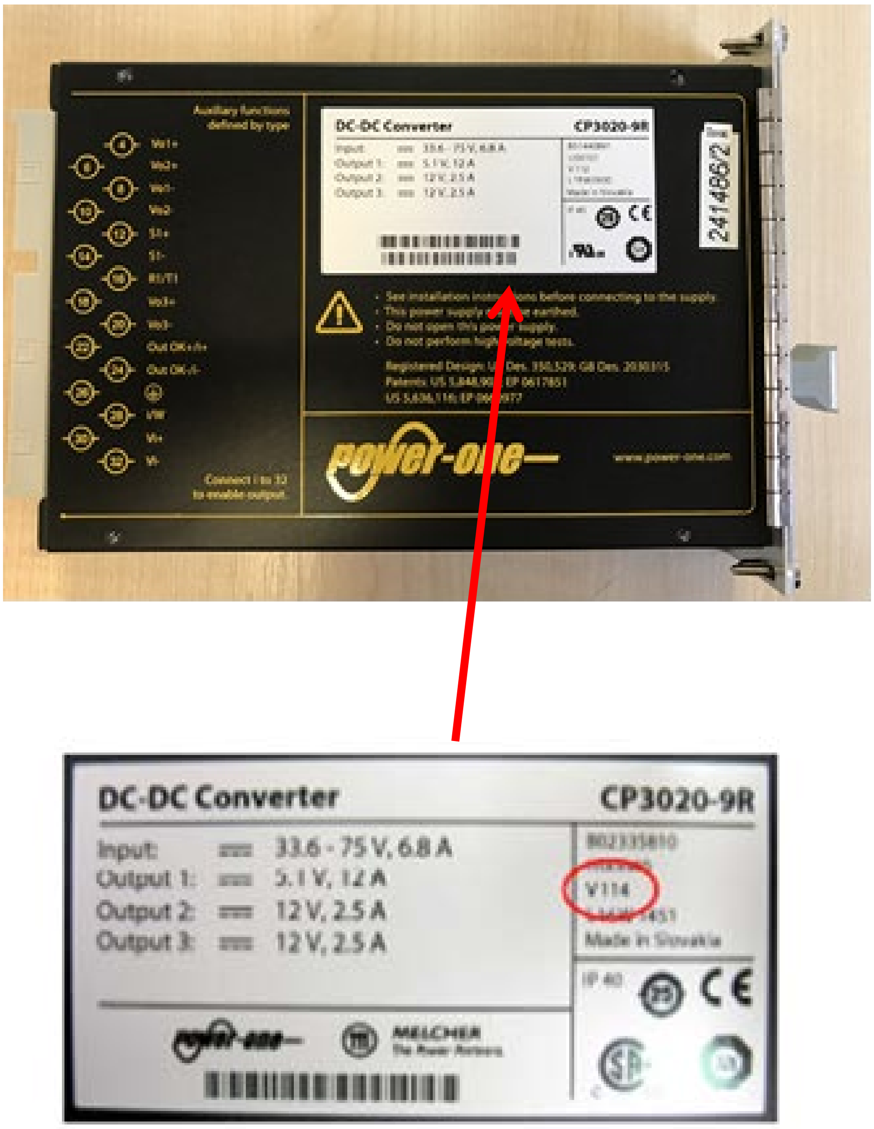


Figure 17

16. LED Indications: Evaluator CPU Cards (EP & EPCM Type)

EPCM CPU Card

EP CPU Card

Figure 18

Indication	Colour	State	Meaning
Alphanumeric Display	**Red**	Frozen bar	No CPU activity or CPU starting up
		*	
		Blank	
		Rotating bar	Correct CPU activity

Connectivity LED’s		
LED	**Colour**	**Meaning**
1		There is communication via the Ethernet Port
2		There is internal communication between CPU’s
3		There is internal communication between CPU’s
4		Thales use only

17. Single Channel Controller (SCC)

This board has been introduced due the obsolescence of the current EP (Embedded Pentium) & EPCM (Embedded Pentium Celeron Mobile) CPU's.

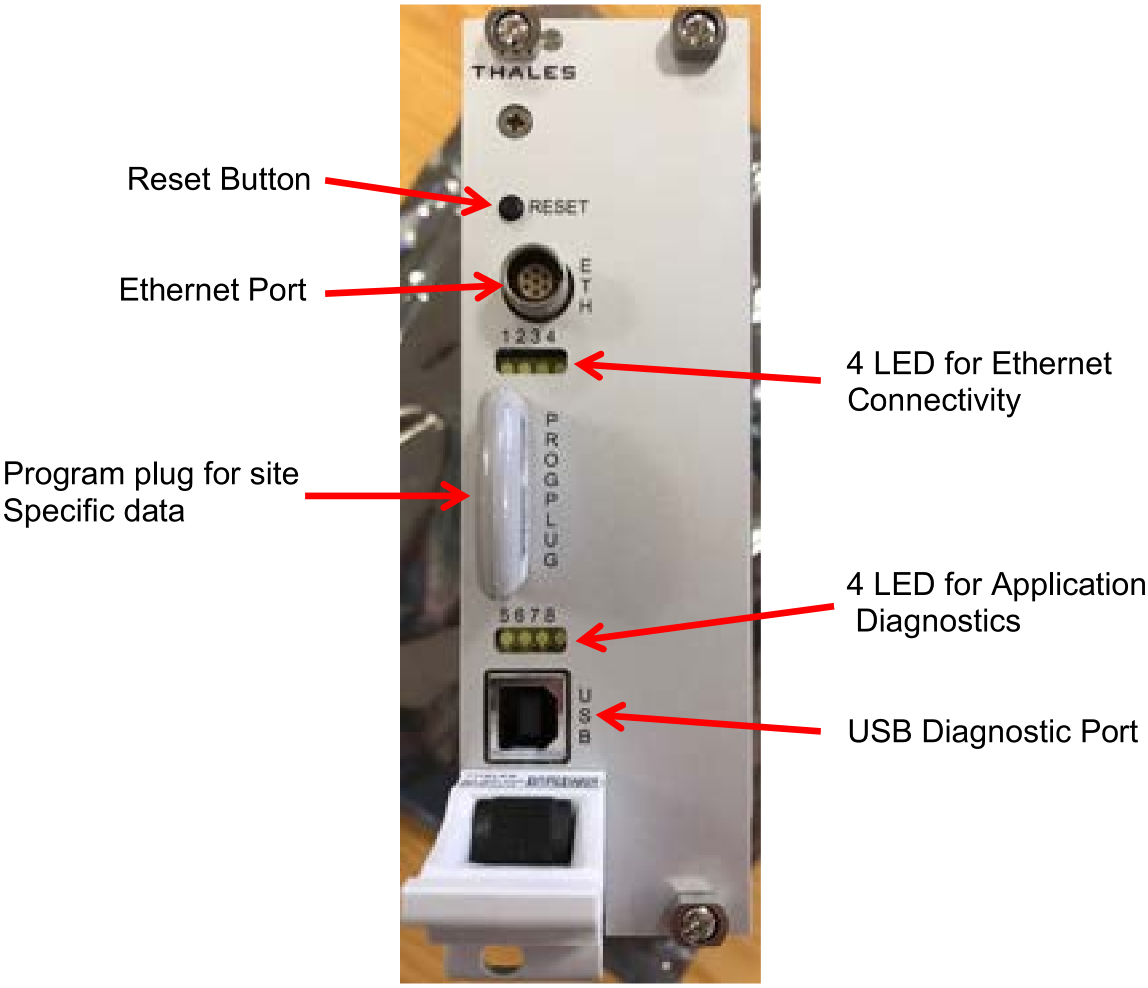


Figure 19

Connectivity LED's		
LED	**Colour**	**Meaning**
1		There is communication via the Ethernet Port
2		There is internal communication between CPU's
3		There is internal communication between CPU's
4		Thales use only
Diagnostic LED's		
LED	**Colour**	**Meaning**
5		These are polling LED's these indicate normal operation
6		
7		
8		

18. CPU Compatibility

There are four different types of CPU for the AzLM ACE:-

a) EP – (Embedded Pentium) Rev 1 (Commonly known as Rev A).
b) EP – (Embedded Pentium) Rev 2 (Commonly known as Rev B).
c) EPCM – (Embedded Pentium Celeron Mobile).
d) SCC – Single Chanel Controller.

These are to be installed in an ACE in pairs and are not mix and match. If CPU 2 only needs to be replaced it should be replaced with the same part number and rev / version number above. If this is not possible both CPUs should be replaced.

EP and EPCM CPUs use the serial connection of CPU 1 or Ethernet port of CPU2. The SCC board uses the USB on CPU 1 and Ethernet port of CPU2.

There are now three types of 128mb compact flash card, WD, Silicon Drive and Swissbit. WD and silicon drive and be mixed and matched in once ace.

19. Flash Cards Compatibility

Figure 20 – Swissbit Compact Flash Cards

Figure 21 – WD & Silicon Drive Compact Flash Cards

<u>Swissbit Type</u>

Swissbit can't be used with WD and silicon drive.

Swissbit cards can only be used by EPCM boards. For ACE's with Swissbit cards only EPCM CPU's can be used.

<u>WD (Western Digital) & Silicon Drive Types</u>

EP Rev 1, EP Rev 2 & EPCM can all use WD and Silicon drive.

	WD (Western Digital)	Silicone Drive	Swissbit
EP Rev 1	YES	YES	NO
EP Rev 2	YES	YES	NO
EPCM	YES	YES	YES
SCC	NO	NO	NO

Table – Compact Flash Card : Compatibility Matrix

<u>Program Plug Type</u>

SCC CPU uses a program plug and not a compact flash card. If the CPU needs to be changed from a EP Rev 1, EP Rev 2 & EPCM to SCC the data will need to be transferred from the compact flash card to the program plug and this must be completed by Thales.

20. Converter ISDN Ethernet (CIE) Card

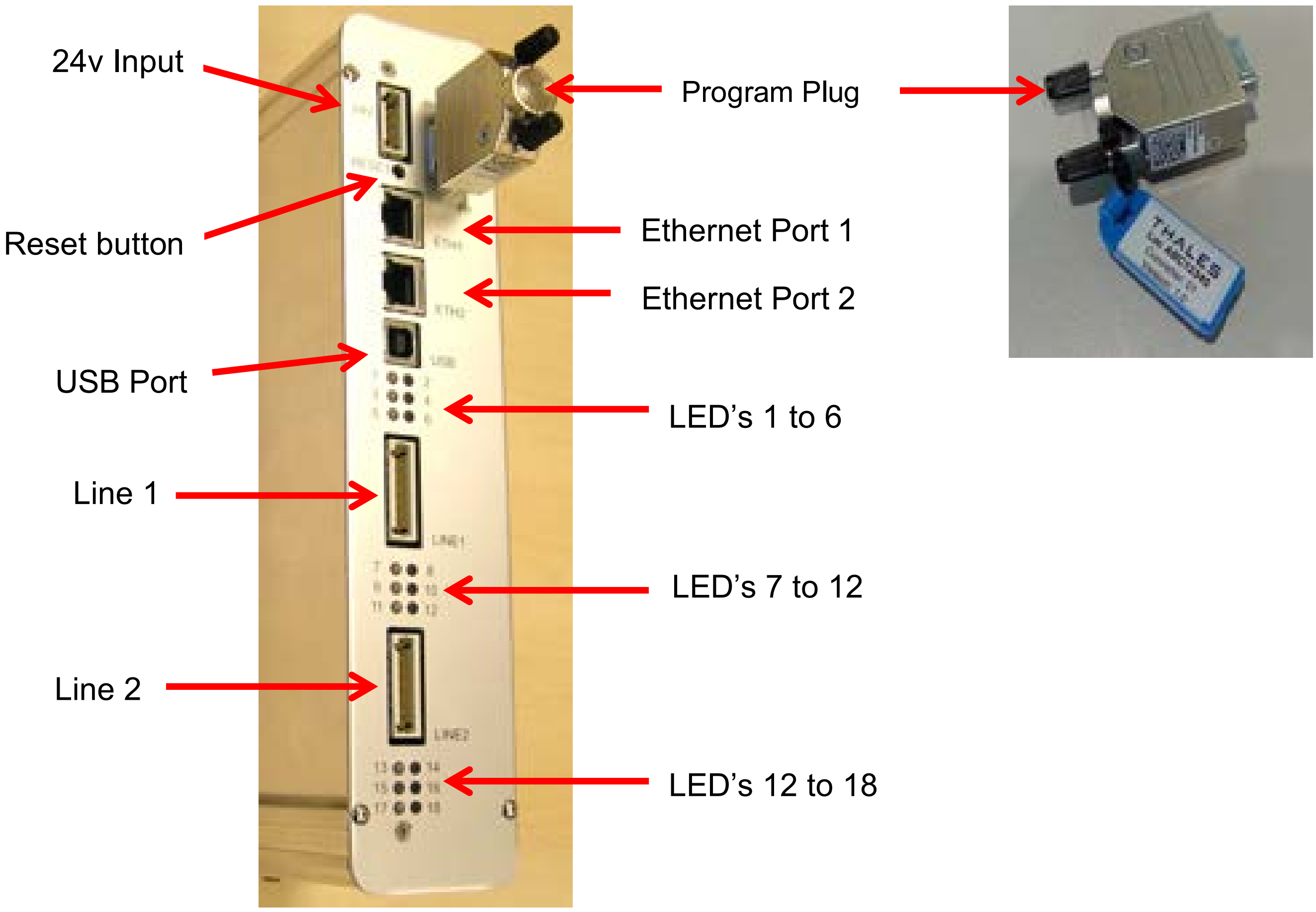


Figure 22

LED	Meaning	Normal Operation
1	Life signal CPU	**Green LED toggles** every second
2	Life signal CPU	**Yellow LED toggles** every second
3	PIC trigger	**Yellow LED toggles** every second
4	Not used	**Off**
5	24V redundant	**Green LED on**: Connected to 2 power supplies
6	24V non-redundant	**Off**: 24 V redundant available, LED 5 on.
7	Modem 1	**Green LED toggles** (every 200 ms) with each received correct telegram from modem 1 / 2.
8	Modem 2	
9	Not used	**Off**
10	DIP-Switches	**Off**
11	Line 1	**Green LED on**: ISDN connection modem 1 ok
12	Line 2	**Green LED on**: ISDN connection modem 2 ok
13	Fuse 1	**Off**
14	Fuse 1	**Red LED on**: Fuse Line 1 defect
15	Not used	**Off**
16	Not used	**Off**
17	Fuse 2	**Off**
18	Fuse 2	**Red LED on**: Fuse Line 2 defect

21. PDCU

Figure 23 - The Power Data Coupling Unit

22. ACE 2oo2 HEX Address's and CAN Numbers (If fitted)

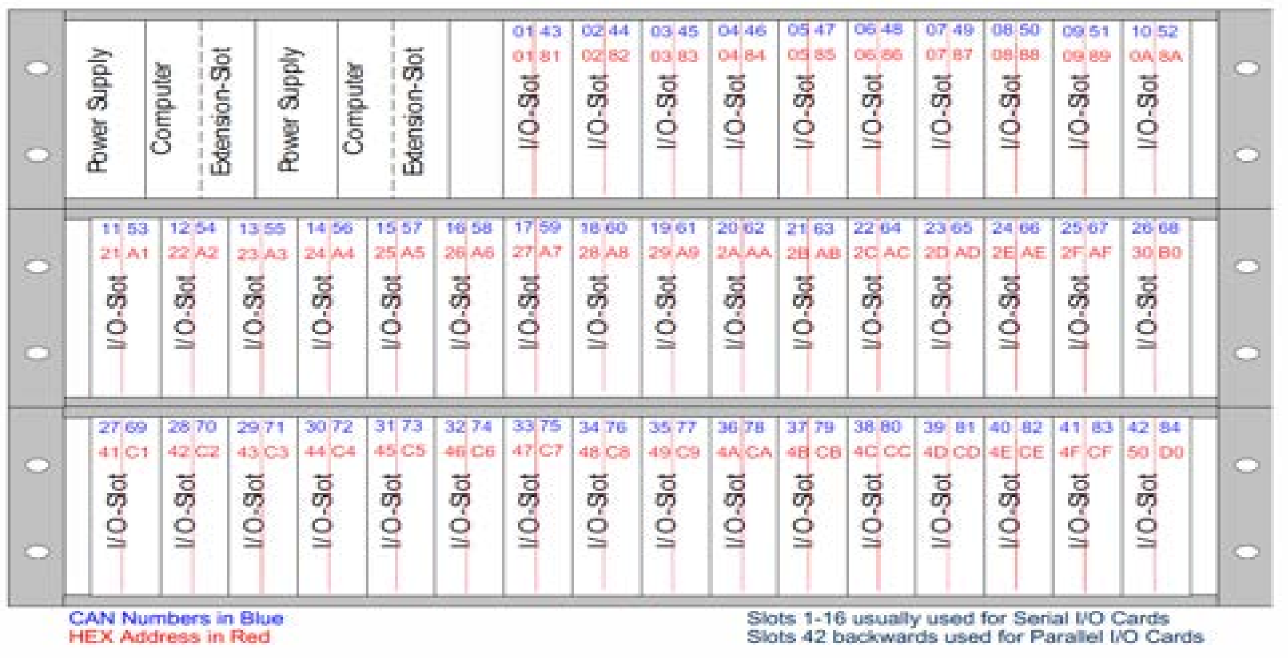


Figure 24

23. ACE 2oo3 HEX Address's and CAN Numbers (If fitted)

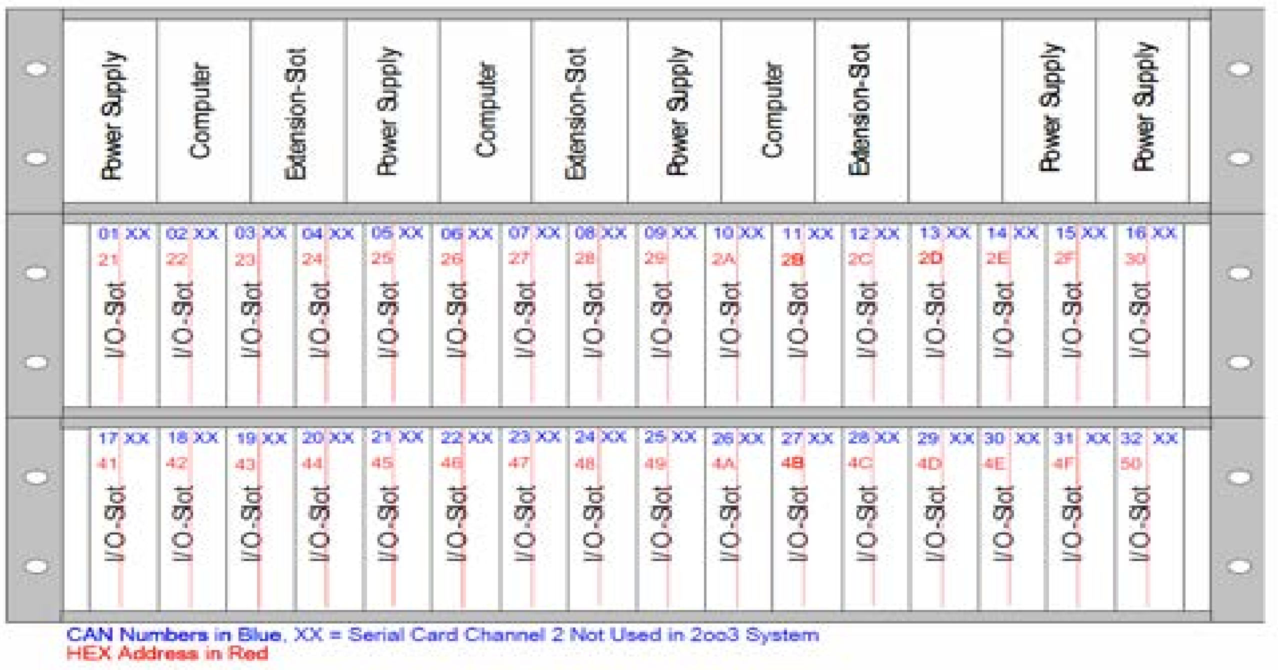


Figure 25

END

GENERAL

Harmon Crossing Processor

Figure 1 – The Harmon Crossing Processor (HXP) is a microprocessor based level crossing control system. Various models are available, however, only the HXP-3R and HXP-3R2 are currently in use on Network Rail infrastructure.

The '3' in the identity relates to these systems being from the Series 3 of the HXP systems – previous generations have been used in the United States – whilst the 'R' indicates that hardware redundancy is inherent within the units through the use of 'normal' and 'standby' systems.

The HXP-3R level crossing control system is able to control a level crossing on a single line. It should be thought of as being formed from two distinct parts, whilst the HXP-3R2 is able to control a level crossing on a double line railway. The HXP-3 comprises of either one (HXP-3R) or two (HXP-3R2) cabinets within which a series of modules, as described below, are contained.

Some modules are installed into predetermined slots within the cabinet and all modules shall be installed with the component side facing to the left.

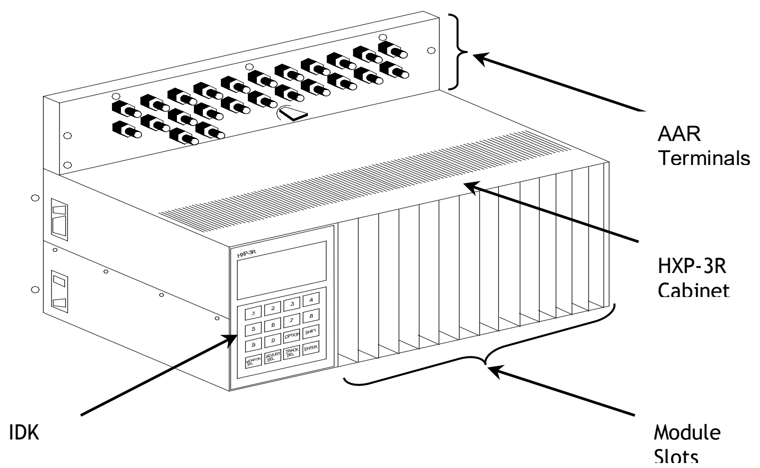


Figure 1 – HXP-3R

Central Processor Unit

The Central Processor Unit (CPU) controls the functions of the HXP-3. Both RAM and ROM memory for the system are located on this module along with non-volatile RAM for storing location specific parameters. Two CPU Modules (Normal and Standby) are installed next to each other in the HXP-3, the second acting as a backup for the first.

Serial Interface Module

The Serial Interface Module (SIM) is required to provide an interface between the HXP-3 and the Information Display Keypad (IDK). Its functions are controlled by a microprocessor located on the module. The SIM's memory is contained in Static RAM and can be accessed by microprocessors on either the CPU or the SIM. Two SIM Modules (Normal and Standby) are installed next to each other in the HXP-3, the second acting as a backup for the first.

Relay Driver Module

The Relay Driver Module (RYD) generates and controls the Motion Detector Relay Drive voltage, which is the main output of the HXP-3. System parameters are stored in Non-Volatile RAM located on this module. The module contains a power supply used to drive the HXP-3 circuits. Two RYD Modules (Normal and Standby) are installed next to each other in the HXP-3, the second acting as a backup for the first.

Transmitter Receiver Module

The Transmitter Receiver Module (TRM) serves as the Track transmitter and receiver for the HXP-3. Each track requires Two TRMs, one Normal and one Standby, to be installed into the HXP-3.

Random Signature Island Module

The Random Signature Island (RSI) Module provides Island relay control without requiring the selection of different operating frequencies. It contains a microprocessor, which triggers the transmitter to generate bursts of energy. These bursts of energy are of random frequency and duration in order to create a signature that can be selectively identified by the receiver, which monitors for the return of each signature. This allows the RSI to maintain Island operation without requiring different frequencies at adjacent Islands. The HXP-3 requires two RSI modules for each line of track present, the second acting as a backup for the first.

Transfer Logic Module

The Transfer Logic Module (TLM) monitors the Island transmitter and receiver currents along with the Island Relay Drive output and the MDR Drive output. If a fault is detected, the TLM transfers operation to the redundant system. All the power fuses in the HXP-3 are located on the TLM.

One TLM shall be installed in all HXP-3 cabinets.

Recorder Memory Module

The Recorder Memory Module (RMM) is used to record internal and external events and a clock is located on this module for time stamping these events.

Information Display Keypad

The Information Display Keypad (IDK), which plugs into the SIM and is secured to the front of the cabinet, is used to enter location parameters and to display system information. The module is made up of a Liquid Crystal Display (LCD) and 16 key keypad that interfaces with the HXP-3 via the SIM.

Auxiliary Relay Drive Module

The Auxiliary Relay Drive Module (AXD) is only present on HXP-3R2 models and has three identical AX Relay Drive outputs for adjacent crossing control or for traffic pre-emption. Each of these outputs can be programmed through the CPU Module. Where AXDs are used on HXP-3R2 equipment, two modules (Normal and Standby) are installed side by side, the second acting as a backup for the first.

End

Includes:	Siemens TRAINGUARD FUTUR 2500 Radio Block Centre (RBC) Cubicle
Exclude:	All other type of RBC/RBC Cubicles

GENERAL

The integrated RBC system is housed in a cubicle with all the associated equipment.

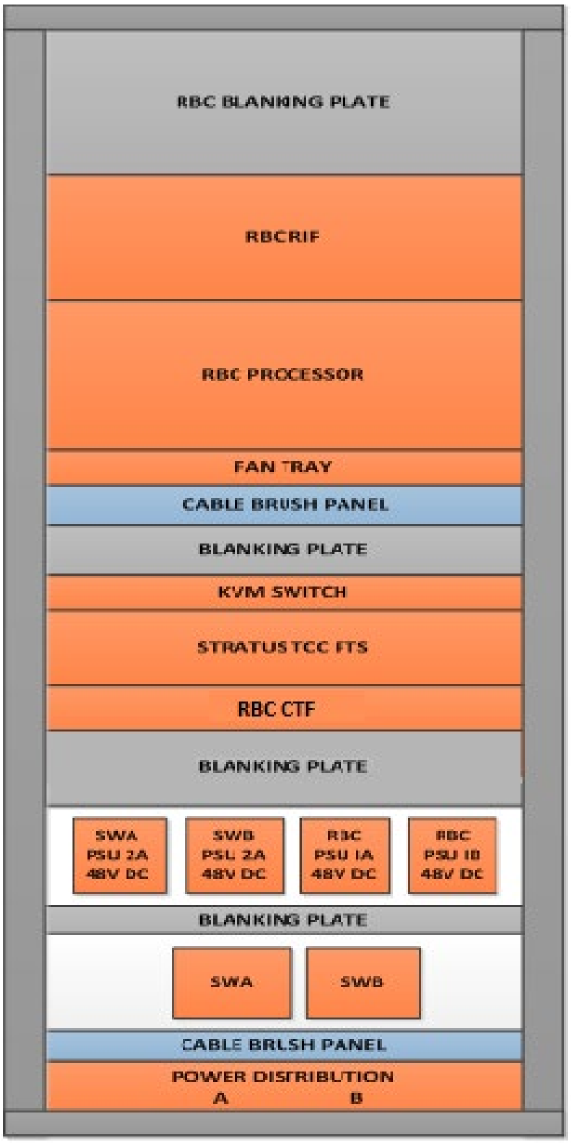


Figure 1 - RBC Cubicle

The TRAINGUARD FUTUR 2500 RBC cubicle is composed of the following elements:

Control Elements:

a) 1 RBC RIF

b) 1 RBC Processor MKII.

Cooling Elements:

a) 3 FAN Tray Modules (1 at the front; centre of the cubicle, 2 at the rear, one at the top, one at the bottom)

Maintenance Elements:

a) 1 KVM. The KVM is made up of:

- 1 KVM Switch
- 1 KVM Rack Console

b) 1 Keyboard

c) 1 PC Debug

d) 1 I/O Board for PC

e) 2 Converters from USB to Ethernet.

f) 1 PBA RBC CTRL

g) 1 Patch Panel

h) 1 GSM-R Stratus TCC FTS Element. This is made up of:

- 1 Server
- 2 ISDN Boards (The ISDN boards are housed in the server)

i) RBC Common Technicians Facility (CTF) – Blue Chip C110 PC

j) Dual Power Supply Unit (PSU) 48V

k) 2 Network Switches (SWITCH A and SWITCH B).

l) Dual Power Supply 110V AC PSUs – A and B supply for the RIF

RBC RIF:

The RBC-RIF is part of the WESTCAD-E architecture and is co-located in the RBC Cubicle and includes the Temporary Speed Restriction (TSR) functionality. The RBC-RIF will also handle the RBC arming process by passing indications to the Control Centre operator.

RBC Processor:

The RBC Processor is built on Ethernet IP Network (LAN/WAN). This provides flexibility to the system and an easy way to connect the RBC to other vital modules.

KVM Switch:

The ‘KVM Switch’ interconnects the TCC and the PC Debug with the ‘KVM Rack Console’ and the ‘Keyboard’.

GSM-R Stratus TCC FTS:

The GSM-R Stratus TCC FTS receives messages from the RBC Processor through the Ethernet interfaces and sends them to the train through the ISDN module.

In addition, it receives messages from the train through the ISDN modules and transmits these messages to the RBC Processor using the LAN network.

The Stratus TCC FTS is made up of:

a) 1 Stratus (server)

b) 2 ISDN Boards (The ISDN boards are housed in the server)

The Server is dual-redundant (CPU A and CPU B), and it is fault tolerant.

Each CPU has got an ISDN Board mounted. “ISDN A” is housed in “CPU A” and “ISDN B” is housed in CPU B.

Common Technicians Facility

This is a local technician’s workstation comprising of a Blue Chip C110 PC loaded with the CTF software. The local TF application is automatically executed when the PC is turned on. The CTF is a diagnostic tool that offers the user fault indications of the system, and replay functionality. The TF in this cubicle (RBC TF-L) is also linked to the RBC TF-S and RBC TF-R to allow remote access from Arch 886.

Power Supplies:

- A Dual Power supply Unit (48V) is provided to power the RBC RIF.
- A separate Dual Power supply (110V DC) is sourced from the signalling supply in LBER to provide power for the RBC Processor.

CISCO 16 Port Network Switches SWA and SWB:

The Cisco Catalyst is a COTS network switch. This connects with the RBC Cubicle at LBER and provides remote communication from TBROC over T-SPN (Thameslink Signalling Private Network).

Datalogger (Test tool)

A data-logger will be attached to the RBC via the Network Switches in the same cubicle. This is a test tool and no maintenance is needed to be provided.

END

Trainstops contain moving parts which can cause severe personal injury.

Equipment Replacement Guidance

1. Replacing a Trainstop (Complete)

The tools required for the following procedure are:

- JE Trainstop
- Common hand tools such as adjustable spanners;
- Approved mechanical lifting equipment with ability to lift 100 kg;
- Trainstop Trip Arm gauge;
- Open ended or ring spanners to suit fixings;
- 20W-50 engine oil;
- Steel measuring tape, ruler, scriber, square, centre punch, hammer;
- Two Packer Plates – can be supplied with the new Trainstops, or separately;
- Sole Plate

Removal

1.1 Keeping clear of the Trip Arm, isolate the supply from the Trainstop.

1.2 Disconnect the tail cables. Place the free end in a safe and dry place ensuring that the cable is not a trip hazard.

1.3 Disconnect the earth bonding cable from the Earth Connection Point on the exterior of the machine case.

1.4 Undo the four fixings securing the Trainstop to the bearers or Sole Plate.

1.5 Take note whether Packer Plates are fitted between the Trainstop and the bearer or Sole Plate.

1.6 Using appropriate lifting equipment, remove the Trainstop and put it in a safe place.

Replacement

1.7 Using appropriate lifting equipment, position the replacement Trainstop on the bearers, fitting Packer Plates if necessary.

1.8 Adjust the position of the Trainstop such that the distance from the inside of the running rail to the centre of the Trip Arm is 222 mm +/- 3 mm, with the body of the Trainstop parallel to the running rail.

1.9 Secure the Trainstop to the bearers using the original fixings (if these fixings are undamaged). If fixings are damaged, they must be replaced with serviceable items.

1.10 Connect the earth bonding cable to the Earth Connection Point on the exterior of the machine case.

1.11 With the Trip Arm in the raised position, use the Trainstop Trip Arm gauge to check that the top of the Trip Arm is 76 mm +/- 3 mm above a line joining the tops of the running rails (Figure 1).

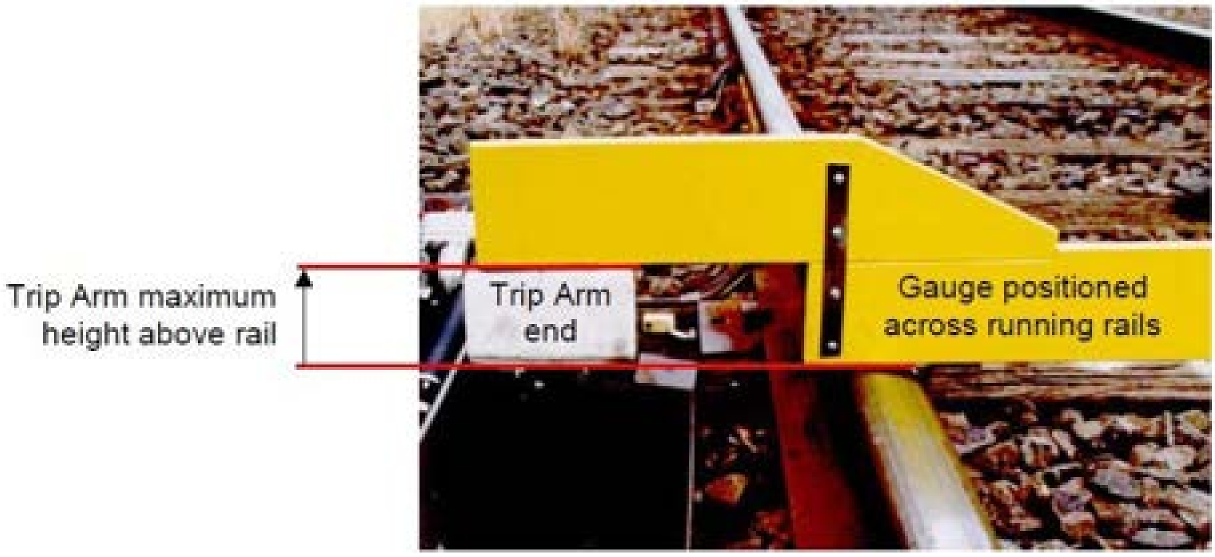


Figure 1 – Height of Trip Arm Checked with Gauge

1.12 Open the top cover of the Trainstop and check the oil level in the dashpot. Oil should be level with the mark on the outside of the dashpot (see Figure 2) when the Trip Arm is raised. If low, fill to the mark with 20W-50 engine oil.

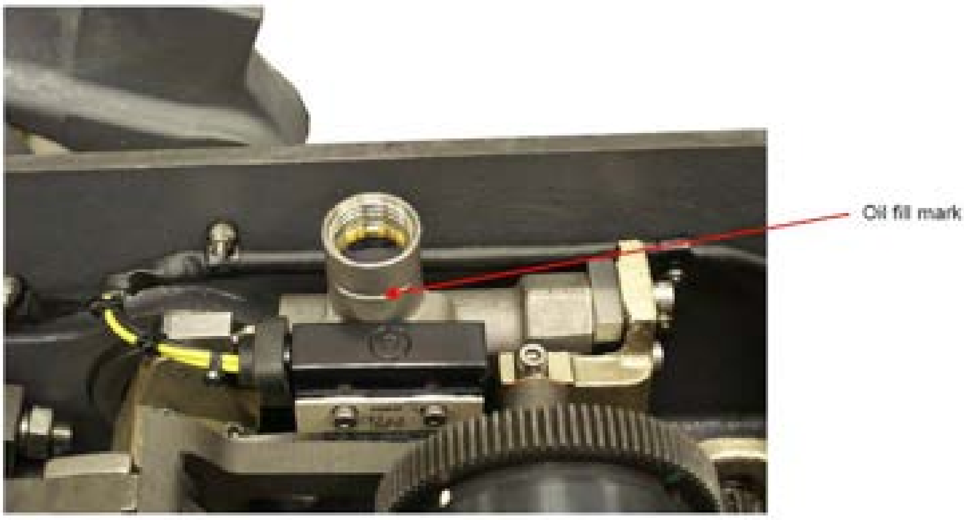


Figure 2 – Dashpot Oil Fill Mark

1.13 Check that the interior of the Trainstop is clear of any tools or equipment, then close and secure the top cover.

2. Replacing a Trainstop Trip Arm

The tools required for the following procedures are:

- Trip Arm Gauge;
- Ruler or steel measuring tape;
- Open ended spanners;
- Ring set spanners;
- Socket set;
- Spanners 24 mm AF;
- Trip Arm;

Removal

2.1 Check you are clear from the Trip Arm, isolate the supply and disconnect the tail cables.

Note the assembly order (base of Trip Arm) – this is for the securing bolt and associated washer, see Figure 3.

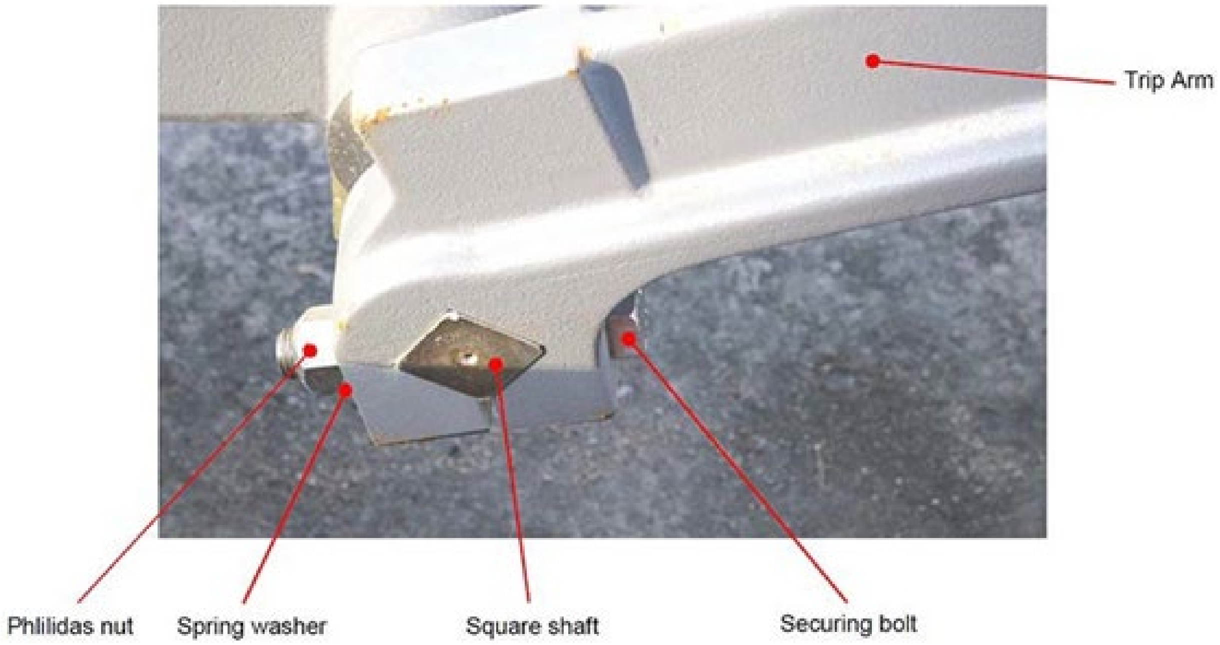


Figure 3 – Trip Arm Securing Bolt

2.2 Remove the securing bolt from the Trip Arm and slide the Trip Arm clear off the square shaft.

Note the assembly order of the shouldered stud fitted towards the top of the Trip Arm.

2.3 Remove the shouldered stud and retain for re-fitting the replacement Trip Arm.

Replacement

2.4 Fit the shouldered stud that was retained from the original Trip Arm.

2.5 Slide the Trip Arm fully onto the square shaft; ensure the shouldered stud engages with the Detector Arm, see, Figure 4.

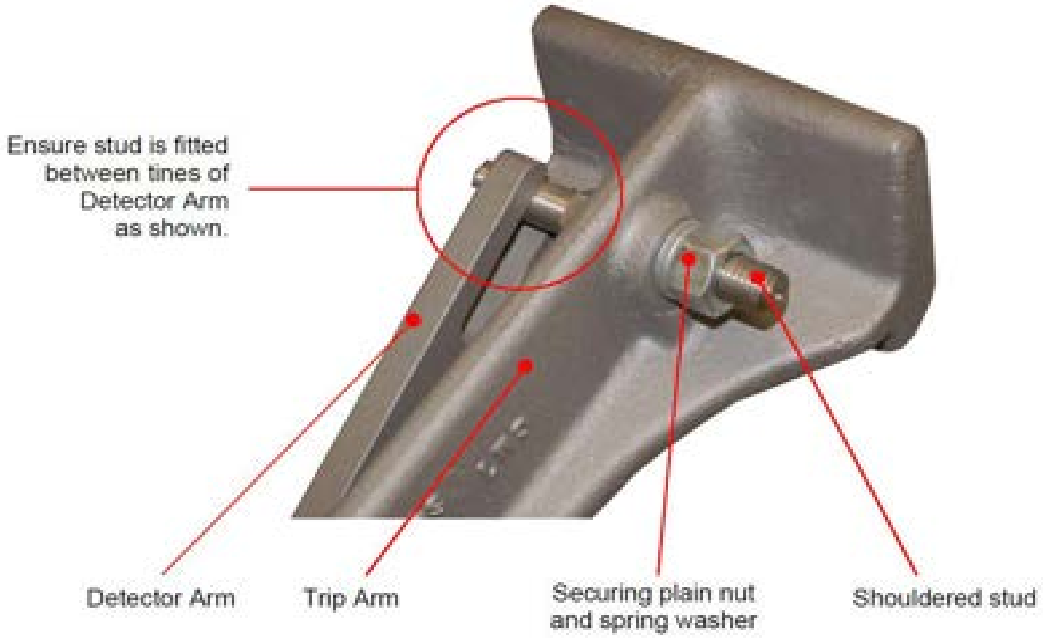


Figure 4 – Trip Arm Correctly Engaged with Detector Arm

2.6 Fit the securing bolt, spring washer and Philidas nut, shown in Figure 3.

2.7 Tighten the securing bolt fully and check that the Trip Arm if secure on the square shaft.

3. Replacing a Motor Assemble

The tools required for the following procedure are:

- Motor Assembly
- Two Nord-lock washers
- Philips cross-head screwdriver;
- Electrical screwdriver;
- Hex key 4 mm AF;

Removal

3.1 Check you are clear from the Trip Arm, isolate the supply and disconnect the tail cables.

3.2 Open the top cover to access the interior of the machine.

3.3 Identify the Rectifier Assembly and Motor Assembly (shown in Figure 5).

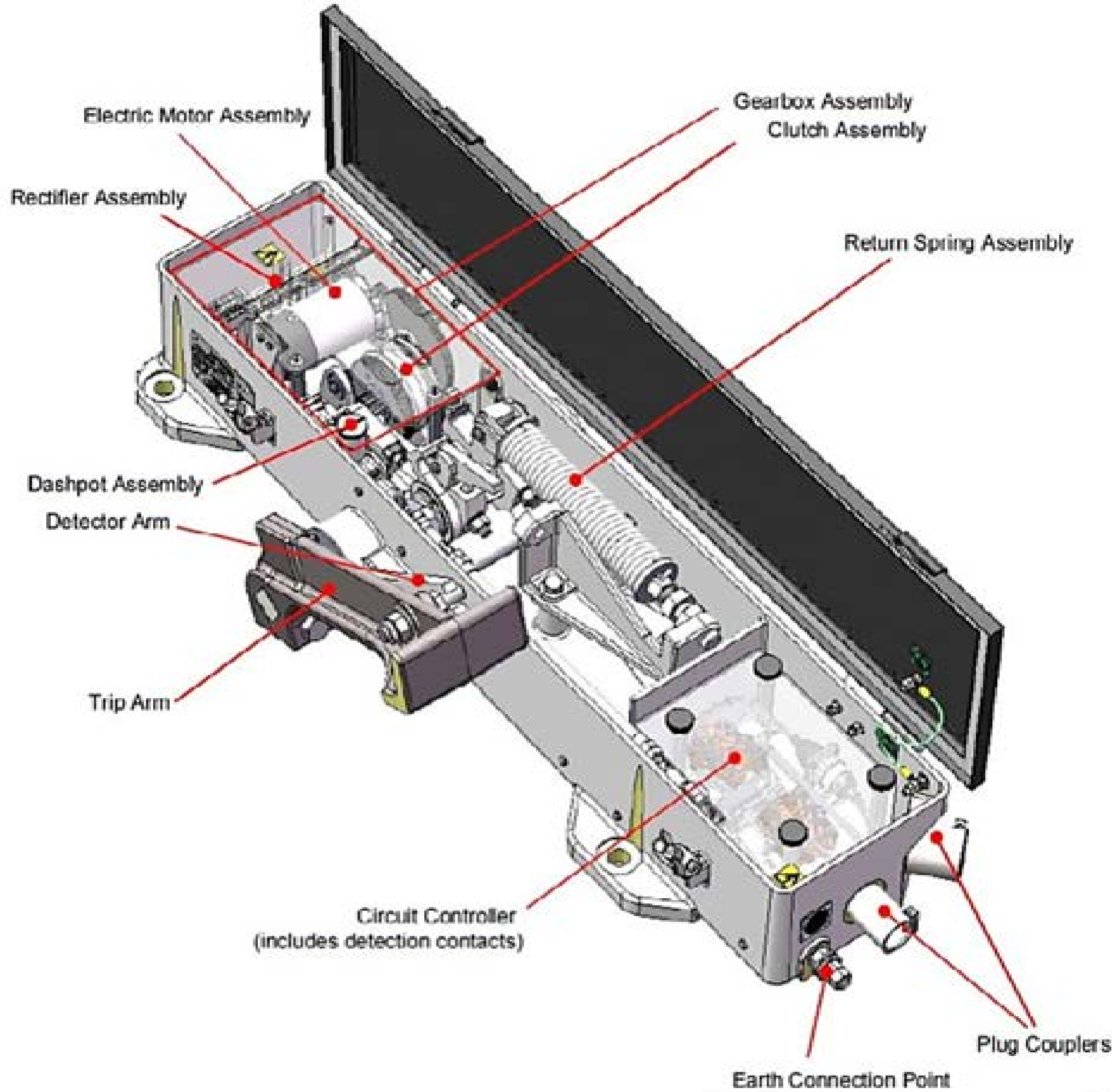


Figure 5 – Style JE Trainstop Main Assemblies

3.4 At the Rectifier Assembly, unscrew the cover fixings and remove the transparent cover.

3.5 Retain cover and fixings for re-use.

3.6 At the Motor Assembly, remove the two mounting plate securing screws (hex socket headed) and associated washers (shown in Figure 6).

3.7 Retain the screws for re-use and discard the washers.

3.8 Lift the Motor and Mounting Plate clear of its mounting and trace the motor supply cable to the terminal block. Take note of the positions of the motor wires in the terminal block.

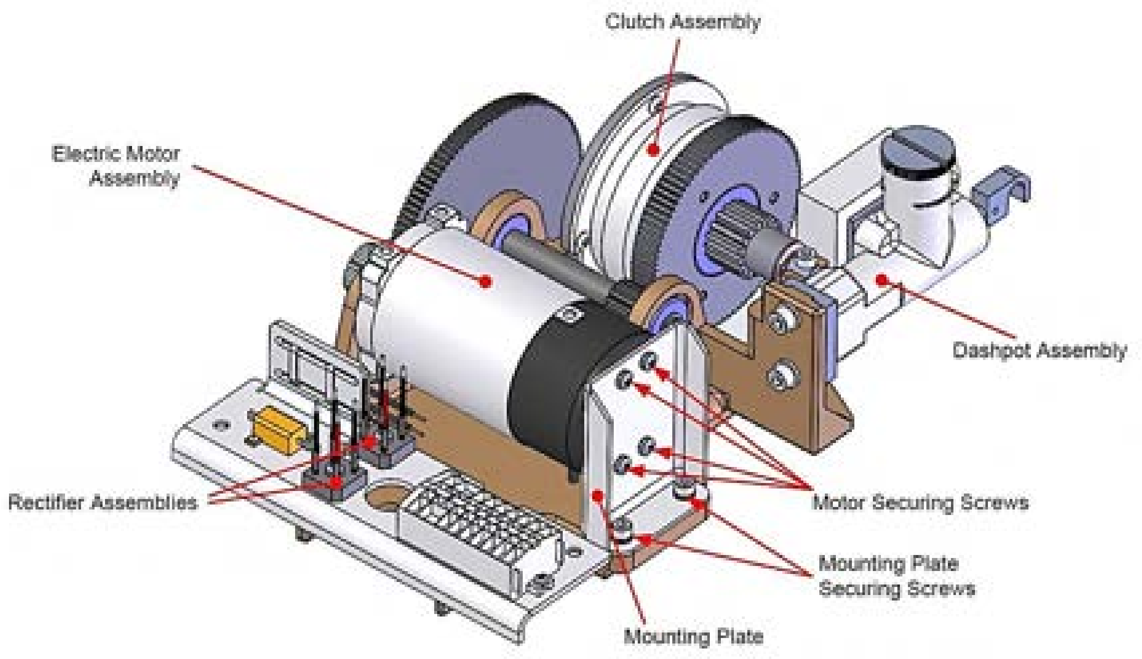


Figure 6 – Gear Box Assembly

3.9 Disconnect the motor wires from the terminal block and remove the Motor Assembly from the Trainstop.

3.10 At the Motor Assembly, remove the four motor securing screws and associated washers (shown in Figure 6). Retain the screws, washers and Mounting Plate for re-use.

Replacement

3.11 Fit the mounting plate on the replacement motor assembly and secure using the four motor securing screws and associated washers (shown in Figure 6).

3.12 Fit the replacement motor and mounting plate into the Trainstop, laying the motor supply cable towards the terminal block. Take care not to trap the motor supply cable.

3.13 Secure the motor assembly by re-fitting the two mounting plate securing screws and two new Nord-lock washers (shown in Figure 6).

3.14 At the terminal block, connect the motor wires in the positions previously noted (Terminal 4 +ve red wire, Terminal 5 -ve blue wire).

3.15 Re-fit the transparent cover over the Rectifier Assembly.

3.16 Close and secure the Trainstop top cover.

End

SYSTEM OVERVIEW

1. Advanced Railway Automation Management and Information System (ARAMIS)

ARAMIS is a sophisticated Rail Traffic Management System which supports planning, supervision, dispatch, control and analysis of train services.

The system has a modular architecture allowing it to be scaled to suit specific customer requirements.

ARAMIS is a Software Product which can be deployed on any suitably designed hardware platform that meets its hardware requirements. The system is configured to its specific installation by data.

The following sections will provide an introduction to the hardware and software elements of the ARAMIS system, and its interfaces.

2. Hardware Components

All the serviceable ARAMIS hardware components are defined as Line Replaceable Units (LRUs).

3. Software Sub-systems

3.1 ARAMIS-D

ARAMIS-D is the primary system within the Plan / Re-Plan layer, and is responsible for near to real-time train planning.

Note, ARAMIS-A is also a function of ARAMIS-D (accessed via the ARAMIS-D menu) that enables the production of analytical reports on the running of the railway, based on data that was collated within ARAMIS-D.

Note: Client HMI is also referred, this is Graphical User Interface (GUI) which is integral to the system, allowing users to access functions of ARAMIS-D

3.2 ARAMIS-W

ARAMIS-W is a web server application that takes a real time read-only feed of data from ARAMIS-D to enable it to present a subset of ARAMIS-D features to ‘remote’ authenticated users.

Such users access the functions provided through Microsoft Explorer browser clients. These are provided and maintained by NR and therefore not covered by this manual.

4. Thales Integration Layer (TIL)

The Thales Integration Layer (TIL) is the generic reference for a collection of components that provide a messaging abstraction layer between ARAMIS-D and the UK focused systems that lie within the External Layer.

5. Maintenance Terminal

The maintenance terminal provides the tools the maintainer needs to undertake the monitoring, log management and Virtual Machine (VM) management tasks. It provides access to the Nagios application for monitoring, the common storage VM for log management and VMware for VM management.

6. Operation Decision Support Tool (ODST)

ARAMIS Traffic Management has been deployed in the ODST configuration for both Wales and Anglia Routes. An ODST system is integrated with Network Rails conventional systems via LINX but is isolated from signalling control. ARAMIS is used as a plan; re-plan tool and the recommendations are then actioned on the control system.

This manual focusses on the sub-systems below the cut-line, known as the ‘Plan/Re-Plan Layer’ which is performed by the ARAMIS System.

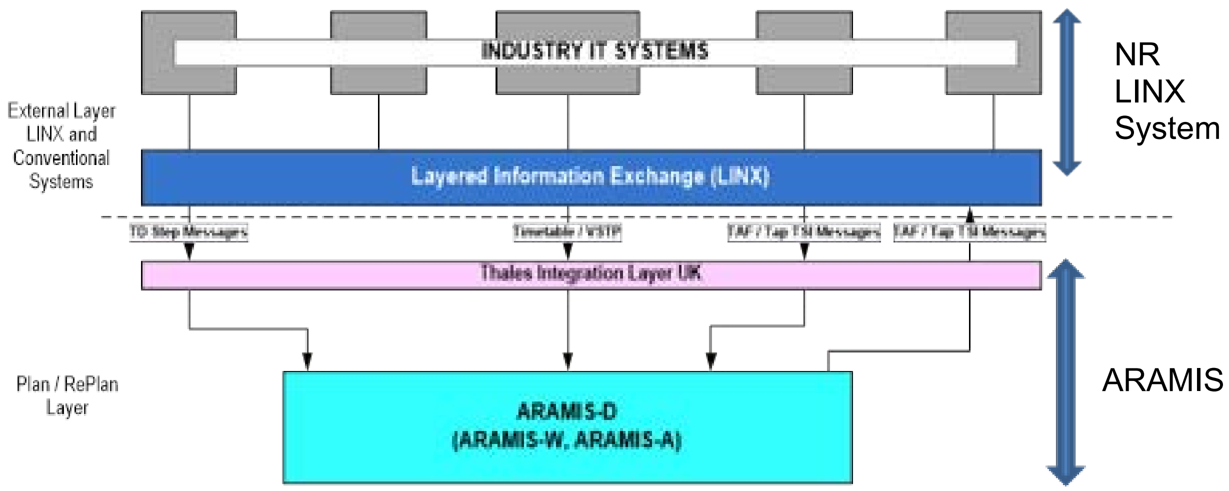


Figure 1 - ODST High Level Summary Schematic of the ODST Architecture

7. Interfaces

ARAMIS interfaces with Network Rail’s Layered INformation eXchange (LINX) system via the TIL. This is an inter-system message broker based on IBM Message Queue (MQ) and File Transfer Protocol (FTP) technologies.

LINX enables ARAMIS to communicate with conventional NR systems such as Integrated Train Planning System (ITPS) and Train Running Under System TOPS (TRUST).

From these systems ARAMIS receives dynamic railway data including Train Describer Step messages, Timetable messages and Telematics Applications for Passenger services (TAP) / Telematics applications for Freight services (TAF) messages.

Communication from the ARAMIS system to LINX and the ARAMIS-W clients is provided by services from Network Rail Telecoms (NRT).

Also, in Anglia, connectivity between Upminster and Romford is provided by NRT services.

The NRT services in the Rail Operating Centre (ROC) are provided by firewalls and a range of switches. The NRT demarcation point between Thales and NRT is the NRT 'Meet Me' rack.

Thales systems are patched into this rack as are NRT systems and a patch is then made between the two end points.

Maintenance of the 'Meet Me' rack is undertaken by Network Rail Telecoms.

8. Power Distribution

8.1 ARAMIS Workstation

- A primary 110Vac Uninterrupted Power Supply (UPS) A - Supplies ARAMIS monitors and Kernel Virtual Machine (KVM) via 110V AC Power Distribution Unit (PDU) mounted in the 19inch equipment rack under the desk.
- A secondary 110Vac UPS B supply – For future provision only.

8.2 ARAMIS Cubicle

The ARAMIS cubicles will be powered via two 230v AC PDU strips providing dual-redundant power to the equipment in the cubicle. These will be fed from separate PDUs within the Equipment Room.

This enables the E&P maintainer to turn off and maintain a single supply without impacting ARAMIS it there are no existing power supply faults.

9. Data Cabling

9.1 Above Workstation Surface Level

ARAMIS monitors are connected via Display Port Cables to the Amulet KVM located in cabinets below the workstation surface.

ARAMIS Keyboard and Mouse are connected to the Amulet KVM via USB cables, typically located in cabinets below the workstation surface.

9.2 Below Workstation Level Wales

From the ARAMIS cabinets under the workstation; the Amulet KVM are wired to a Fibre Optic Patch Panel using a 2-core Multimode Fibre cable.

A ruggedised 2-core Multimode Fibre cables are used to connect the Fibre Optic Patch Panel from the workstations, to another Fibre Optic Patch Panel housed in the main equipment rack for patching to the Client Personal Computer (PC).

10. Below Workstation Level Upminster

From the ARAMIS cabinets under the workstation; the Amulet KVM are wired to a desktop machine in the Upminster under desk equipment cabinet.

11. System Maintenance Features

The ARAMIS hardware platform has been designed with simplicity, availability and reliability in mind.

ARAMIS uses COTS components utilising the best of Information Technology (IT) design such as the use of redundancy, VMWare, Storage Area Networks (SAN), blade servers and Redundant Array of Independent Disks (RAID) disks for incremental/differential back-ups. The hardware platform features:

11.1 Dual redundant Hot Swappable Components

The servers provided by Thales are high quality industrial servers that incorporate redundant, hot swappable power supplies, fans and disks.

It is possible to hot swap all these hardware components without powering down.

For example, even a faulty disk can be removed without powering down, and a replacement disk inserted.

The new disk will be re-built by the system using RAID technology with minimal intervention required by the Maintainer.

11.2 Self-monitoring Servers

The servers are monitored by the Manufacturer’s Server Management Facility that provides an intuitive monitoring and reporting system.

This will report errors when they occur and present them as status indications against physical representations of the equipment impacted.

No sophisticated analysis of log files or error messages is required.

The Network Rail Maintainer can get an overview of the system status from the Nagios based monitoring system.

11.3 Use of Virtual Machines

The system requires multiple servers to host ARAMIS, Oracle data bases and other software components that make up the TMS as a whole.

However, the use of virtual machines enables these applications to be hosted on the same physical hardware, increasing the reliability by reducing the number of hardware components and associated communications infrastructure that would be required by stand-alone servers.

11.4 Use of Virtual Machines and Disk Images

The combination of virtual machines and the ability to take disk images of the virtual machine, and its hosted operating system and applications enables the complete server software architecture to be stored in one file.

This greatly eases configuration, loading and control of the system avoiding the need for the Maintainer to know the structure and configuration of the hosted software.

11.5 Pre-configured Spares

All agreed spares provided for the system will be fully pre-configured and ready to use, facilitating as far as possible, the ability to plug and play with as little post-installation configuration as possible.

12. Maintenance Mode

12.1 Placing a Server into Maintenance Mode

A server that is experiencing performance issues can have a negative impact on the system as VMware will be continually moving virtual machines between resources.

This can be addressed by exploiting the built-in redundancy of the system and placing the problematic server into maintenance mode to restrict it from use by VMware.

The redundancy within the system allows for three servers to be placed into maintenance mode before there are any performance 19impacts.

However, problematic servers should be repaired or replaced as soon as an issue is identified to guarantee the availability of ARAMIS is maintained.

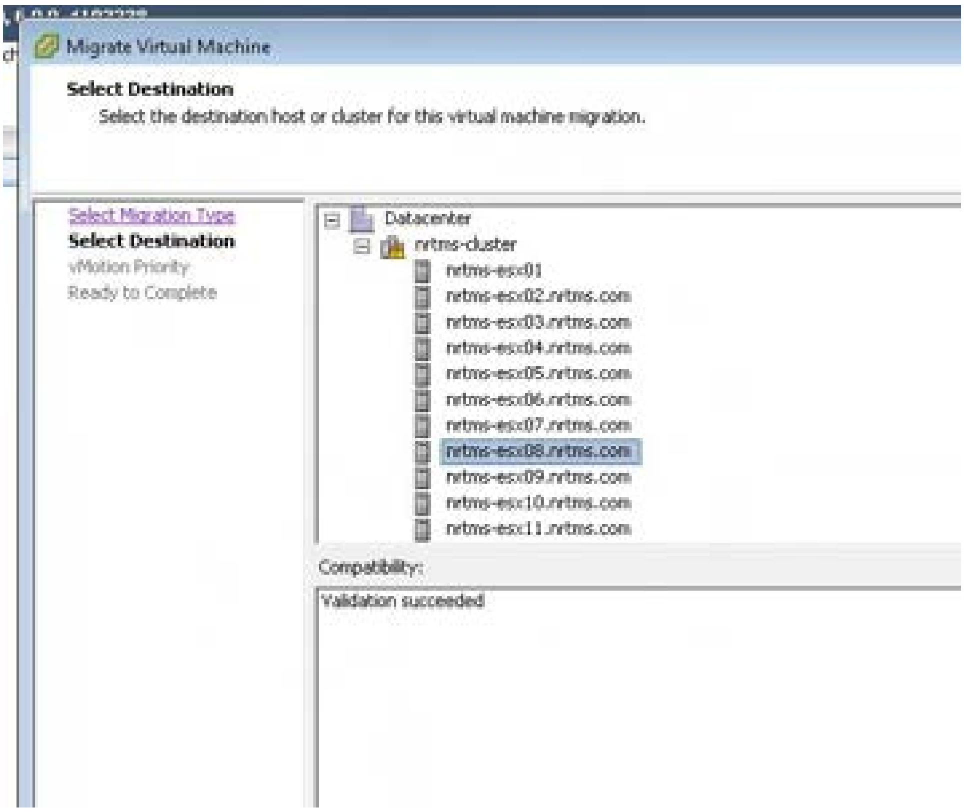
All instances of placing a server into maintenance mode should be reported to the Thales Service Centre.

The following steps should be completed to restrict a server from use by VMware:

1. Select the failed server from the list of servers.

2. For each VM on that server, right click and select migrate.

3. Select another available server to migrate the VM to.



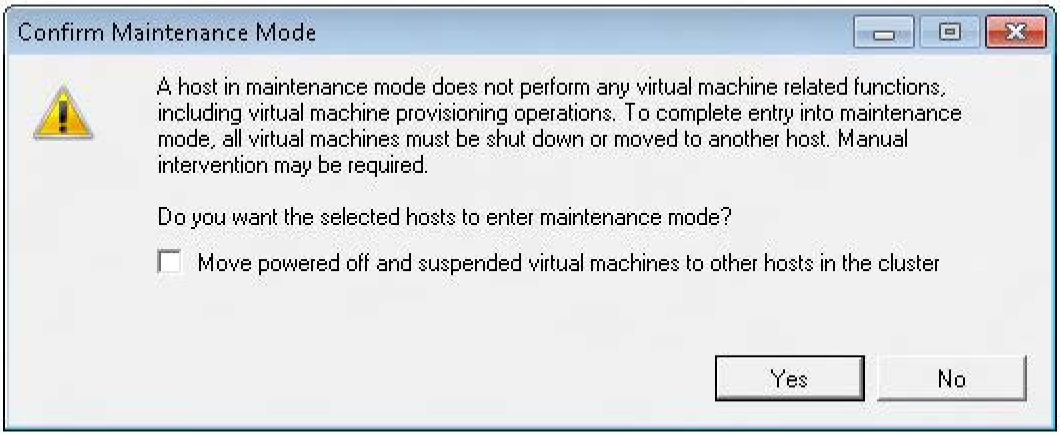
4. Once migration of VM is complete, select High Priority from the dialogue.

5. Click Finish.

6. Repeat steps 2 – 5 for all remaining VMs.

7. Right click on failed server which now has no active VMs running on it. Select enter maintenance mode.

8. Deselect the check box regarding VM allocation on the dialogue as this has been manually achieved in the steps above.



9. The failed server should now be identified in the list as being in maintenance mode.

13. System Hardware Components 2nd Line Maintenance Responsibilities

The table 1 lists the ARAMIS hardware LRU components and describes their 2nd Line maintenance responsibilities in accordance with the maintenance philosophy.

ARAMIS Hardware Components	Hardware Sub-Components	Hardware Profile ANNEX Reference	2nd Line Maintenance Responsibility
Workstation Monitor - NEC Multisync EA273WMi	-	A1	Network Rail
Workstation Keyboard - Microsoft Wired Keyboard 600	-	A2	Network Rail
Workstation Mouse - Microsoft Basic Optical Mouse	-	A2	Network Rail
Zero Client – Amulet DXZ4-M	-	A3	Network Rail
Client PC - Dell Precision 7910 Rackmount	Workstation	A4	Thales
	Hard Disk Drive (SSD)	A4	Network Rail
	Fan	A4	Network Rail
	Power Supplies	A4	Network Rail
Virtual Server - Dell PowerEdge R530 Rackmount	Server	A5	Thales
	Hard Disk Drive (SD)	A5	Network Rail
	Fan	A5	Network Rail
	Power Supplies	A5	Network Rail
Maintenance Server - PowerEdge M620 Blade	Blade Servers	A6	Thales
	Hard Disk Drive	A6	Network Rail
	Fan	A6	Network Rail
	Power Supplies	A6	Network Rail
	10GB Network Interface Card	A6	Thales
Server Storage SAN - HP MSA 2040	2040 SAN	A7	Thales
	Hard Disk Drive	A7	Network Rail
	Power Supplies	A7	Network Rail
	HP MSA SAN Controller (Single Only)	A7	Network Rail
Network Core Switch - Cisco Nexus 5672UP	Core Switch	A8	Thales
	Power Supplies	A8	Network Rail
	Fan	A8	Network Rail
Network Access Switch - Cisco Catalyst 2960XR-24TS-I	Access Switch	A9	Thales
	Power Supplies (with in-built Fan)	A9	Network Rail
Network Management Switch - Cisco Catalyst 2960XR-48TS-I	Management Switch	A10	Thales
	Power Supplies (with built in Fan)	A10	Network Rail
Firewall - CISCO ASA 5545-X WITH FIRE POWER Services	Firewall	A11	Thales
	PSU	A11	Network Rail
	HDD (single only)	A11	Network Rail
Server HMI - KVM Rackmount Console Unicorn 17	-	A12	Network Rail
Maintenance Terminal – Dell Latitude E5570 Laptop	-	A13	Thales

Table 1 - ARAMIS hardware LRU components

14. Acronyms and Abbreviations

Term	Description
ARAMIS ODST	Advanced Railway Automation Management & Information System Includes ARAMIS-A / ARAMIS-D, ARAMIS-W and ARAMIS-TIL products.
ATS	Automatic Transfer Switch
CATS	Course A Training System
CCTV	Closed-Circuit Television
CPC	Client PC
CPU	Central Processing Unit
ESXi	VMware ESXi is a purpose-built bare-metal hypervisor that installs directly onto a physical server.
FT	Fault Tolerant
Gbps	Gigabits per second
HA	High Availability
HMI	Human Machine Interface
iSCSI	Internet Small Computer System Interface
LAN	Local Area Network
LX	Level Crossing
M&S	Maintenance and Support
Mbps	Megabits per second
MSVR	Maintenance Server
MWS	Maintenance Laptop
NR	Network Rail
NRT	Network Rail Telecoms
NRTMS	Network Rail Traffic Management System
O&M	Operations and Maintenance
ODST	Operations Decision Support Tool
PC	Personal Computer
PCIe	Peripheral Component Interconnect Express
PCoIP	PC over Internet Protocol
PDU	Power Distribution Unit
PSU	Power Supply Unit
RAID	Redundant Array of Independent Disks
ROC	Rail Operating Centre
SAN	Storage Area Network
SATA	Serial AT Attachment
SCSI	Small Computer System Interface
SSD	Solid State Drive/Disk
SSM	Shift Signaller Manager

Term	Description
SWA	Access Switch
SWC	Core Switch
TAF	Telematic Applications for Freight
TAP	Telematic Application for Passenger
TRC	Train Running Controller
TRESIM	Simulator by The Rail Engineering Company
vCPU	virtual CPU
VM	Virtual Machine
vSAN	virtual Storage Area Network
USB	Universal Serial Bus

Table 2 – Acronyms and Abbreviations

15. Configuration of the Amulet

CONFIGURATION PROCESS

This process shall only be carried out by a competent person, if at any point during the process you are unsure of what you seeing or actions you should take you must immediately stop work and seek advice.

Establishing a PCoIP connection

15.1 After a short delay, the built-in On-Screen Display will be visible on the monitor connected to the port

NOTE: *The zero client can be configured to use DHCP or a static IP address. To change the settings in the On-Screen Display, open the Options menu (top left), click the Configurations item and then the Network tab. If required, the default password is ahkdante. Do not change the default password.*

15.2 Click the Connect button. The 'Discovering hosts' message will display, followed by a list of all available hosts.

NOTE: *The Connect button is greyed out until the DXZ4 has a network connection and an IP address. If no PCoIP hosts are available, the connect button will still work but, after trying and failing to discover any hosts, the 'No Hosts available for connection' message is displayed.*

Amulet Configuration

15.3 Plug in AMULET via Ethernet to a hub.

15.4 Plug in laptop to a hub, set IP to 192.168.1.10

15.5 Browse to IP 192.168.1.50

15.6 Login – password is “ahkdante”.

15.7 Change session to “Direct to Host”.

15.8 Set IP 192.168.1.100

15.9 Power – Set both timeout to 0 seconds.

Configuration -> Power

15.10 Set power configuration as follows:

- Screensaver, suspect, power off timeouts all 0.
- Remote host power control – off.
- Power on after power loss – checked.
- Enable wake on USB, Wake on LAN – checked.

Configuration -> USB -> Authorised devices

15.11 Set authorised device as follows:

VID	PID
045E	07F8
045E	00CB
04B4	6572

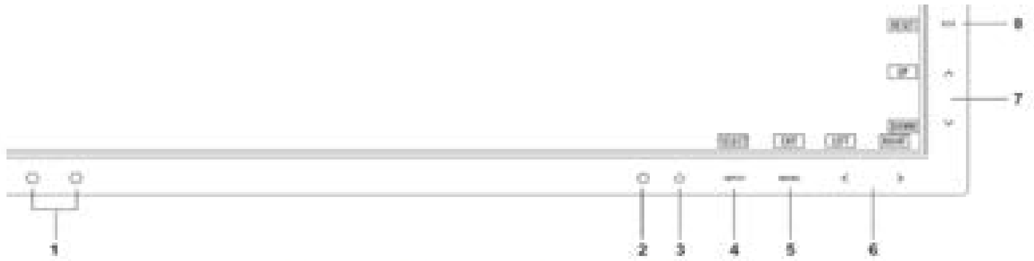
Select a PCoIP host from the list using the host IP address as a reference and click OK.

If the connection is successful, the Link LED displays constant green and the video from the remote workstation displays on the monitor(s).

16. Component Breakdown

16.1 Workstation Monitor - NEC Multisync EA273WMi

Front View



1 Ambibright Sensor Human Sensor	Detects the level of ambient lighting, allowing the monitor to make adjustments to various settings resulting in a more comfortable viewing experience. Do not cover this sensor.
2 LED	Indicates that the power is on or off.
3 Power	Turns the monitor on and off.
4 INPUT/SELECT	Enters the OSD Control menu. Enters OSD sub menus. Changes the input source when not in the OSD Control menu.
5 MENU/EXIT	Accesses OSD menu. Exits the OSD sub menu. Exits OSD Control menu.
6 LEFT/RIGHT	Navigates to the left or right through the OSD Control menu. You can adjust the BRIGHTNESS directly while the OSD menu is off*.
7 UP/DOWN	Navigates up or down through the OSD Control menu. You can adjust the VOLUME directly when not in the OSD Control menu*.
8 RESET/ECO	Resets the OSD back to factory settings in the OSD control menu. Switches among ECO MODE settings. Activates Auto Adjust function if helded for 3 seconds while the OSD menu is off (Analog input only)*.

* When Hot Key function is OFF, this function is disabled.

Back View

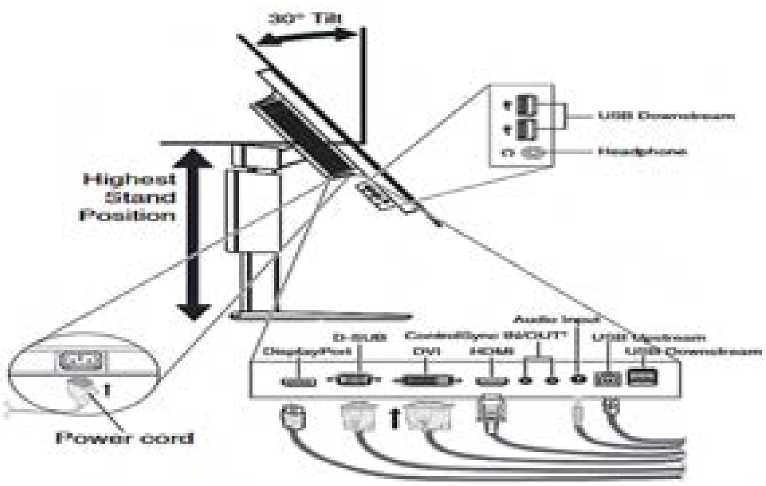


Figure 3 – Monitor Connections

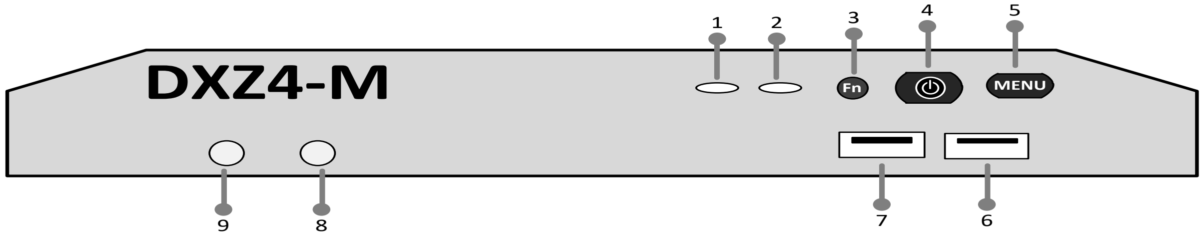
Workstation Keyboard - Microsoft Wired Keyboard 600 & Optical Mouse -

Figure 4 - Workstation Keyboard - Microsoft Wired Keyboard 600 & Optical Mouse

16.2 Zero Client – Amulet DXZ4-M

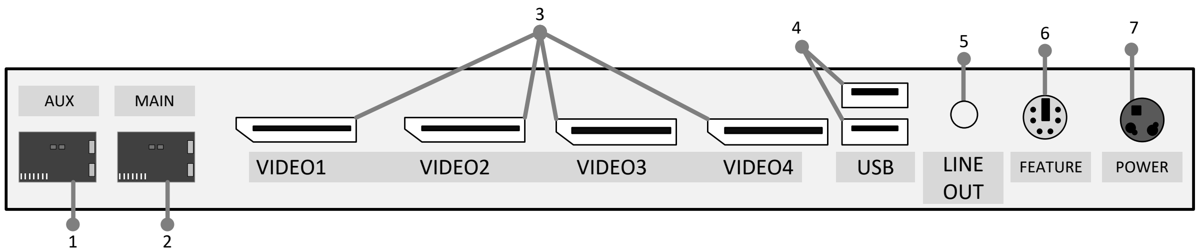
A Zero Client provides an interface between the monitors/keyboard/mouse to its associated Client PC via a network connection.

Front View



1 Switch Status LED	4 Power Button & LED	7 USB 2.0 Keyboard Port
2 Link LED	5 Menu Switch LED	8 3.5mm Earphone Port
3 Functional Switch Button & LED	6 USB 2.0 Mouse Port	9 3.5mm Microphone Port

Back View

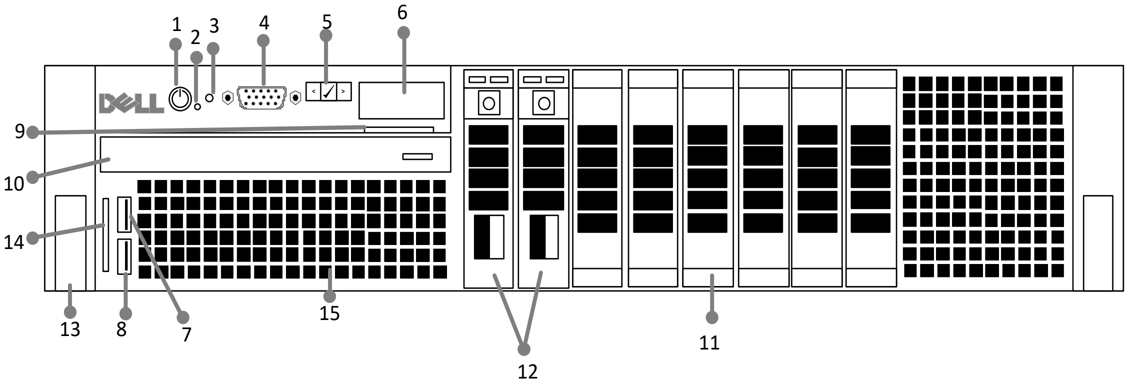


1 AUX SPF+ Network Port	4 USB 2.0 Ports	7 DC Power Port
2 Main SPF+ Network Port	5 3.5mm Line Out Audio Port	
3 Video Out Ports	6 Amulet Feature Port	

16.3 Client PC - Dell Precision 7910 Rackmount

Client PCs are windows-based workstations with standard configurations and ARAMIS Client software with specific configurations installed.

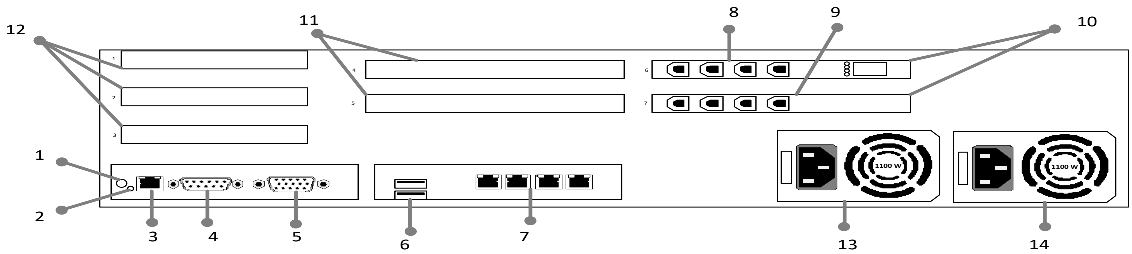
Front View



1	Power On Button	6	LCD Panel*	11	Hard Drive / SSDs slot
2	NMI Button	7	USB Port/iDRAC	12	2 x Hard drive (OCC)
3	System ID Button	8	USB Connector 2.0	13	Device Pull-Out Flaps
4	Video Connector	9	Information Tag	14	SD Card Slot
5	LCD Menu Buttons	10	Optical Drive (optional)	15	Vents

* LCD Display displays Blue background in normal working. When faulty will display fault and back light will change colour to Amber

Back View

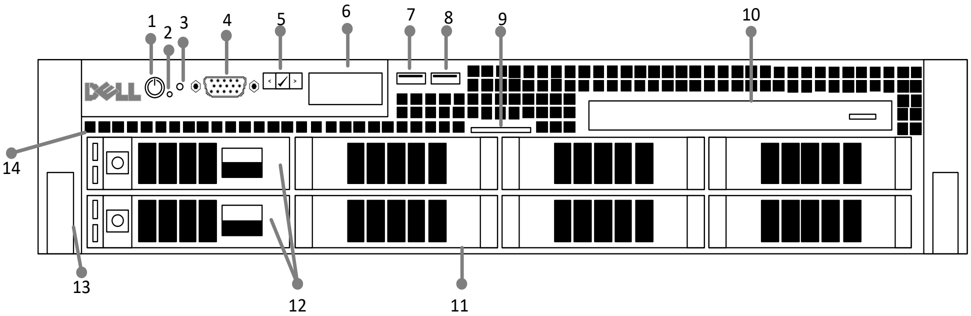


1	System ID Port	6	USB Connector 2.0	11	PCIe Card Slots
2	System ID Button	7	Ethernet Connectors	12	½ PCIe Card Slots
3	iDRAC8 Enterprise Port	8	PCIe Amulet Host Card	13	Power Supply Unit 1
4	Serial Port	9	PCIe Graphics Card	14	Power Supply Unit 2
5	Video/VGA Port	10	PCIe Card Slots		

16.4 Virtual Server - Dell PowerEdge R530 Rackmount

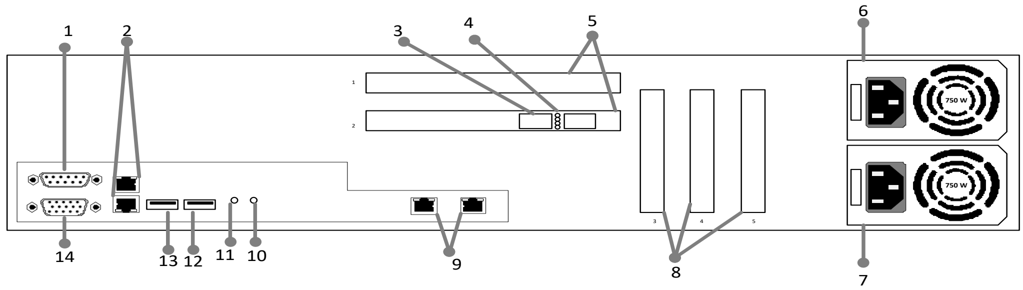
VM Servers runs the TM software on a virtualised estate.

Front View



1	Power On Button	6	LCD Panel	11	Hard Drive / SSDs slot
2	NMI Button	7	USB Port/iDRAC	12	2 x Hard drive bays (OCC)
3	System ID Button	8	USB Connector 2.0	13	Device Pull-Out Flaps
4	Video Connector	9	Information Tag	14	Vents
5	LCD Menu Buttons	10	Optical Drive (optional)		

Back View

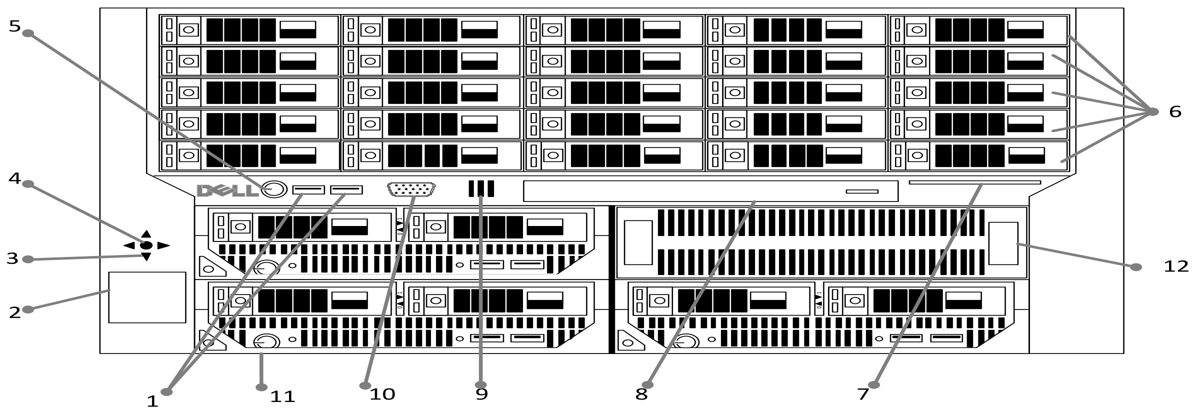


1	Serial Port	6	Power Supply 1	11	System ID Button
2	Ethernet Connectors	7	Power Supply 2	12	USB Connector 3.0
3	PCIe Connectors	8	½ PCIe Card Slots	13	USB Connector 2.0
4	PCIe Monitoring Lights	9	Ethernet Connectors	14	Video / VGA Port
5	PCIe Card Slots	10	System ID Port		

16.5 Maintenance Server – Dell PowerEdge VRTX Chassis & M620 Blade

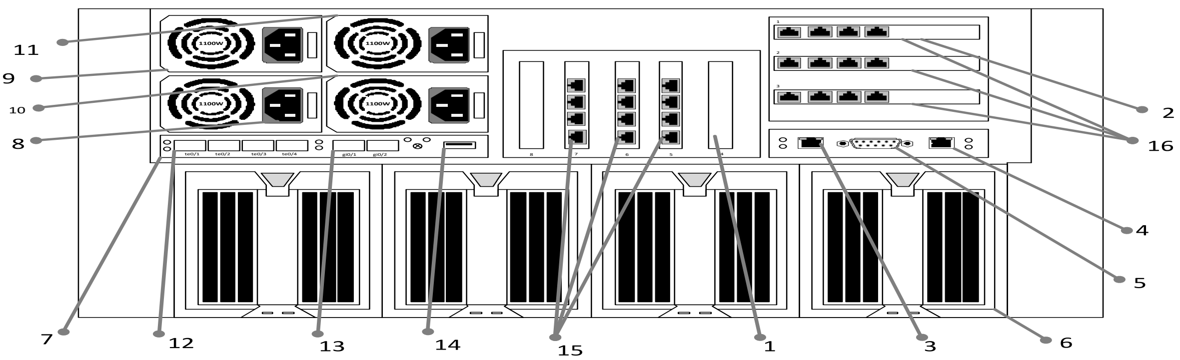
Maintenance Server provides the means by which system and data updates are propagated onto the live system. All updates are tested on the maintenance server first.

Chassis - Front View



1	USB Connectors	5	Power Button	9	Vents
2	LCD Panel	6	Hard Drives	10	Video Connector
3	LCD Menu Scroll Buttons	7	Information Tag	11	Server Module
4	Selection Button	8	Optical Drive	12	Blanking Module

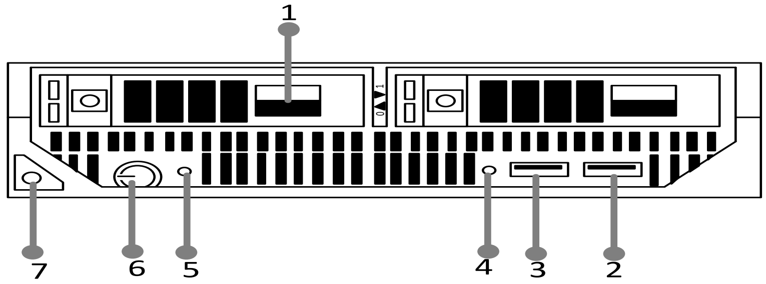
Chassis - Back View



1	½ PCIe Card Slots	7	NIC I/O Module Ports	13	NIC SPF+ Ports
2	PCIe Card Slots	8	Power Supply Unit (PSU4)	14	NIC I/O USB Port
3	CMC GbE Port 2	9	Power Supply Unit (PSU3)	15	NIC PCI RJ45 ports
4	CMC GbE Port 1	10	Power Supply Unit (PSU1)	16	NIC PCI RJ45 ports
5	Serial Connector	11	Power Supply Unit (PSU2)		
6	Blower Module	12	NIC SPF+ Ports		

16.6 M630 Blade

Front View

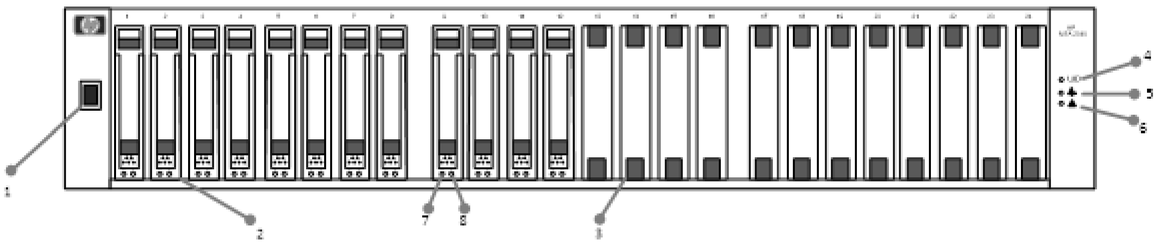


1	Hard Drive or SSDs	4	Management Indicator	7	Status Server Module Handle
2	USB2 Port	5	Power On Button		
3	USB1 / iDRAC Port	6	Server Module Power Indicator		

The back view is not shown as this would not be visible or accessible to the Maintainer due to this being housed within the VRTX Chassis.

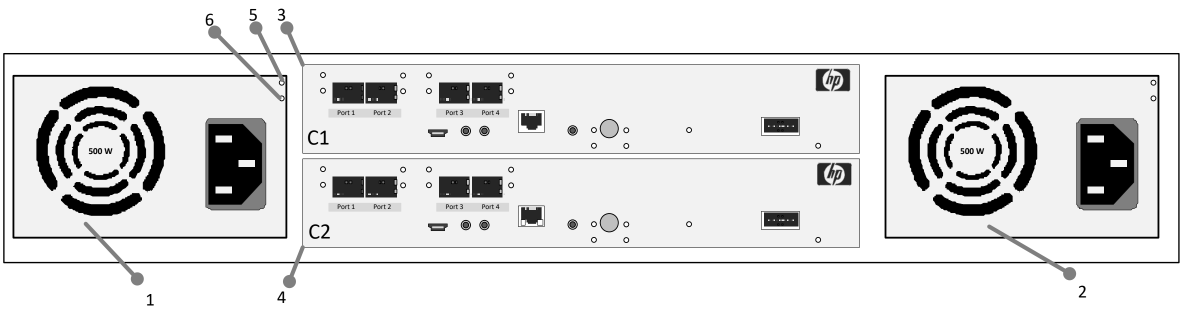
16.7 Server Storage SAN – HP MSA 2040 & Controller

Virtual SANs present Oracle RAC with its expected disk hardware, as if it were physical disks.



Front View	Enclosure ID LED	4	Unit Identification LED	7	Disk Drive Online / Activity LED
2	Server Hard Drive	5	Heartbeat LED	8	Disk Drive Fault LED
3	Hard Drive Blanking	6	Fault ID LED		

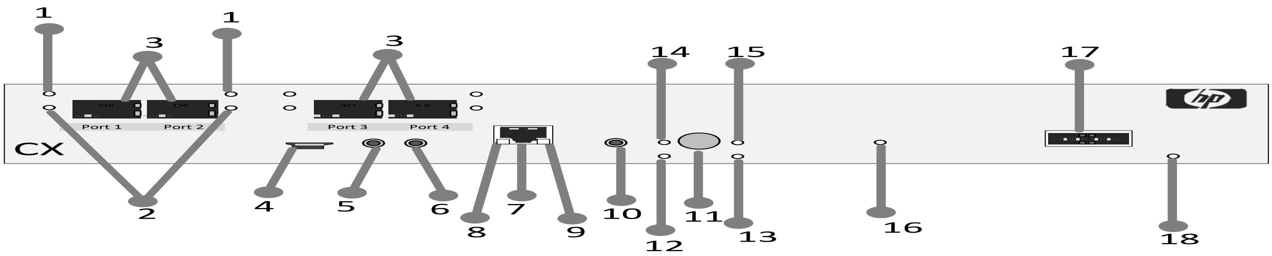
Back View



1	Power Supply Unit 1	3	SAN Controller Module 1	5	Input Source Power LED
2	Power Supply Unit 2	4	SAN Controller Module	6	Voltage/Fan Fault/Service

16.8 SAN Controller

Front View

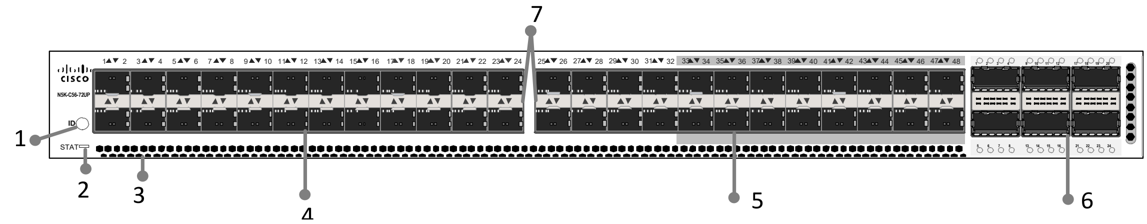


1	Link Status LED FC Mode	7	Network Port	13	Fault/Service Required LED
2	Link Status LED iSCSI	8	Network Port Activity LED	14	OK to Remove LED
3	SPF+ Host Ports	9	Network Port Speed LED	15	FRU OK LED
4	CLI Port Mini-USB	10	Service Port 1	16	Cache Status LED
5	Service Port 2	11	Disabled Button	17	SAS Expansion Port
6	CLI Port	12	Unit Locator LED	18	SAS Expansion Port

16.9 Network Core Switch - Cisco Nexus 5672UP

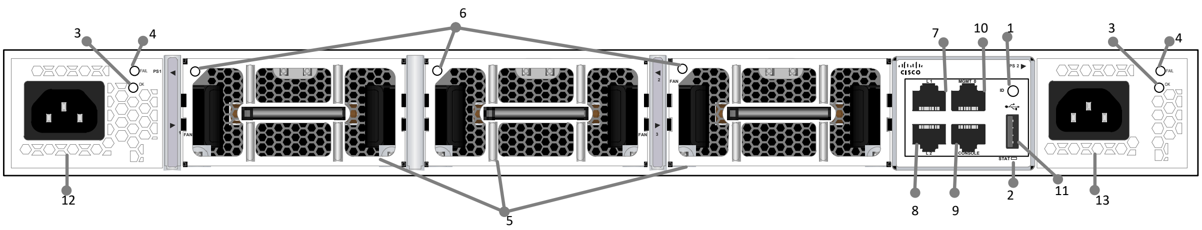
- Network Core Switch provides access to the virtual server.

Front View



1	Chassis Located LED	4	SPF+ Ports	7	Port LEDs
2	Power Status LED	5	SPF+ Ports		
3	Vents	6	QSFP+ Ports		

Back View

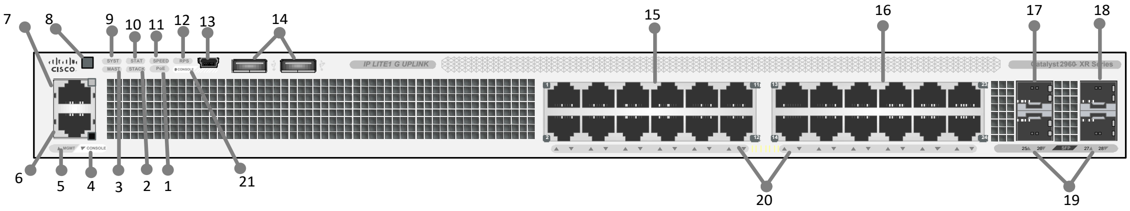


1	Chassis Locator LED	6	Fan Blower Status LED	11	USB 2.0 Port
2	Power Status LED	7	L1 RJ45 Port	12	Power Supply Unit 1
3	PSU OK LED	8	L2 RJ45 Port	13	Power Supply Unit 2
4	PSU FAIL LED	9	CONSOLE RJ45 Port		
5	Fan Blower	10	MGMT RJ45 Port		

16.10 Network Access Switch - Cisco Catalyst 2960XR-24TS-I

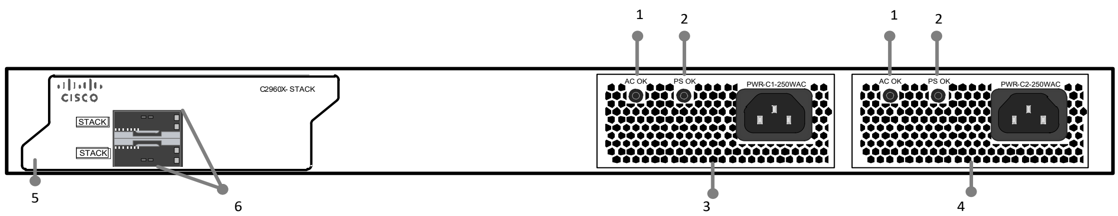
Description: Network Access Switch provides access to the Client PC.

Front View



1	Power over Ethernet LED	8	Mode Button	15	Ethernet Ports RJ45
2	Stack LED	9	System LED	16	Ethernet Ports RJ45
3	Master LED	10	STAT LED	17	Ethernet SFP Ports
4	Console LED	11	Speed LED	18	Ethernet SFP Ports
5	MGMT LED	12	IPRS LED	19	SFP Port LEDs
6	Console RJ45 Port	13	USB Type B Console Port	20	RJ45 Port LEDs
7	MGMT RJ45 Port	14	USB Type A Port	21	USB Type B Port LED

Back View

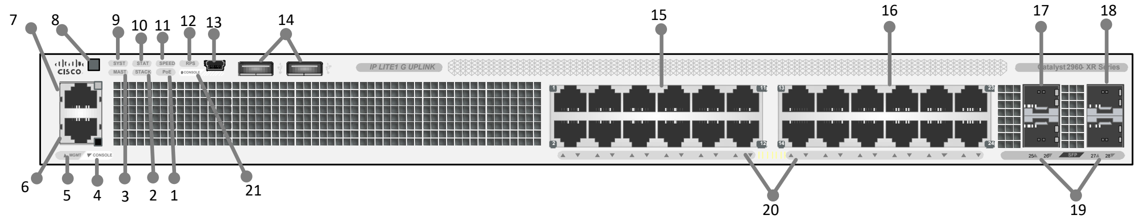


1	PS OK LED	3	Power Supply Unit 1	5	CISCO Stack Module
2	AC OK LED	4	Power Supply Unit 2	6	Cisco Stack Ports

16.11 Network Management Switch - Cisco Catalyst 2960XR-48TS-I

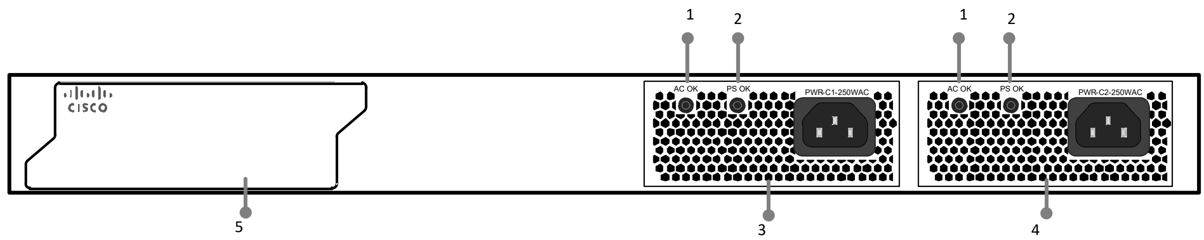
Network Management Switch provides access to the Maintenance Blade Server and the Virtual Servers.

Front View



1	Power over Ethernet LED	8	Mode Button	15	Ethernet Ports RJ45
2	Stack LED	9	System LED	16	Ethernet Ports RJ45
3	Master LED	10	STAT LED	17	Ethernet SFP Ports
4	Console LED	11	Speed LED	18	Ethernet SFP Ports
5	MGMT LED	12	IPRS LED	19	SFP Port LEDs
6	Console RJ45 Port	13	USB Type B Console Port	20	RJ45 Port LEDs
7	MGMT RJ45 Port	14	USB Type A Port	21	USB Type B Port LED

Back View

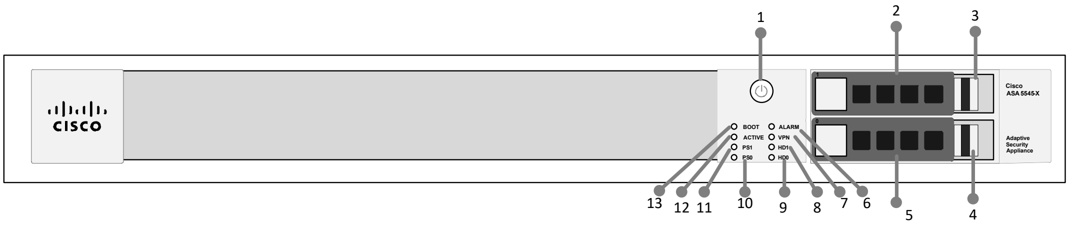


1	PS OK LED	3	Power Supply Unit 1	5	Stack Module Plate
2	AC OK LED	4	Power Supply Unit 2	6	

16.12 Firewall - CISCO ASA 5545-X with Fire Power Services

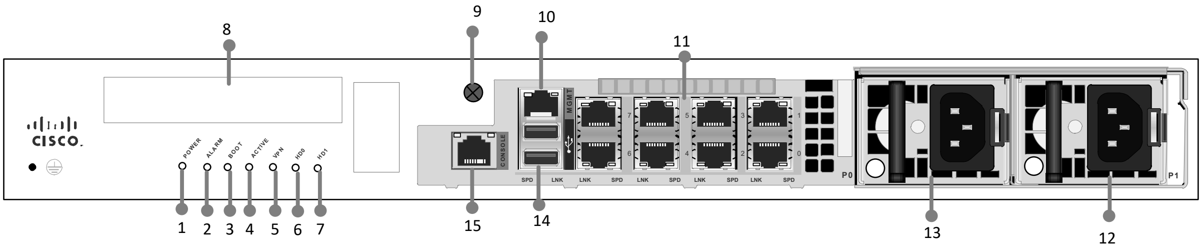
The CISCO Firewall provides integrated threat protection against cyber and advanced malware.

Front View



1	Power Button	6	Alarm	11	PS0
2	Hard-disk Slot	7	VPN	12	Active
3	Hard-disk Release Button	8	HD1	13	Boot
4	Hard-disk Release Button	9	HD0		
5	Hard-disk Slot	10	PS1		

Back View

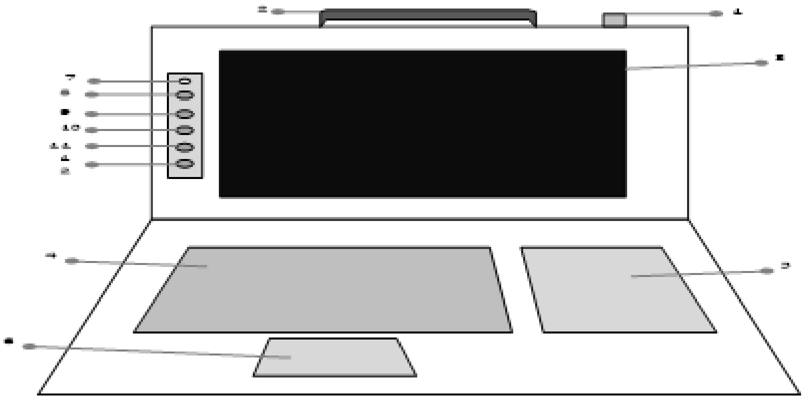


1	Power LED	6	HD0 LED	11	RJ-45 Ports
2	Alarm LED	7	HD1 LED	12	Power Supply 1
3	Boot LED	8	I/O Slot	13	Power Supply 0
4	Active LED	9	Thumbscrew	14	USB Ports
5	VPN LED	10	Management I/O Interface	15	Console Port

16.13 Server HMI - KVM Rackmount Console Unicorn 17

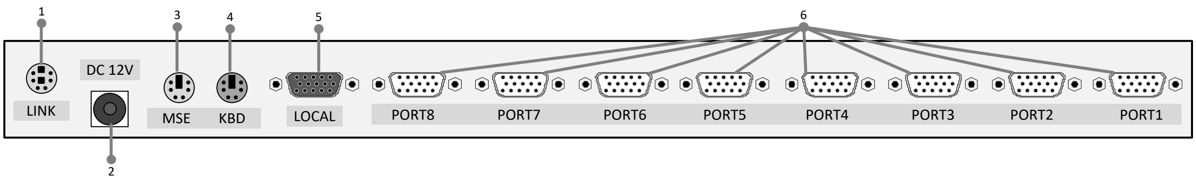
The KVM Rack-mount Console is used as the HMI for the Servers which will be utilised for diagnostics and maintenance of the devices.

Front View



1	Key Lock	6	Mouse Track Pad	11	Down Navigation Button
2	Handle	7	Power LED	12	Menu Button
3	17” LCD Screen	8	Power Button		
4	Full QWERTY Keyboard	9	Auto Adjust Button		
5	Number Pad	10	Up Navigation Button		

Back View



1	KVM External Control Link	3	PS/2 Mouse Port	5	Local KVM Out Port
2	12V DC Power Port	4	PS/2 Keyboard Port	6	KVM Input Port (8)

16.14 Maintenance Terminal - Dell Latitude E5570 Laptop

The Maintenance Terminal is a fixed laptop provided for Thales maintenance staff, enabling them to undertake diagnostics, software upgrades, software and data updates. This maintenance terminal also provides system status view for maintenance staff.

END

Equipment Identification

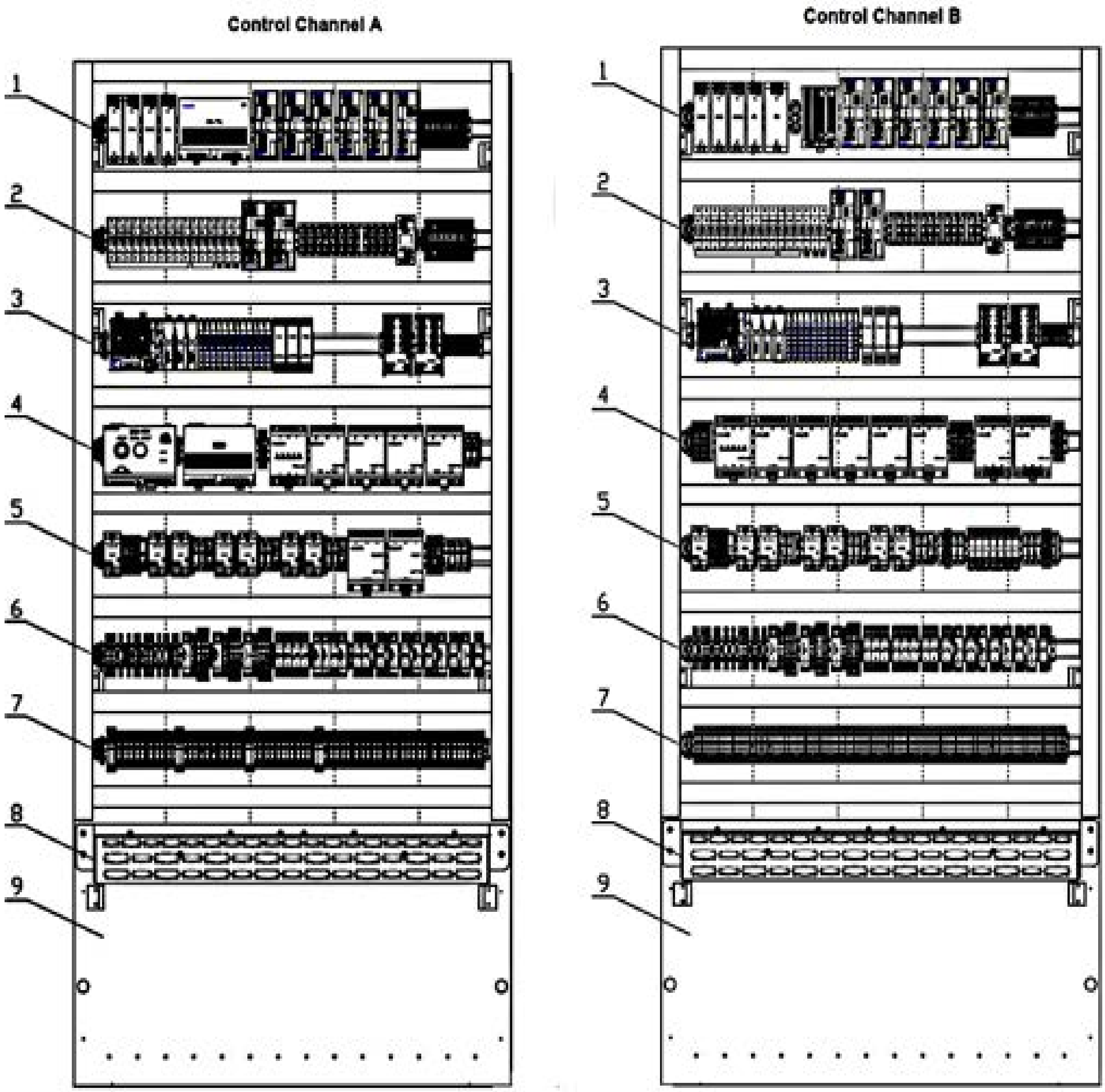
Section Index

1. Definitions & Abbreviations

EBI Gate 2000 (SPA-5/GBR)	Brand name for the family of SPA-5 level crossing systems
LX	Level Crossing System. Set of devices that warn road users about approaching trains.
PLC	Programmable Logic Controller
CPU	Central Processing Unit – main part of the PLC
PE	Protective Earth
+UA, +UB	Isolated power supply voltages for Control Channels A and B
RCD	Residual Current Device
ERP-9	Remote Control Device
DnC	Diagnostic and Control
CF	Compact Flash - Memory card installed in the CPU socket
POD	Primary Obstacle Detector
COD	Complementary Obstacle Detector
DVR	Digital Video Recorder
BPM	Barrier Protection Modules
ERR-8	Set of Power Supply and Control Racks ERR-8 Release 01 for *EBI* Gate 2000 (SPA-5/GBR)

2. Control Rack – Layout & Equipment Descriptions

2.1 Control Rack Layout



Control Channel A	
Number	**Terminal Strip ID**
1	LAA
2	LAB
3	LAC
4	LAD
5	LAE
6	LAF
7	Plug coupler sub-assembly
8	
9	

Control Channel B	
Number	**Terminal Strip ID**
1	LBA
2	LBB
3	LBC
4	LBD
5	LBE
6	LBF
7	Plug coupler sub-assembly
8	
9	

2.2 Control Rack – Manual Control Module EMH-261

EMH-261 module is equipped with:

- Button (with backlight) used during system start up procedure,
- Two LED indication lamps informing about correct operation of the data logger function.

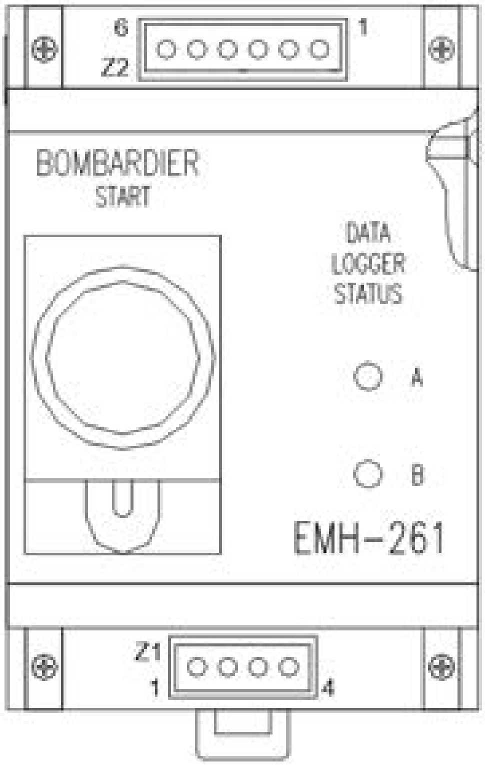


Fig. 1. EMH-261 front view

2.3 Control Rack – Manual Control Module EMH-264

EMH-264 module is equipped with:

- Button that enables the function of red road light failure reset,
- Button that enables the function of obstacle detection alarm reset,
- Switch that enables control over COD shutters,
- Switch that enables control over BOD outputs.

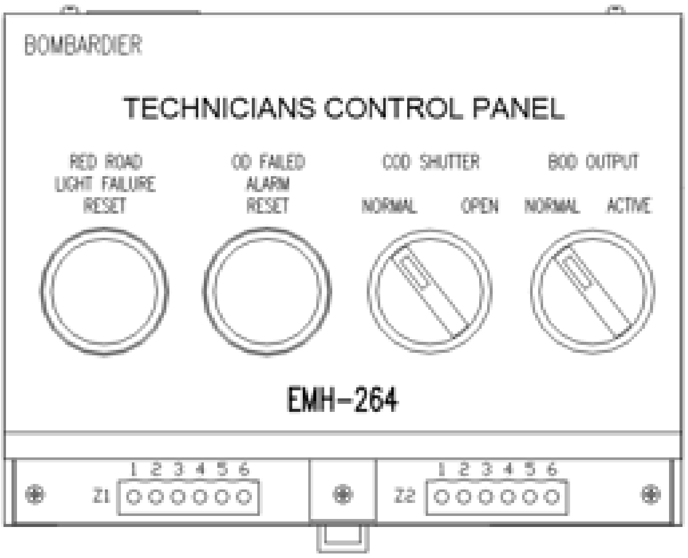


Fig. 2. EMH-264 front view

2.4 Control Rack – Digital input modules

There is a set of digital input modules connected to each CPU within each PLC.

The working status of the each module is reported via lit “r” LED placed on the front panel.

The “e” LED should remain turned off. The status of each pin (DI1, DI2, etc.) is indicated by green LEDs with indicating numbers.

When an input is in active state a corresponding LED is lit.

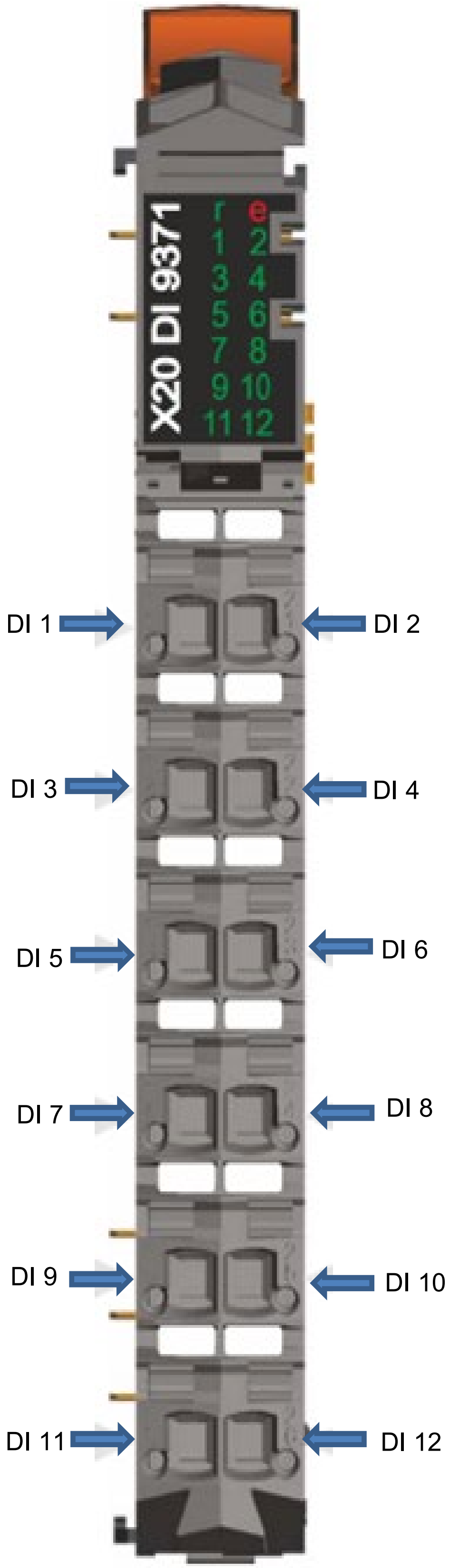


Fig. 3. Input module X20DI9371 (12 inputs)

2.5 Control Rack – Digital output modules

There is a set of digital output modules connected to each CPU within each PLC.

The working status of the each module is reported via lit “r” LED placed on the front panel.

The “e” LED should remain turned off. The status of each pin (DO1, DO2, etc.) is indicated by orange LEDs with indicating numbers.

When an output is in active state a corresponding LED is lit.

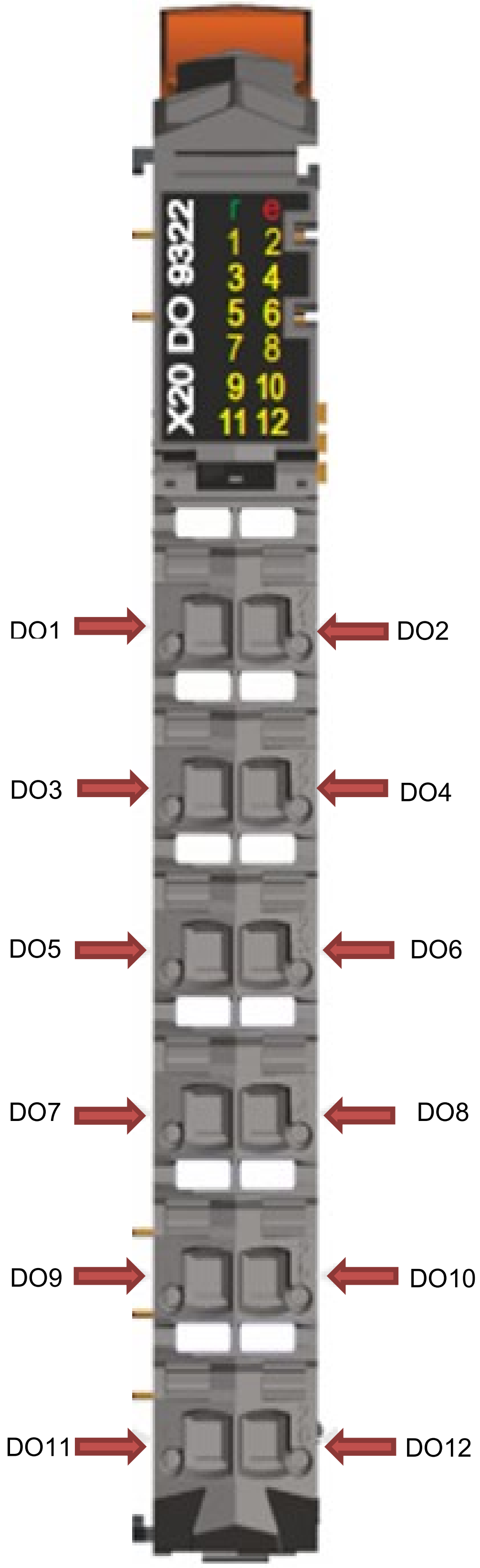


Fig. 4. Output module X20DO9322 (12 outputs)

2.6 Control Rack – List of input and output signals

The inputs and outputs are numbered according to following rules:

- groups represent PLC input or output modules that are marked from left to the right using capital letters A, B, C, ... ,
- The version of the group configuration is marked with number 1, 2, ...

LED No.	Terminal	Description	Signal in Control Channel A	Signal in Control Channel B
1	11	Gen1 Waveform	inGen1 A	inGen1 B
2	21	Gen1Start LX	inGenStart A	inGenStart B
3	12	Hut door	inHutDoor A	inHutDoor B
4	22	Fire Danger	inFire A	inFire B
5	13	Battery Voltage of channel A/B	inBatteryA	inBatteryB
6	23	Mains Power 230V of channel A/B	inMainsA	inMainsB
7	14	Earth leakage detector TH1 of channel A/B	inTH1A	inTH1B
8	24	Earth leakage detector TH2 of channel A/B	inTH2A	inTH2B
9	15	Battery Voltage of channel C	inBatteryC	-
10	25	Mains Power 230V of channel C	inMainsC	-
11	16	Earth leakage detector TH1 of channel C	inTH1C	-
12	26	Earth leakage detector TH2 of channel C	inTH2C	-

Table 1 - Input group A1/GBR (DI 12in module)

LED No.	Terminal	Description	Signal in Control Channel A	Signal in Control Channel B
1	11	Lidar A/B LL fault	inCOD_LL_FLT_A	inCOD_LL_FLT_B
2	21	Lidar A/B LL clear	inCOD_LL_FRE_A	inCOD_LL_FRE_B
3	12	Lidar A/B HL fault	inCOD_HL_FLT_A	inCOD_HL_FLT_B
4	22	Lidar A/B HL clear	inCOD_HL_FRE_A	inCOD_HL_FRE_B
5	13	Lidar C/D LL fault	inCOD_LL_FLT_C	inCOD_LL_FLT_D
6	23	Lidar C/D LL clear	inCOD_LL_FRE_C	inCOD_LL_FRE_D
7	14	Lidar C/D HL fault	inCOD_HL_FLT_C	inCOD_HL_FLT_D
8	24	Lidar C/D HL clear	inCOD_HL_FRE_C	inCOD_HL_FRE_D
9	15	Technician Reset Button: Road signals OK acknowledge	inTechnReset A	inTechnReset B
10	25	COD Shutter Normal/Open	inCOD_SHUTTER A	inCOD_SHUTTER B
11	16	BOD Output Normal/Active	inBOD_OUTPUT A	inBOD_OUTPUT B
12	26	POD Failed Alarm Reset	inOD_FLT_ALM_RST A	inOD_FLT_ALM_RST B

Table 2 - Input group B1/GBR (DI 12in module)

LED No.	Terminal	Description	Signal in Control Channel A	Signal in Control Channel B
1	11	Gen 1 Waveform	outGen1 A	outGen1 B
2	21	Opto-coupler cyclical test pulse	outTT A	outTT B
3	12	-	-	-
4	22	EMH module LED1/LED2 – Logger A/B status	outEvLogger A	outEvLogger B
5	13	EMH module LED – START	-	outStartPLC
6	23	Gen2 Waveform	outGen2 A	outGen2 B
7	14	Radar START	outOD_START A	outOD_START B
8	24	Radar STOP	outOD_STOP A	outOD_STOP B
9	15	LIDAR Power ON/OFF	-	outCOD_ON_OFF
10	25	LIDAR Shutter OPEN/CLOSE	-	outCOD_OP_CL
11	16	LCU Raise Locked	outLCU_Locked	-
12	26	XCU Crossing Clear Ind.	-	outXCU_CCind

Table 3 - Output group C1/GBR (DO 12out module)

LED No.	Terminal	Description	Signal in Control Channel A	Signal in Control Channel B
1	11	Signal at time of clearing controls. (CC)NPR de-energised, (CC)SR and (BARR)CR energised.	outIL_XZGR A	outIL_XZGR B
2	21	Crossing locked down. (DN)SR energised	outIL_DN_SPR A	outIL_DN_SPR B
3	12	Operates when raise sequence is pre-selected	outIL_RAISE_NZPR A	outIL_RAISE_NZPR B
4	22	Operates when auto mode is set	outIL_ASPR A	outIL_ASPR B
5	13	Operates when the barrier are up or the crossing is opening	outIL_XNSKPR A	outIL_XNSKPR B
6	23	Operates when the signaller has operated the manual raise control, and the LCU is not being used	outIL_RAISE_N2PR A	outIL_RAISE_N2PR B
7	14	COD HL FRE Total to DVR/POD FRE to DVR	outDVR_HL_FRE	outDVR_POD_FRE
8	24	COD LL FRE Total to DVR/OD Not Failed	outDVR_LL_FRE	outDVR_OD_NFLT
9	15	BOD FREE Total to DVR/OD START to DVR	outDVR_BOD_FREE	outDVR_OD_START
10	25	OD FLT RESET to DVR/OD STOP to DVR	outDVR_OD_RESET	outDVR_OD_STOP
11	16	Interlocking - reserved	-	-
12	26	-	-	-

Table 4 - Output group D1/GBR (DO 12out module)

LED No.	Terminal	Description	Signal in Control Channel A	Signal in Control Channel B
1	11	Absent Switch in Closed position if absent switch provided	inIL_ABS_LPR A	inIL_ABS_LPR B
2	21	Absent Switch in Open position if absent switch provided	inIL_ABS_LPZR A	inIL_ABS_LPZR B
3	12	Train Approaching from either direction	inIL_TAR A	inIL_TAR B
4	22	Operates to prove that the level crossing is effective in interlocking	inIL_DN_S2PR A	inIL_DN_S2PR B
5	13	Operates to prove signal clearing conditions have released in the interlocking	inIL_DN_S2PZR A	inIL_DN_S2PZR B
6	23	Operates when crossing is free to open	inIL_XZR A	inIL_XZR B
7	14	Operates to prove that all routes over the level crossing are normal	inIL_NL2PR A	inIL_NL2PR B
8	24	Feedback signal of output XZGR	inIL_XZGRf A	inIL_XZGRf B
9	15	Feedback signal of output (DN)SPR	inIL_DN_SPRf A	inIL_DN_SPRf B
10	25	Feedback signal of output (RAI.)NZPR	inIL_RAISE_NZPRf A	inIL_RAISE_NZPRf B
11	16	Feedback signal of output ASPR	inIL_ASPRf A	inIL_ASPRf B
12	26	Feedback signal of output XNSKPR	inIL_XNSKPRf A	inIL_XNSKPRf B

Table 5 - Input group E1/GBR (DI 12int module)

LED No.	Terminal	Description	Signal in Control Channel A	Signal in Control Channel B
1	11	RADAR - Cleared	inPOD_FRE A	inPOD_FRE B
2	21	RADAR - Active	inPOD_ACT A	inPOD_ACT B
3	12	RADAR - Fault	inPOD_FLT A	inPOD_FLT B
4	22	Feedback of Radar START	inOD_STARTf A	inOD_STARTf B
5	13	Feedback of Radar STOP	inOD_STOPf A	inOD_STOPf B
6	23	ID of control channel A (-UA)/ ID of control channel B (+UB)	inChannel_ID A	inChannel_ID B
7	14	TD254D Inductive Loop – BOD12/BOD34	inBOD_L12_FLT	inBOD_L34_FLT
8	24	TD254D Inductive Loop - BOD1/BOD3	inBOD_L1_FREE	inBOD_L3_FREE
9	15	TD254D Inductive Loop – BOD2/BOD4	inBOD_L2_FREE	inBOD_L4_FREE
10	25	-	-	-
11	16	-	-	-
12	26	-	-	-

Table 6 - Input group F1/GBR (DI 12in module)

LED No.	Terminal	Description	Signal in Control Channel A	Signal in Control Channel B
1	11	XCU NORMAL	inXCU_Normal A	inXCU_Normal B
2	21	XCU DOOR	-	inXCU_Door
3	12	XCU SIGNALS ON	inXCU_SignalsON A	inXCU_SignalsON B
4	22	XCU Crossing Clear	inXCU_CrossClear A	inXCU_CrossClear B
5	13	Level Crossing locked	inIL_LC_LOCKED A	inIL_LC_LOCKED B
6	23	Feedback signal of output (RAISE)N2PR	inIL_RAISE_N2PRf A	inIL_RAISE_N2PRf B
7	14	LCU NORMAL	inLCU_Normal A	inLCU_Normal B
8	24	LCU HAND	inLCU_Hand A	inLCU_Hand B
9	15	LCU RAISE	inLCU_Raise A	inLCU_Raise B
10	25	LCU STOP	inLCU_Stop A	inLCU_Stop B
11	16	LCU LOWER	inLCU_Lower A	inLCU_Lower B
12	26	LCU DOOR	inLCU_Door A	-

Table 7 - Input group G1/GBR (DI 12in module)

LED No.	Terminal	Description	Signal in Control Channel A	Signal in Control Channel B
1	11	Feedback of entrance barriers direction of movement	inBM_Dirf A	inBM_Dirf B
2	21	Barrier MB1/BM2 intermediate position	inBM_1m	inBM_2m
3	12	Barrier BM1/BM2 lowered position	inBM_1d	inBM_2d
4	22	Barrier BM1/BM2 raised position	inBM_1u	inBM_2u
5	13	Barrier BM1/BM2 door	inBM_1ok	inBM_2ok
6	23	Barrier BM1/BM2 intact	inBM_1i	inBM_2i
7	14	Feedback of exit barriers direction of movement	inBM_DirExf A	inBM_DirExf B
8	24	Barrier BM3/BM4 intermediate position	inBM_3m	inBM_4m
9	15	Barrier BM3/BM4 lowered position	inBM_3d	inBM_4d
10	25	Barrier BM3/BM4 raised position	inBM_3u	inBM_4u
11	16	Barrier BM3/BM4 door	inBM_3ok	inBM_4ok
12	26	Barrier BM3/BM4 intact	inBM_3i	inBM_4i

Table 8 - Input group H1/GBR (DI 12in module)

LED No.	Terminal	Description	Signal in Control Channel A	Signal in Control Channel B
1	11	-	-	-
2	21	-	-	-
3	12	-	-	-
4	22	-	-	-
5	13	-	-	-
6	23	-	-	-
7	14	Interlocking - reserved	-	-
8	24		inIL_TAZPR A	inIL_TAZPR B
9	15	-	-	-
10	25	-	-	-
11	16	-	-	-
12	26	-	-	-

Table 9 - Input group I1/GBR (DI 12in module)

LED No.	Terminal	Description	Signal in Control Channel A	Signal in Control Channel B
1	11	Entrance barriers direction of movement	outBM_Dir A	outBM_Dir B
2	21	Barrier BM1/BM2 move on	outBM_1move	outBM_2move
3	12	Barrier BM1/BM2 brake on	outBM_1brake	outBM_2brake
4	22	Barrier BM1/BM2 lanterns on	outBM_1lamps	outBM_2lamps
5	13	Exit barriers direction of movement	outBM_DirEx A	outBM_DirEx B
6	23	Barrier BM3/BM4 move on	outBM_3move	outBM_4move
7	14	Barrier BM3/BM4 brake on	outBM_3brake	outBM_4brake
8	24	Barrier BM3/BM4 lanterns on	outBM_3lamps	outBM_4lamps
9	15	-	-	-
10	25	-	-	-
11	16	-	-	-
12	26	-	-	-

Table 10 - Output group J1/GBR (DO 12out module)

2.7 Control Rack – Power Supply Module EMF-8

Power Supply Modules EMF-8 are controlling chambers of road signals. The external elements of EMF-8 are presented below:

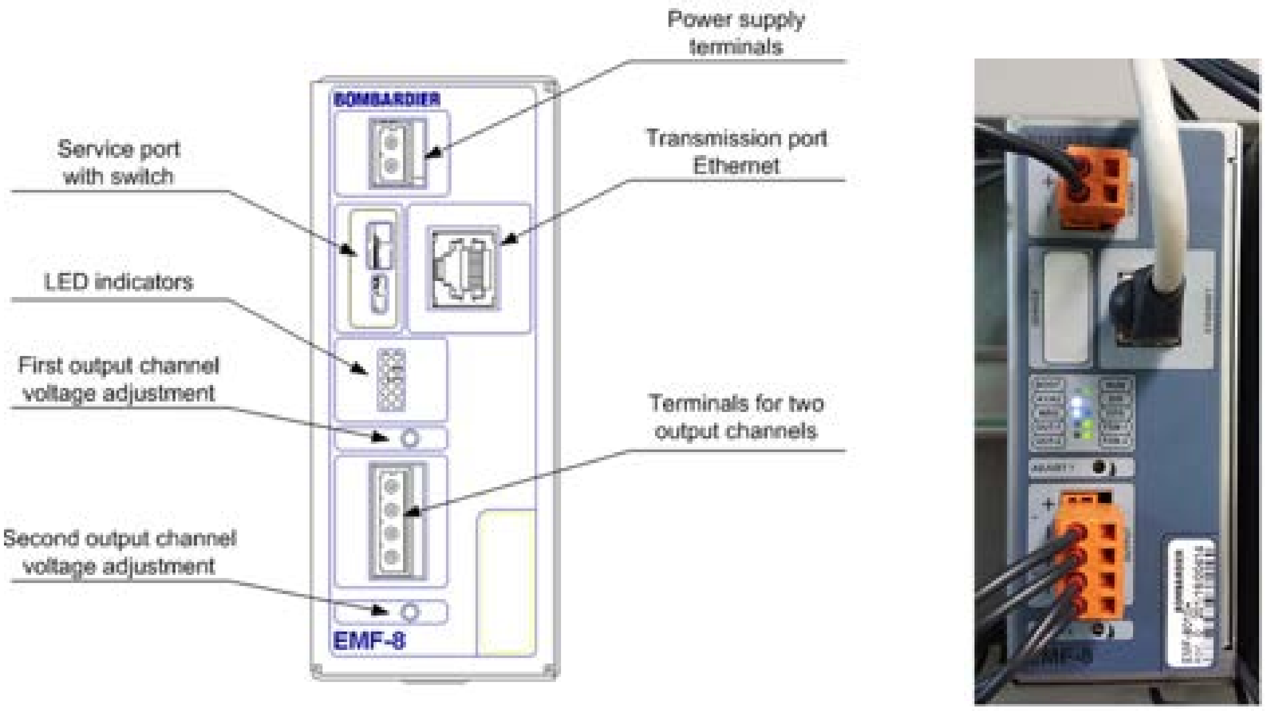


Fig. 5. Power Supply Module EMF-8

Fig. 6 - Power Supply Module EMF-8, Sound Generator EDG-5 – LED indicators

The meanings of LED indicators (front panel description in brackets):

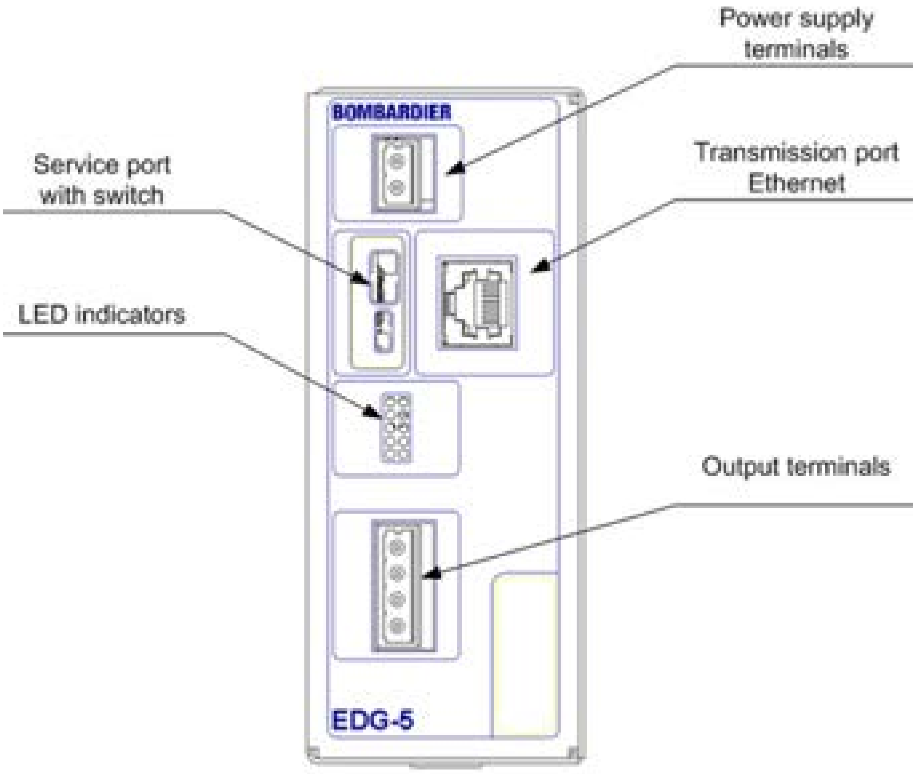
- TransmissionRx (MSG) - LED blinks for about 100ms after receiving message,
- ActiveModes (A1/A2):
  - LED continuous on – Active,
  - LED 2Hz flash – Active Without Transmission,
  - LED off – in case of all other states.
- OutputSignal (OUT1, OUT2) - requested state of output signals,
- DiagStart (D/S):
  - LED off – no Diag or Start state,
  - LED on – Start state,
  - LED 2Hz flashing – Diag state.
- Feedback (FDB-1, FDB-2) – read back state of output signal:
  - LED on – output signal is active,
  - LED off – output signal is inactive,
  - LED 10Hz flashing – output signal state is incorrect.
- Config (CFG):
  - LED off – configuration OK,
  - LED 2Hz flashing – no configuration data,
  - LED 1Hz flashing – invalid configuration data.
- Run (RUN) – blinks for about 10ms when device works properly with about 2Hz frequency, continuous on or off when device stops.

Fig. 7. Power Supply Module EMF-8, Sound Generator EDG-5 – Service port

- Service port of EMF-8 shall be sealed with a special sticker.

2.8 Control Rack – Sound Generator EDG-5

- Sound Generators EDG-5 are controlling acoustic warning signals. The external elements of this module are presented below:



- The meaning of LED indicators is the same as for EMF-8.

- Service port must be sealed with a special sticker.

2.9 Control Rack – Signal Amplifier EDZ-35

Signal Amplifier EDZ-35 consists of five electronic keys acting as buffers for PLC outputs.

Each output circuit (K1, K2, K3, K4, K5) is equipped with voltage and current indication circuit with two LED lamps.

In each pair the green LED represents the output voltage detection and the red LED represents current detection.

Fig. 9. Signal Amplifier EDZ-35

2.10 Control Rack – Electronic Key EDZ-5

Electronic Key EDZ-5 is a simple electronic key. It is equipped with red LED lamp which is lit when the module is activated.

Fig. 10. Electronic Key EDZ-5

2.11 Control Rack and Power Supply Rack – Earth Leakage Detector

Power supply channels A and B are insulated with each other and with the equipotential bar PE.

The Earth Leakage Detectors are applied to check the resistance between PE, UA and UB. There is also an “Earth Leakage Detector” in power supply channel C.

The “Earth Leakage Detector” is equipped with:

- LCD display which presents actual value of insulation resistance,
- ON LED lamp which is lit when the module is powered,
- Two AL1, AL2 LED lamps informing about two levels of insulation degradation.

Fig. 11. Earth Leakage Detector

2.12 Control Rack – Current Transducer

Current Transducer is applied in control circuit of barrier machines to allow high current measurements for analogy input cards of PLC A and B.

It is equipped with LED indicator informing that the module is powered (PWR) and that an error in module operation was detected (ERR).

Current Transducer has two plugs.

Fig. 12. Current Transducer - WAGO current measurement unit

2.13 Control Rack – ETHERNET Switch

The ETHERNET communication is held via ETHERNET switches. These modules are equipped with LED lamps:

- Pwr – the module is powered,
- L/A is lit up green – link is active,
- L/A is flashing green – link is active and data is transferred.

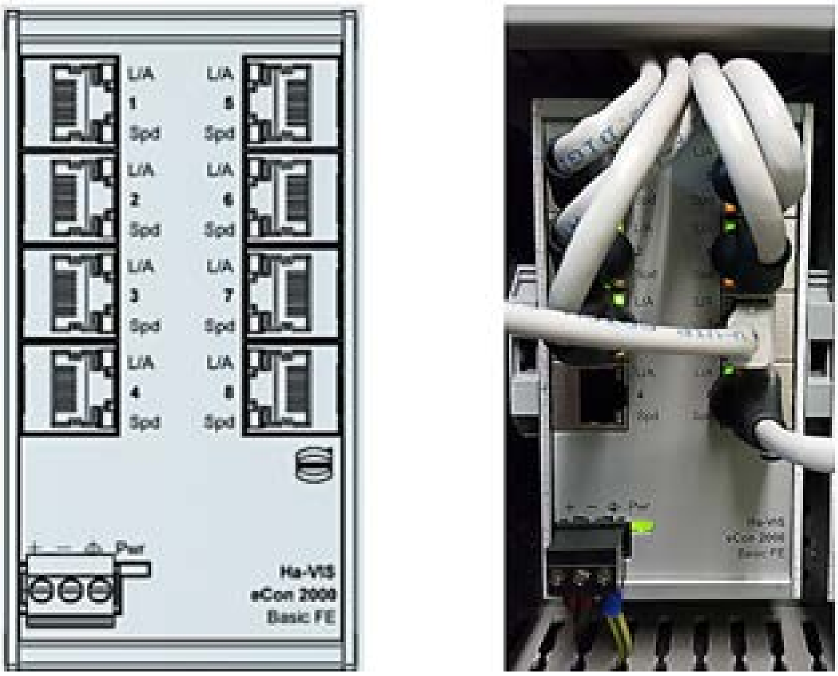
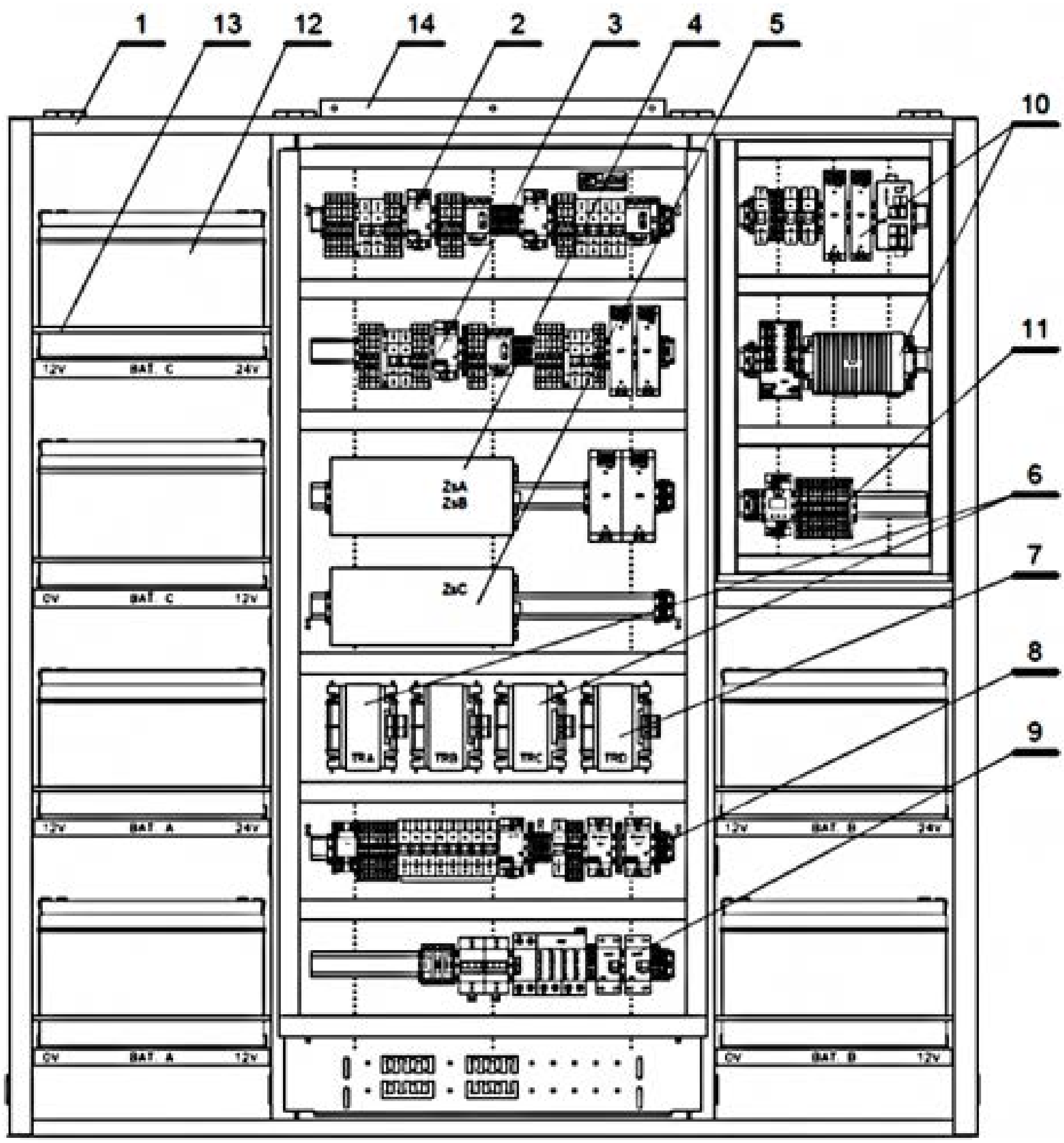


Fig. 13. ETHERNET Switch

3. Power Supply Equipment and Fuses

3.1 Power Supply Rack – General View



Number	Description
1	Chassis
2	ZZA Terminal Strip
3	ZZB Terminal Strip
4	ZZC Terminal Strip
5	ZZX Terminal Strip
6	Transformers TRA, TRB & TRC
7	Autotransformer TRD

Number	Description
8	ZZD Terminal Strip
9	ZZE Terminal Strip
10	LTZ Module
11	ZZE Terminal Strip in LTZ Module
12	Batteries 12v, 85 Ah
13	Battery Blocking Bars
14	Mounting Bracket

3.2 Power Supply and Control Racks – Before switching on checklist

Before switching on the ERR-8 below listed steps have to be performed:

- Check using AC voltmeter if the main power supply voltage is above 195V,
- Check using DC voltmeter if batteries voltage is above 26V,
- Perform visual inspection of all terminal strips,
- Check if all fuses are turned off in terminal strips LAB and LBB.

3.3 Power Supply and Control Racks – Switching on and off

To switch on the ERR-8 follow the instructions described in the manual, To switch off move downward levers of all fuses listed in 3.4

3.4 Power Supply and Control Racks – Manual restart procedure

It is enough to switch off only the fuses LA and LB on Control Racks to execute manual restart procedure.

3.5 Power Supply and Control Racks – Fuses

On both racks there is a set of fuses that check power supply for ERR-8 sub-circuits.

In order to turn on a fuse move the lever up to the end.

In order to turn off move the lever downward.

The list of all fuses with explanation of their function and position on the racks:

Power supply rack

TYTAN	Fused mains power switch
ISOLATION SWITCH	Safety mains power disconnector
FA	Mains power supply for power channel A
FB	Mains power supply for power channel B
FC	Mains power supply for power channel C
FD	Mains power supply for POD internal heater
TV	Mains power supply for DVR LCD
FL	Internal lighting
FF	Fan
FS	General purpose electric outlet, heater
P.P	Smoke detector
RCD1, RCD2	Residual Current Device
ZA	Power channel A: batteries load fuse
ZB	Power channel B: batteries load fuse
ZC	Power channel C: batteries load fuse
ZiA	Power channel A: battery charging fuse
ZiB	Power channel B: battery charging fuse

ZiC	Power channel C: battery charging fuse
BS	Power supply for COD shutter motors
BV	Power supply for DVR and BPM modules
BL	Power supply for CODs
BR	Power supply for POD

Control rack (channel A)

LA	Fuse of PLC in channel A
ODŁ.A	Fuse of EMB-1 module
RS14A	Fuse of red chambers in road signals 1, 2, 3, 4 (channel A)
RSYA	Fuse of amber chambers in road signals 1, 4, 5, 8
BMA	Fuse of group of barrier machines BM1 and BM3
RS58A	Fuse of red chambers in road signals 5, 6, 7, 8 (channel A)
D1	Fuse of audible signal DZ1
D5	Fuse of audible signal DZ5
BM1	Main fuse of barrier machine BM1
BM3	Main fuse of barrier machine BM3
B1	Fuse of electromagnetic brake in BM1
B3	Fuse of electromagnetic brake in BM3

Control rack (channel B)

LB	Fuse of PLC in channel B
INT	Fuse of output part of interlocking interface
RS14B	Fuse of red chambers in road signals 1, 2, 3, 4 (channel B)
RSYB	Fuse of amber chambers in road signals 2, 3, 6, 7
BMB	Fuse of group of barrier machines BM2 and BM4
RS58B	Fuse of red chambers in road signals 5, 6, 7, 8 (channel B)
D2	Fuse of audible signal DZ2
D6	Fuse of audible signal DZ6
BM2	Main fuse of barrier machine BM2
BM4	Main fuse of barrier machine BM4
B2	Fuse of electromagnetic brake in BM2
B4	Fuse of electromagnetic brake in BM4

3.6 Guidelines for Stabilized Power Supply DC/DC Converter MERAWEX

The output voltage of Stabilized Power Supply DC/DC Converter MERAWEX is adjusted during production process.

As the performance of lead-acid batteries depends on the charging voltage the user is not allowed to make any adjustments of their output voltage.

3.7 Guidelines for other DC/DC converters (Phoenix Contact)

The output voltage of other DC/DC converters (Phoenix Contact) is adjusted during its production and installation process. It is not allowed to make any adjustments of their output voltages.

3.8 Adjusting output voltage of Power Supply Module EMF-8

Power Supply Module EMF-8 consists of two independent DC/DC converters. It is used as a power supply for the road signals.

Adjustment of its output voltages can be done (when necessary) by means of two multi-turn potentiometers (shown below) with use suitable screwdriver.

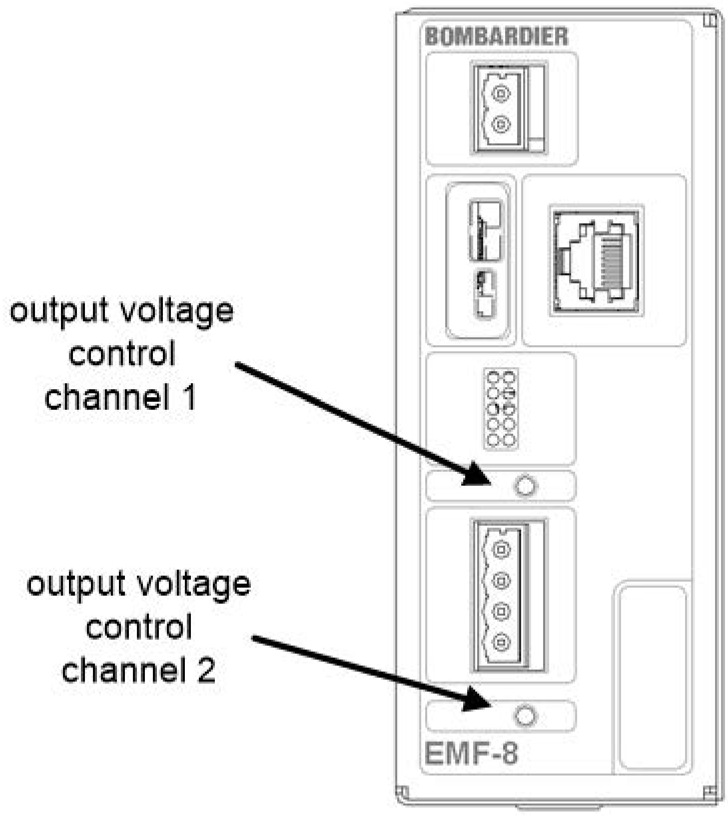


Fig. 14. Adjusting EMF-8 output voltage

END

This appendix covers the checking the status of various equipment at the interlocking, acronyms and system restart.

1. CALS Board (Internal)

1.1 Observe all the power supply LEDs of the CALs (CALS PAP i=1 to 3) are lit.

1.2 Check the PAP rack's circuit breaker is powered. The Start (green) button shall be engaged, the Stop (red) shall not be engaged.

1.3 If the circuit breaker is not powered, check incoming power. If this is within +-20% of 24 V, re-engage the circuit breaker.

1.4 If the circuit breaker trips again, replace the CALS board.

1.5 Using a meter, check the following voltages at the measurement points on the CALS board:

- 5V VME (+4.7 V to +5.5 V)
- =12V VME (+11.5 V to 12.5 V)
- -12V VME (-11.5 V to 12.5 V)
- 5V VL (+4.7 V to 5.5 V)
- 24 VREG (23 to 25V)

If these voltages are not measured, replace the CALS board.

2. CME+ Board

2.1 Observe the LEDs of the CME:

	VA	VA
(Unlit) E ⊗	(Flashing) ⊗ ⊗ (Steady)	(Flashing) ⊗ ⊗ (Steady)
	Rx	Tx
(Unlit) E ⊗	(Flashing) ⊗ ⊗ (Steady)	(Flashing) ⊗ ⊗ (Steady)
	VA	VA

If these indications are not correct, replace the CME+ board.

3. CIER Board

3.1 Observe the CIER board is displayed in red on the Technicians Terminal.

3.2 Observe on the front face of the CIER board that the LEDs of Ethernet ports 1 and 2 are not flashing. Also, and/or the two LEDS of the Console port are steady green or off.

If these indications are not correct, replace the CIER2 board.

4. CAP Board

4.1 Observe LEDS of the CAP board are in the following state:

(Flashing) BFL ⊗
(Flashing) CPU ⊗

If the CPU LED is lit, replace the CAP dongle (BCH).

If the LEDs are in the expected state, replace the CAP board.

5. CVO Board

5.1 Observe LEDS of the CVO board are in the following state:

lit)	W	⊗	⊗	H	(unlit)
(pulsating)	M	⊗	⊗	E	(unlit)
(flashing)	1	⊗	⊗	2	(unlit)

If these indications are not correct, replace the CIER2 board.

6. CIER Ethernet Cables

6.1 Disconnect the Ethernet cables between the CIER board and the Ethernet switch.

6.2 Using another Ethernet cable, connect between the CIER board and the Ethernet switch and check for the following states on the Technicians Terminals:

a) If the connection stays green, keep the new Ethernet cable.

b) If the connection remains faulty, reconnect the existing Ethernet cable.

7. Acronyms

Acronym	French Meaning	English Meaning
AG	**AG**uile	Point
BCH	**B**ou**CH**on	Dongle
CALM	**C**arte **AL**imentation d'une architecture bi-**M**TOR	Power Supply Board for MTOR architecture
CALS	**C**arte **AL**imentation **S**ol	Power Supply Board
CAP	**C**arte d'**A**p**p**lication	Processing Unit Board
CIER	**C**arte **I**nterface **E**thernet **R**éseau	Ethernet Network Interface Board
CG	**C**hien de **G**arde	Watchdog
CME	**C**arte **M**émoire d'**E**change	Shared Memory Board
CRCD	**C**arte à **R**elais à **C**ommande **D**iversifiée	Duplicated Output Relay Board
CSD	**C**alculateur de **S**écurité **D**isponible	Module containing CAP, CVO & CME boards and CAP & CVO dongles
CVO	**C**arte **VO**teur	Voting Board
HES	**H**ybride d'**E**ntrée de **S**écuité	Hybrid Safety Inputs
MTOR	**M**odule **T**out **O**u **R**ien	Digital Module
PAP	**P**anier d'**AP**plication	Application Rack
PES	**P**anier d'**E**ntrées / **S**orties	Inputs / Outputs Rack
PVF	**P**anier d'**V**entilation **F**orcée	Forced Ventilation Rack
SEI	**S**ystème d'**E**nclenchement **I**nformatisé	Interlocking System
SSKC	**S**ous-**S**ystème (**K**) **C**ontrôleur commande	I/O Module command control sub-system
SX	**S**ignau**x**	Signal
TTD	**T**erminal **T**echnique **D**eporté	Remote Technicians Terminal
UT	**U**nité de **T**raitement	Processing Unit

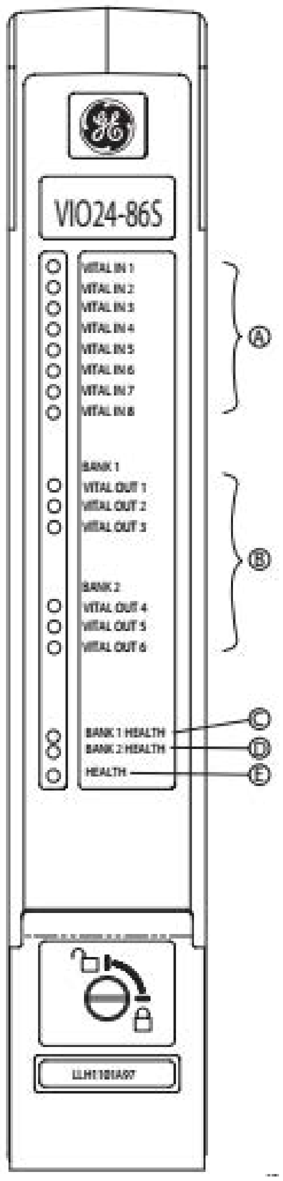
8. Interlocking Restart

When restarting the interlocking, all interlocking controls such as route bars, shall be reapplied using the TT.

END

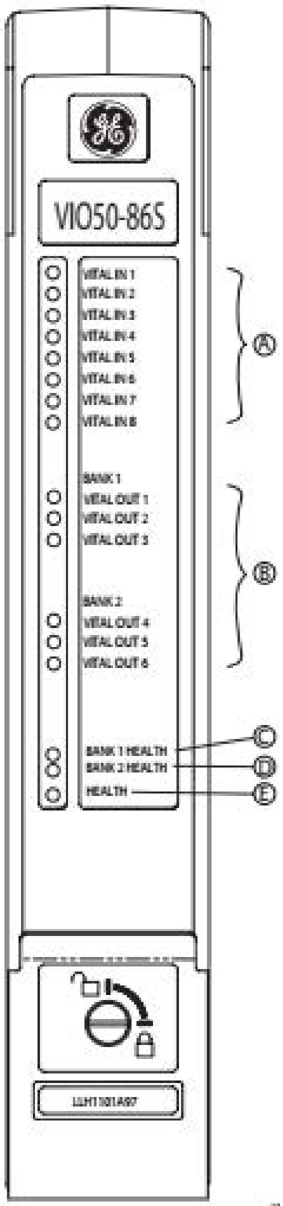
Status and Description of LED Indications.

1. VIO24-86S



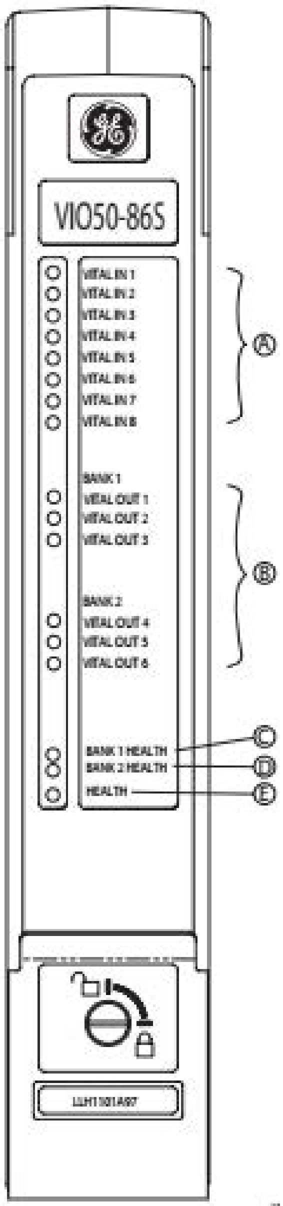
VIO24-86S		
LED	**Status**	**Description**
A. VITAL IN 1-8	On	Input is energised (When input rises above 16.0 ± 0.5VDC). Will accept voltages up to 64 VDC.
A. VITAL IN 1-8	Off	Not Energised (When input falls below6.0 ± 0.5VDC)
B. VITAL OUT 1-3	On	Output is energised
B. VITAL OUT 1-3	Off	Not Energised
B. VITAL OUT 4-6	On	Output is energised
B. VITAL OUT 4-6	Off	Not Energised
C. BANK 1 HEALTH	On	Bank 1 vital outputs 1-3 are functioning properly.
C. BANK 1 HEALTH	Off	1 or more of Vital Outputs 1-3 has failed. If 1 Vital Output fails the other 2 Vital Outputs on the same Bank are shutdown.
D. BANK 2 HEALTH	On	Bank 2 vital outputs 4-6 are functioning properly.
D. BANK 2 HEALTH	Off	1 or more of Vital Outputs 4-6 has failed. If 1 Vital Output fails the other 2 Vital Outputs on the same Bank are shutdown.
E. HEALTH	On	Module able to function properly.
E. HEALTH	Off	Module is in Safe State Retention State (check system log & Alarms).

2. VIO50-86S



VIO50-86S		
LED	**Status**	**Description**
A. VITAL IN 1-8	On	Input is energised (When input rises above 39.0 ± 0.5VDC). Will accept voltages up to 64 VDC
A. VITAL IN 1-8	Off	Not Energised (When input falls below12.5 ± 0.5VDC)
B. VITAL OUT 1-3	On	Output is energised
B. VITAL OUT 1-3	Off	Not Energised
B. VITAL OUT 4-6	On	Output is energised
B. VITAL OUT 4-6	Off	Not Energised
C. BANK 1 HEALTH	On	Bank 1 vital outputs 1-3 are functioning properly.
C. BANK 1 HEALTH	Off	1 or more of Vital Outputs 1-3 has failed. If 1 Vital Output fails the other 2 Vital Outputs on the same Bank are shutdown.
D. BANK 2 HEALTH	On	Bank 2 vital outputs 4-6 are functioning properly.
D. BANK 2 HEALTH	Off	1 or more of Vital Outputs 4-6 has failed. If 1 Vital Output fails the other 2 Vital Outputs on the same Bank are shutdown.
E. HEALTH	On	Module able to function properly.
E. HEALTH	Off	Module is in Safe State Retention State (check system log & Alarms).

3. VLD-R8AC



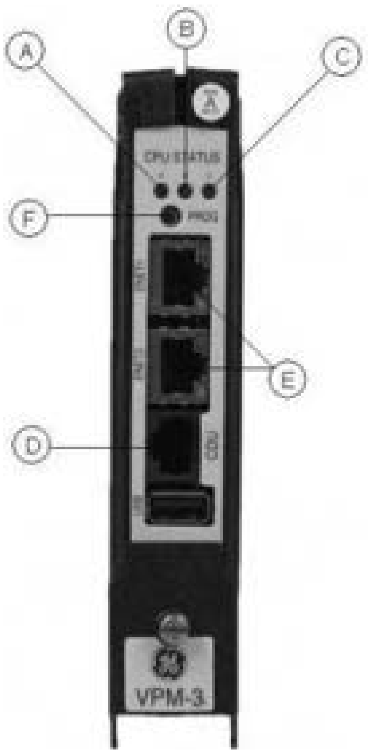
VLD-R8AC		
LED	**Status**	**Description**
A. LAMP 1-8	On	Lamp Output LED is lit when corresponding Lamp Output is energised.
A. LAMP 1-8	Off	Lamp Output LED is not lit when corresponding Lamp Output is not energised. See Note 1. All Lamps out, See Note 2.
B. VSSR	On	Vital Signal Stop Relay is energised.
B. VSSR	Off	VSSR is disabled. See Note 1. See Note 2. See Note 3.
C. HEALTH	On	Module Health LED is lit when VSSR is energised and all internal self-tests pass.
C. HEALTH	Off	Input power is <85VAC RMS or 110VAC lost for more than 0.5s or one or more health check failed, VSSR output disabled. VLD is in Safe State. (It will be 30s before the module attempts to recover).

Note 1: The VLD-R8AC contains feedback circuitry to allow the VPM to monitor and report on the integrity of the lamp output circuitry. The response to a detected fault on defined outputs (off when should be on, on when should be off, etc.) is a de-energising of all the Lamp Outputs and a disabling of the Vital Signal Stop Relay (VSSR) output. After a lamp module has been shut down, the VPM disables the eight Lamp Outputs and the VSSR output for a minimum of 30 seconds. After 30 seconds have passed, the VSSR output is enabled and the VPM performs a health check. If the lamp module passes the health checks, the VLD-R8AC resumes normal operation. Otherwise, if the lamp module fails one or more health checks, the VSSR output is disabled and the VPM waits another 30 seconds before retrying.

Note 2: If the VLD-R8AC internal monitoring circuit senses an unsafe fault all outputs on the module are de-energised and the VSSR output is de-energised. Outputs that are red-retained are immediately energised over a back contact of the VSSR.

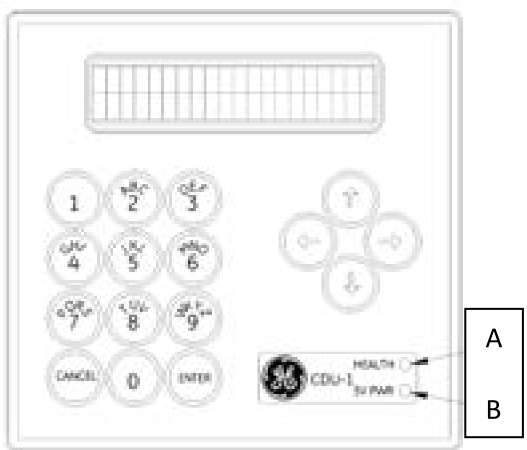
Note 3: If the VSSR de-energises due to a failure in the VLD-R8AC module, the module cannot be re-initialised without manual intervention. If the VSSR de-energises due to power failure, the module and VSSR will re-initialise automatically when power is restored.

4. VPM-3



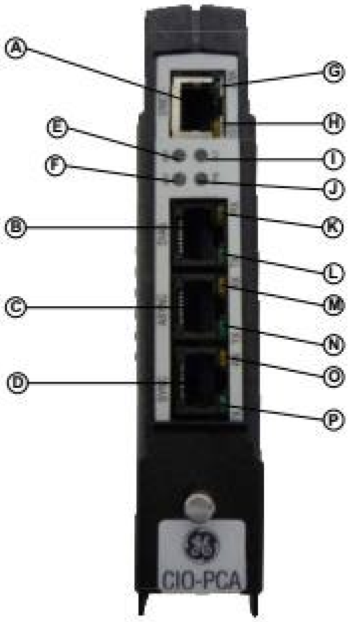
VPM-3		
LED	**Status**	**Description**
A, B or C	Off	CPU is not functioning.
A, B or C	Steady On	The CPU is initialising (only valid status during startup). If one or more continuously illuminated during normal operation, the CPU is not functioning.
A, B or C	Flashing	CPU is Active and functioning normally
All three CPU LEDs	Flashing amber/ red pattern	Update mode (the mode used to update VPM-3 executive software or application programs).
E. Green LED Ethernet connection	Steady/ Flashing	Connected/active
E. Amber LED Ethernet connection speed	On	100Mbs
E. Amber LED Ethernet connection speed	Off	10Mbs
F. Prog Button		1. If depressed during a power cycle, causes the VPM-3 to enter update mode. 2. Used to confirm Local Presence when requested.

5. CDU-1



CDU-1		
LED	**Status**	**Description**
A. HEALTH	On	System CPUs are operating normally
A. HEALTH	Off	A CPU has halted/or not operating and also during system resets.
B. 5V PWR	On	Output of Central Power Supply is within acceptable parameters.
B. 5V PWR	Off	No power

6. **CIO-PCA**



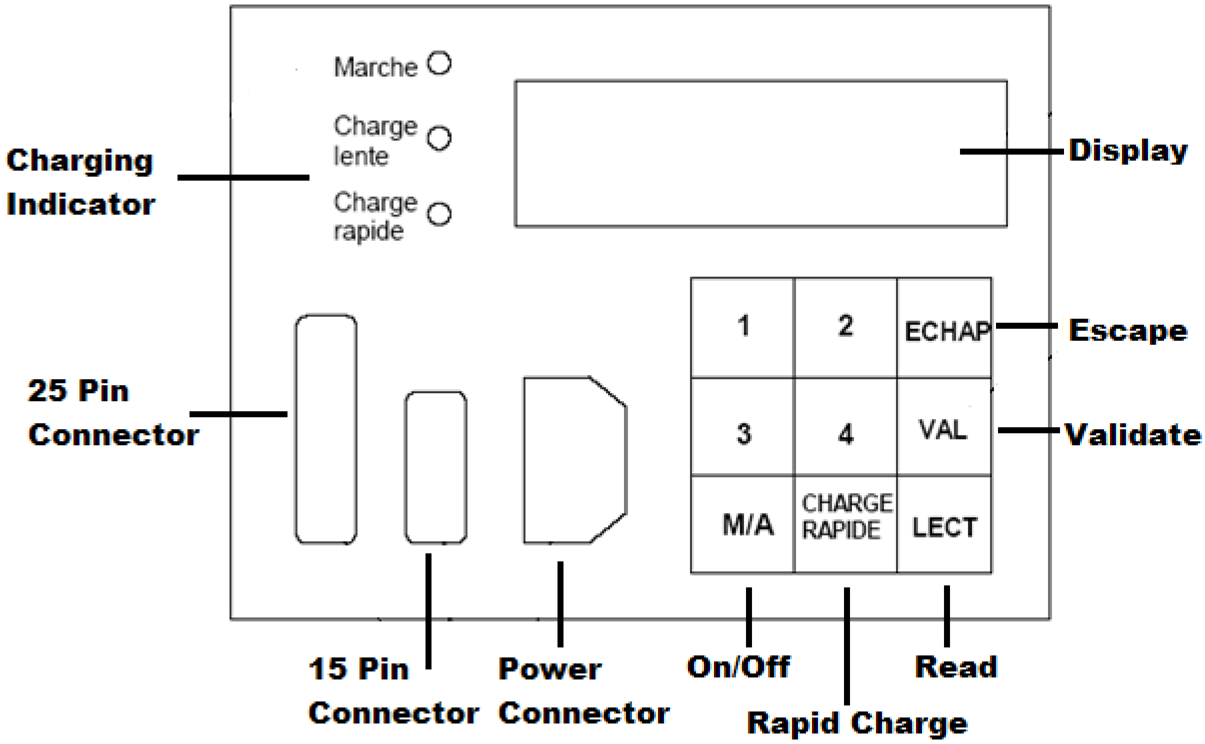
VPM-3		
LED	**Status**	**Description**
E. BKP	On	Receiving data from ElectroLogIXS backplane
F. ASY	On	A valid frame (good CRC) has been received from ASYNC (radio control) port.
G. LINK	On	Ethernet connected to ElectroLogIXS and active
G. LINK	Flashing	Activity on the link
H. 100 (Amber)	On	Ethernet data rate. Connection at 100M
H. 100 (Amber)	Flashing	Data collisions detected
I. HLT	Flashing	CIO-PCA Health. LED flashes approx. once per second when module functioning properly
J. SYN	On	A valid frame (good CRC) has been received from SYNC (radio control) port.
K. RX (Amber)	On	Receive data present on DIAG port to ElectroLogIXS
M. RX (Amber)	On	Receive data present on ASYNC port to ElectroLogIXS
O. RX (Amber)	On	Receive data present on SYNC port to ElectroLogIXS
L. TX (Green)	On	Transmit data present on DIAG port to ElectroLogIXS
N. TX (Green)	On	Transmit data present on ASYNC port to ElectroLogIXS
P. TX (Green)	On	Transmit data present on SYNC port to ElectroLogIXS

END

1. Equipment Description

SNCF Catalogue number for the tester and all the associated cables is: 7.954.5494, Supplier: ALSTOM. This will become stand PADS number after trial Certification.

It is a portable tool with and is designed to be laid flat on the balise. The upper face features: a display, three light indicators, three connectors and a nine touch keypad.



*****IMPORTANT NOTE*****

The Battery Life for the tester is an estimated 3 hours. The Tester is to remain on charge when not in use.

There are two charging rates available;

- 'Charge Lente' Slow Charge – 30 Hours
- 'Charge Rapid' Fast Charge – 14 Hours

If 'Charge Rapid' is used, the tool will automatically switch back to Charge Lente after the charge cycle has completed and can be powered by at this rate continuously.

When the tool has less than 10 mins remaining, a 'BAT' message will display on the right hand side of the display.

2. Main functions

The test tool is capable of all measurements necessary for the installation and maintenance of the Balises. It is used for testing both KVB SN Balises and encoders, and can carry out the following functions:

- Test “serial” Balises and display the messages.
- Read “serial” message on an encoder output.
- Read “serial” message on maintenance connector of the encoder SBI card.
- Read messages at the end of a Balise tail cable.
- Read maintenance messages produced by encoder through the UCS maintenance card.

3. Accessories

The Test tool should have the following cable connectors as part of the kit:

- Mains cable and supply power connector.
- 25-pin cable to SBI Card Output
- 25-pin cable to UCS Card
- 25-pin cable to Balise tail cable
- 15-pin cable to SBI Maintenance Output

Figure1 - Cable connector identification

4. Test tool software

The Maintenance Tool software reference is V 2 0 0.

This software version can be identified by switching on, press the ‘M/A’ (on/off) and the ‘1’ key simultaneously.

The version number will be displayed for 6 seconds.

5. Using the Test Tool

5.1 Starting & selecting a function

To turn on the tester, press ‘M/A’ key on the keyboard.

To switch the tester off, press the ‘M/A’ key again.

The tool automatically selects the function to be performed by recognizing the connection that has been made.

If two connections are made simultaneously, the message “double connexion en entrée interdite” (double connection in inputs are forbidden) is displayed.

If there is no cable, the “test balise” function is automatically selected.

6. Reading either encoder or extension encoder maintenance messages

6.1 With the tester connected to the UCS maintenance card, after turning on, the following is message is displayed;

1	.	A	F	F	I	C	H	E		C	O	N	F	I	G				
2	.	L	E	C	T	U	R	E		I	N	C	I	D	E	N	T	S	
3	.	E	T	A	T		D	E	S		E	N	T	R	E	E	S		
4	.	E	F	F	A	C	E	M	E	N	T		M	E	M	O	I	R	E

6.2 Choose the required function by pressing key ‘1’, ‘2’, ‘3’ or ‘4’.

Key ‘1’ allows the encoder configuration. See Section 7

Key ‘2’ allows the reading of the encoder failure memory. See Section 8

Key ‘3’ makes it possible to read continuously the encoder input states. See Section 9

Key ‘4’ allows the erasing of the encoder failure memory. See Section 10.

A standby message is displayed as soon as any of these four key has been pressed.

VEUILLEZ PATIENTER

(Please Wait)

7. Encoder Configuration

Key '1' makes it possible to display the input card types, the balise driven by every output and the number of programmed messages for every output.

CE1:ELI IS1:A 023MES
CE2:ECI IS2:A 008MES
CE3:ECI IS3:A 012MES
CE4:--- IS4:NON UTIL

This display describes the following configuration:

- 1st input card: ELI (not used in UK)
- 2nd input card: ECI
- 3rd input card: ECI
- 4th input card non installed
- Output 1: balise of type A with 23 programmed messages (including one anomaly message)
- Output 2: balise of type A with 8 programmed messages (including one anomaly message)
- Output 3: balise of type A with 12 programmed messages (including one anomaly message)
- Output 4: free

7.1 As soon as the configuration is displayed the operator can access the encoder software version number by pressing key "1".

CODEUR / EXTENSION
VERSION LOGICIELLE
XXX

(Encoder/extension – Software version)

7.2 Pushing on key 'ECHAP' (escape) returns the user to the main menu.

8. Reading the Fault Memory

8.1 From the main menu shown in section 6, press key ‘2’ to read the fault memory.

Pressing the ‘VAL’ key returns the user to the previous failure.

8.2 Record any failure and investigate where practicable.

8.3 Escalate any failure to SM’s.

Transferring data from the UCS card failure memory into the tool can last a few seconds. During this period of time the standby message is displayed. If no failure is recorded the following message is displayed:

AUCUN INCIDENT
ENREGISTRE

(No failure recorded)

If there are any failures the last failure is displayed:

INCIDENT 8/8
LB XXXXX LA XXXXX
ADR XXXXXX
0001J 09H 29MN 12S

The first line shows the failure number and all the failures recorded (in this example the 8th failure out of 8 recorded).

The second line makes clear the kind of encoder software mistake either for LB (firmware) or LA (application).

The tables of the main failure codes and their meaning can be found below.

The third line shows the software address (if the information is available) where the failure happened.

The fourth line specifies the time spent between the moment the failure has taken place and its reading by the tool in days, hours, minutes and seconds (in this example the 8th failure took place 1 day, 9 hours, 29 minutes and 12 seconds before being read by the tool).

Note: An encoder power supply failure disturbs the earlier failures dating. If the tool detects the power supply failure (by inconsistency between the failure order in the memory and the dating values); it will not display any time value for the earlier failures. If it does not detect it the time values will be distorted.

List of Error Codes

Applicative software errors

Error codes #	Description
100	No error
101	Non detected breakdown
107	Lack of BCC
108	New BCC
109	BCC reading anomaly
110	Incorrect BCC checking sum
111	Incorrect BCC signature
112	Incorrect n°1 input card signature
113	Incorrect n°2 input card signature
114	Incorrect n°3 input card signature
115	Incorrect n°3 input card signature
116	Incorrect input card signatures
117	Incorrect SBI card signature
124	Incorrect output cards signature
125	Incorrect card signatures
126	N°1 exit anomaly message
127	N°2 exit anomaly message
128	N°3 exit anomaly message
129	N°4 exit anomaly message
130	Anomaly messages on several exits

 # for UCS version 1.0.4 or 2.0.3

Firmware Errors

Error codes #	Description
1	No mistake detected
2	Incorrect reading memory checking sum
3	BCC error
4	Saved memory error
5	No error in the saved memory

 # for UCS version 1.0.4 or 2.0.3

9. Reading the Encoder Input States

9.1 From the main menu shown in section 6, press key ‘3’ to read the encoder input states. The following message is displayed;

E	T	A	T	S		D	E	S		E	N	T	R	E	E	S			
E	n	t	r	e	r		l	e		n	u	m	e	r	o		d	e	
l	a		c	a	r	t	e	:		1	,	2	,	3	,	4	,		

(State of the entries - Enter the card 1, 2, 3, 4)

9.2 By pressing '1', '2', '3', or '4' tool displays continuously the state of the card inputs selected:

C		E	N	T	R	E	E		1	2	3	4	5	6	7	8	9	A	
A		T	Y	P	E				1	3	1	1	0	0	0	0	0	0	
R		A	S	P	E	C	T		E	C	F	F	D	D	D	D	D	D	
3		E	T	A	T				0	0	0	1	0	0	0	0	0	0	

(Entree = Entry Type = Type Aspect = Aspect Etat = State)

9.3 To return to start, press 'ECHAP' (escape) Key.

The symbols displayed to define the input types are:

Input type	Symbol
TE0	0
TE1	1
TE2	2
TE3	3
TE4	4

The symbols displayed to define the input aspects are:

Aspect	Symbol
Off or non-active	E
Fixed and on or active	F
Flashing (not used in UK)	C
Free input	D

The "state" line shows the instantaneous state of the inputs read by the encoder while it was scanning them for the last time before the failure.

This state can take the value 1 or 0.

10. Erasing the failure memory

10.1 From the main menu shown in Section 6, press key '4' to erase the encoder failure memory. The following message is displayed;

C	O	N	F	I	R	M	E	R		E	F	F	A	C	E	M	E	N	T
M	E	M	O	I	R	E		I	N	C	I	D	E	N	T				
			V	A	L		/		E	C	H	A	P		?				

(Confirm erasing incident memory – Validate / escape)

10.2 To cancel the request and return to start, press 'ECHAP' (escape) Key.

10.3 Key “VAL” triggers the erasing of all the failures in the memory.

The “wait message” is displayed then the action is confirmed by the following display:

	M	E	M	O	I	R	E		E	F	F	A	C	E	E			

(Memory erased)

10.4 To return to start, press ‘ECHAP’ (escape) Key.

11. Error codes generated by the tool

If faults occur when using it, the test tool will generate one of the following messages (see table below). The LCD displays the error code number followed by its label.

Error code	Displayed message	Meaning
10	Double connection in input forbidden (double connexion entrée interdite)	It is not possible to connect simultaneously a cord to each connector (15-pin and 25-pin)
12	Memory reading impossible. (lecture memoire impossible)	The encoder shows that it is impossible for it to read the failure memory.
14	Maintenance Link fault between encoder and tool (défaut liaison maintenance codeur-testeur)	After a request the tool has not received an encoder answer within expected time
16	Balise message code x unknown (Type de balise non reconnu:XX)	Presence of an unknown field code in a KVB SN message.
18	synchronization word missing or inconsistent (mot de synchronisation inconsistent ou incoherent)	Synchronization words were not found in the received message
26	Balise configuration not recognised: XX (type de balise non reconnu)	The Balise configuration transmitted in the message is not of a valid configuration (XX is equal to the decimal value of the transmitted configuration)
27	CS or CRC incorrect digital message (SC ou CRC incorrect message numérique)	The test tool has recognized a message from KVB SN but the checksum (CS) or the cyclic redundancy code (CRC) is wrong
28	Erasing memory impossible (effacement mémoire impossible)	The erasing memory order has not been carried out.
29	Maintenance Link fault between encoder and tool (défaut liaison maintenance codeur-testeur)	The frame code has not been recognised
30	Sampling fault, internal to the tool (erreur d’échantillonnage interne testeur)	There have been collisions on SPI connection.
31	Maintenance Link fault between encoder and tool (défaut liaison maintenance codeur-testeur)	Parity error
32	Sampling fault, internal to the tool (erreur d’échantillonnage interne testeur)	Granted time to sample data has gone beyond limit.

The list of error codes is not exhaustive.

Some codes rarely occur; if it happens to be the case ask the supplier.

Press the ‘ECHAP’ (‘Escape’) key if you want to clear an error message from the display.

In the case of a ‘test tool software problem’, software may no longer respond and it may be impossible to clear the display.

In this case, cut the power supply then start again (press the ‘on/off’ key twice successively).

END

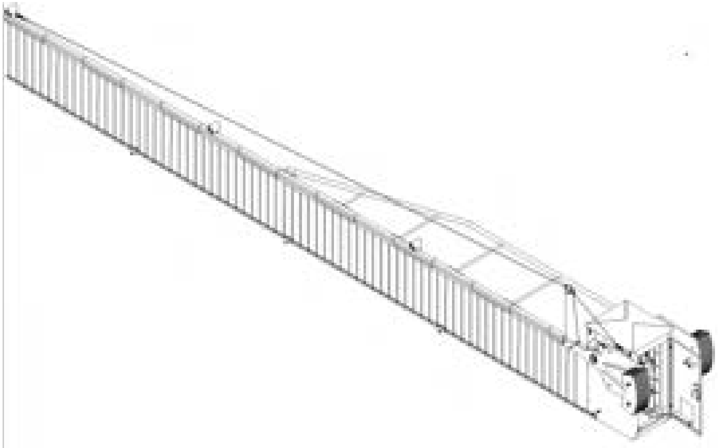


Figure 1 - Overview of the Newgate Barrier

1. Acronyms & Glossary

For the purposes of this document the following acronyms are used.

Term	Description
BL	Barrier Lower
BLSS	Barrier Limit Safety Switch
BPC	Boom Proving Contact
BR	Barrier Raised
BRSS	Brake Release Safety Switch
CRS	Centres
D1	Barrier Up Command
D2	Barrier Down Command
DFT	Dry Film Thickness
DN	Down
DNS	Barrier Down Signal
L.H	Left Hand
LCIAB	Level Crossing In a Box
LCU	Local Control Unit
LPSS	Locking Pin Safety Switch
MCB	Manual Crossing Barrier
MCB's	Miniature Circuit Breakers
MDPC	Maintainers Door Proving Contact
NGR	Newgate Rail
NR	Network Rail
OD	Object Detection
ODPC	Operators Door Proving Contact
PL	Plug
PPG	Paint System Company
PX	Proximity Sensor
R.H	Right Hand
RER	Lights On Signal
STO	Safe Torque Off
SUPPORT MEMBER	A rigid assembly used on barriers with booms 7.1m and over to support the barrier boom and prevent excessive sideways movement.
UPS	Uninterruptable Power Supply

2. Technical Data: Booms

Construction : Steel Frame, Aluminium Arm

Available Spans:

Single Sided

- 3600mm
- 4100mm
- 4600mm
- 5100mm
- 5600mm
- 6100mm
- 6600mm

Double Sided

- 7100mm
- 7600mm
- 8100mm
- 8600mm
- 9100mm

All Spans 7100mm+ are fitted with straining wire and support member.

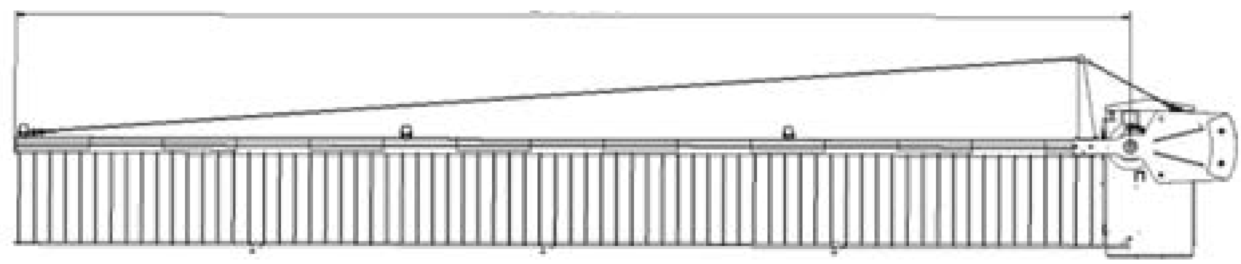
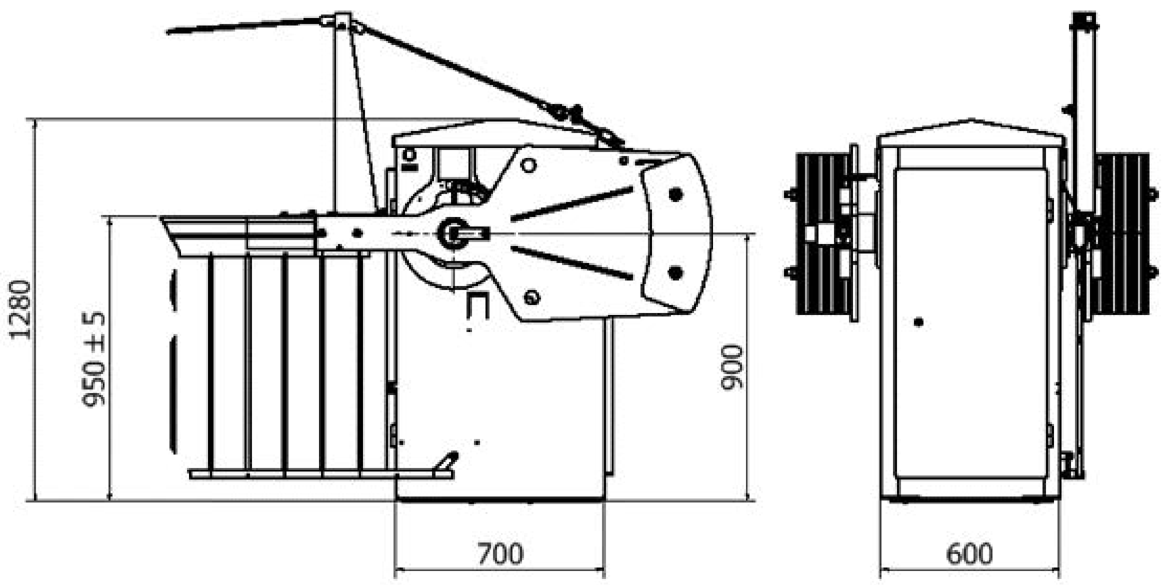


Figure 2 – Span (Side View)

Booms are powder coated white RAL9010 and are fitted with 600mm long red (BS381C-537) vertical stripes. 50mm wide red and white reflective tape is fitted either side of the boom. A-Frame if fitted is powder coated white RAL9010.

3. Technical Data: Barrier Machine

Power Requirements	110v 1ph 50Hz
Fused Rating	20 amps
Operation Movement	0-85° (Horizontal to Vertical)
Time of Operation	8 to 10 seconds (Lower)
	6 to 10 seconds (Raise)
Handing	R.H. or L.H. (Optional)
Manual Operation	By Manual Pump
Weight	475 kg (Barrier excluding Weights, Side arms & Booms)
	85 Kg (each sidearm)
	9.5 Kg(each weight)
Dimensions	



IP Rating	IP56
Control System	Various (as specified)
Storage Temperature	0 to +50 °C (do not store outside for long periods of time)
Operating Temperature Range	-25 to + 40 °C (external ambient)
Noise Level	Less than 70 Db

NOTE: The Barrier Machine is fitted with safety interlocks to the operators and technicians' doors to prevent the machine from running when either door is open.

Should this be bypassed for fault diagnostics and testing setup purposes only, the areas shown in figures 3 & 4 should be treated with extreme caution.

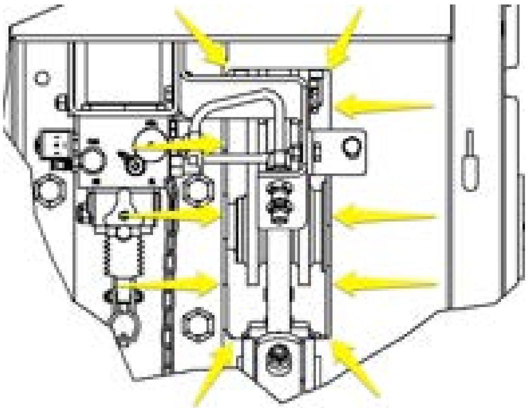


Figure 3 – Danger Zones

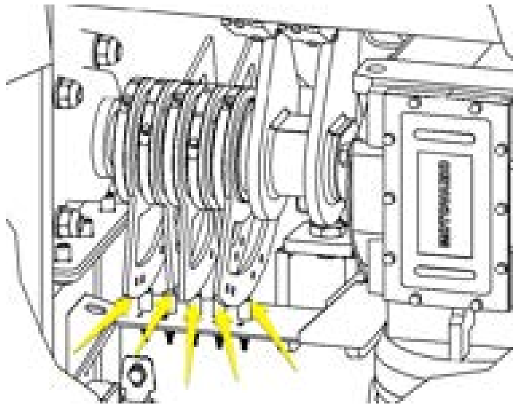


Figure 4 - Proximity Sensors

4. Product Functionality and System Operation

4.1 Product Functionality

The Newgate NGR18000 barrier machine consists of a rigid pressed steel frame containing an electric motor and gearbox, transmitting drive directly to the output shaft; the shaft is attached to the frame by self-aligning ball bearings.

The movement of the shaft is controlled via the position limit cams and proximity sensors. The proximity limit cams are set in house to control:

- Upper & Lower limits of the barrier movement.
- Fast/Slow speed changeover positions.
- Lights on feedback signal to control system.

The position limit cams are factory set, if adjustment is required to satisfy carriageway cross fall or camber, design information to be supplied to manufacture for machine to be factory set as require.

Either a single or pair of side arms are attached to the output shaft, holding the bias weights, boom, straining wire and support member.

The barrier can be operated manually in the event of a power failure by opening the rear access door, disengaging the motor brake and using the hydraulic hand pump to operate the boom

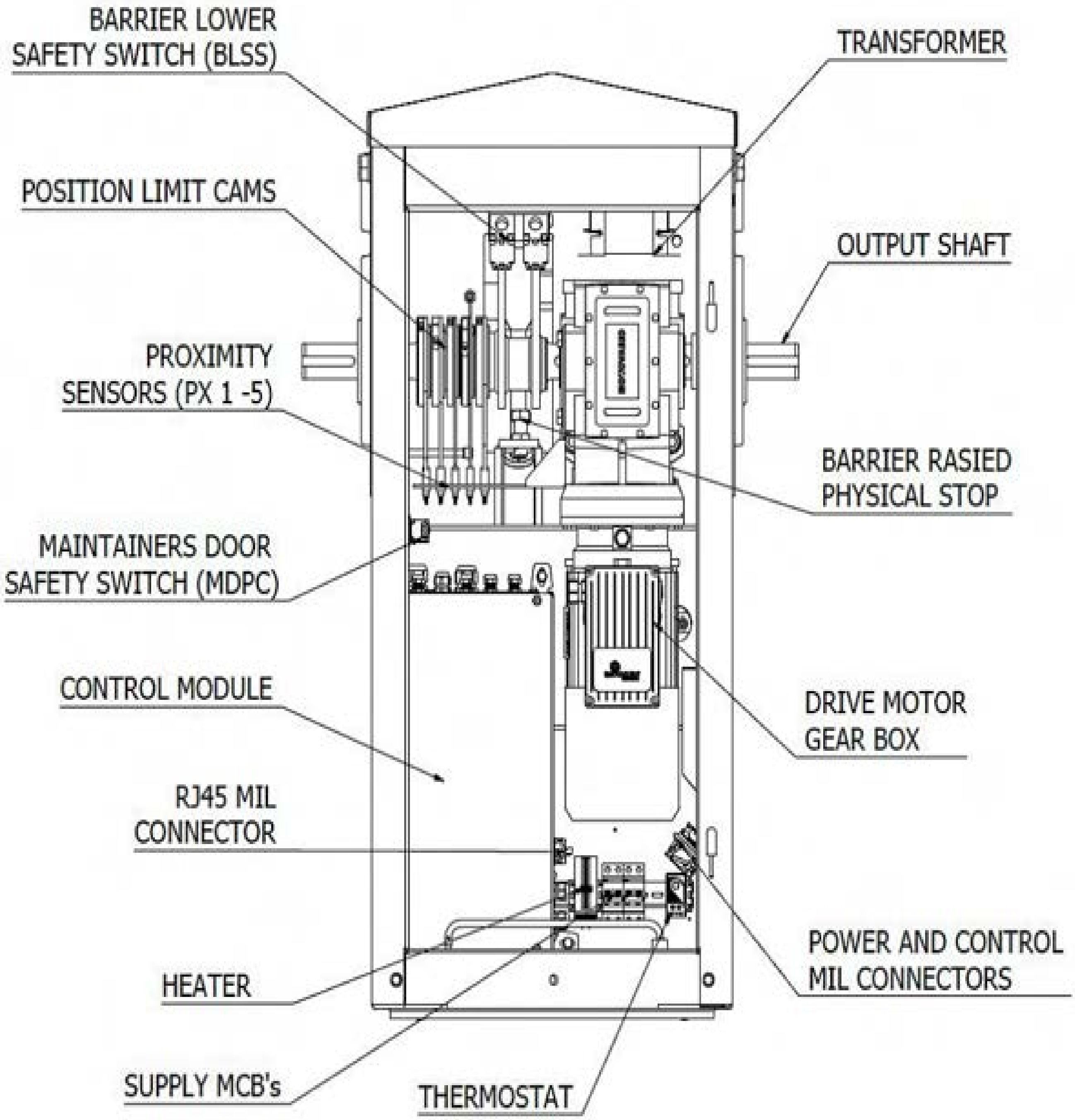


Figure 5 - View with Technician's door removed

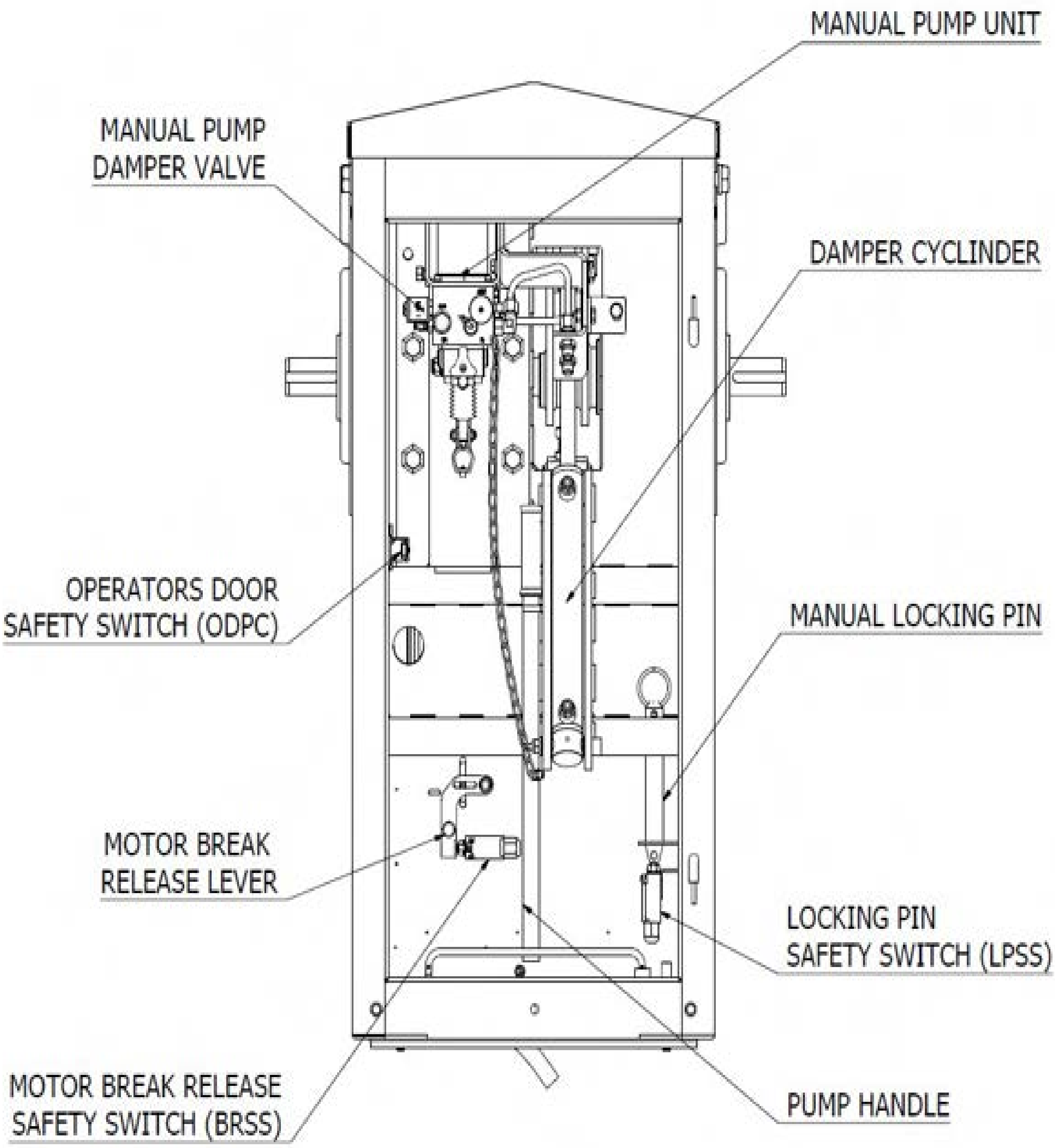


Figure 6 - View with Maintenance door removed

4.2 Product Compatibility

The Newgate Rail (NGR) Barrier machine housing is designed to be directly replaceable with existing BR843 machines. The standard stud 500mm x 440mm centres and foundation requirements are the same.

For seamless repairs original NGR booms and boom braces should be used. BR843 boom braces are not compatible with the NGR18000 barrier machine.

4.3 System Operation

The motor is controlled by the frequency inverter unit which provides the following functions for the barrier machine enabling consistent and reliable operation:

- Separate raise and lower acceleration / deceleration time periods.
- Separate fast and slow speed changeover angles thus ensuring a smooth transition to the raised and lowered rest positions.

The acceleration, deceleration, fast and slow speeds are determined by the fixed parameters in the inverter settings, pre-set for the barrier option required.

The safety controller logic performs the barrier control operation via the inputs and outputs assigned to the controller.

The default rest state of the barrier is in the raised position awaiting a lower signal from the external control system.

4.4 Lowering Operation

a) Lower signal received (D2), barrier accelerates to the fast speed setting.

b) Lights On angle position ≤ 40º detected by the Proximity Sensor PX3, Lights On interlock interface signal (RER) to external control system enabled.

c) Fast/slow speed changeover angle position detected by Proximity Sensor PX4, barrier decelerates to the slow speed setting.

d) Lowered angle position detected by the Proximity Sensor PX2, barrier again decelerates to the lowered stop position.

e) Barrier angle ≥ 4º, barrier lower safety limit switches BLSS 1&2 actuated, Safety Down interlock to external control (DN) activated and timer initiated in controller logic, after time period motor inverter STO interlock removed, inverter inoperable.

f) Barrier Down interlock to external control (DNS) activated.

4.5 Raise Operation

a) Raise signal received (D1), motor inverter STO interlock initialised, inverter operable.

b) Timer initiated in safety controller logic, after 0.5 seconds the barrier accelerates to the fast speed setting.

c) Lights Off angle position ≥ 40º detected by the Proximity Sensor PX3, Lights Off interlock interface signal (RER) to external control system enabled.

d) Fast/slow speed changeover angle position detected by Proximity Sensor PX 5, barrier decelerates to the slow speed setting.

e) Barrier Raised angle position detected by the Proximity Sensor PX1, barrier again decelerates to the Raised stop position.

f) Barrier Up interlock to external control (UP) activated.

g) Barrier Down interlock to external control (DNS) activated.

4.6 Additional Control System Interface Signals

a) Boom Proving (BPC) – Barrier boom in position on boom adapter, Boom Proving interlock contact to external control system activated.

b) Door Proving (ODPC+MDPC) – Barrier main casing access doors closed, Door Proving contact to external control system activated.

c) Boom Lights – The boom lights operation are controlled from the external control system.

5. Barrier Control Module and Barrier Mounted Equipment

5.1 Barrier Control Module

The Control Module is designed on a plug and socket basis (PL1-7) (see Figure 4 for location) to enable the whole Control Module assembly to be removed and replaced without the need to disconnect any cables from the termination points.

This is aimed at reducing the down time of the barrier operation should there be a need to replace the Control Module assembly.

The function signals to the barrier (Lower, Raise, and- Boom Lights) are controlled externally and the interface signals for specific positions of the barrier during the operation are transmitted to the external equipment.

Electrical control equipment mounted within the barrier casing, external to the Control Module, act to provide a safe, accurate and consistent function for the barrier.

The position limit cams are pre-set to obtain the optimum performance of the barrier and should not be adjusted.

5.2 Barrier Mounted Equipment and Function

This equipment comprises of the following items:

Braked Motor Assembly

Used to drive the barrier machine gearbox allowing the boom to be raised and lowered. The assembly also provides locking of the boom in the raised and lowered rest positions.

Proximity Sensors (PX1-5)

PX1 – Barrier not Raised

To detect whenever the barrier is not in the raised position.

Initiates the raise deceleration time period which is pre-set in the inverter parameters

PX2 – Barrier not Lowered

To detect whenever the barrier is not in the lowered position.

Initiates the lower deceleration time period which is pre-set in the inverter parameters.

PX3 – Lights On

To detect whenever the barrier is between 0º - 40º.

PX4 – Barrier Lower Fast Speed

To detect when the barrier inverter is to be switched between fast and slow speed during the lower cycle.

PX5 – Barrier Raise Fast Speed

To detect when the barrier inverter is to be switched between fast and slow speed during the raise cycle.

Lowered Safety Limit Switches (BLSS 1 & 2)

To detect when the barrier is between 4º - 0º in order to output safety signal for Barrier Down.

Operator Door Safety Switch (ODPC)

Used to isolate barrier control preventing the machine to be operated when the operator's door is open.

Maintainer Door Safety Switch (MDPC)

Used to isolate barrier control preventing the machine to be operated when the maintainer's door is open.

Locking Pin Safety Switch (LPSS)

To isolate barrier control when the locking pin is not in the home stored location.

Motor Brake Release Safety Switch (BRSS)

To isolate barrier control when the motor brake override lever is not in the normal operating position.

Manual Pump Damper Valve

This valve, when energised causes the hydraulic oil to bypass the manual pump cylinder.

6. Handling

6.1 Transporting

For ease of transportation, the barrier pedestal is despatched with the boom and if applicable A frame detached.

The boom side arms are secured in the vertical position with pins to lock them in place.

The assembly is transported, mounted to a pallet (for stability), due to the weight of the item a local risk assessment should be carried out and a lifting plan in place before lifting the equipment on site.

The use of a lifting appliance e.g. fork truck or small crane is strongly recommended.

6.2 Lifting

The barrier should always be lifted using the appropriate lifting equipment.

To lift remove the four M20 bolts around the top of the barrier pedestal (highlighted) and replace with M20 Lifting eyebolts to DIN580 or equivalent rated to 830kg slinging at 45°.

Attach 4 legged lifting chains (7mm chain) rated to 3100kg to lifting eyes.

NOTE: See below table for maximum machine weight, ref 9100mm = 947kg.

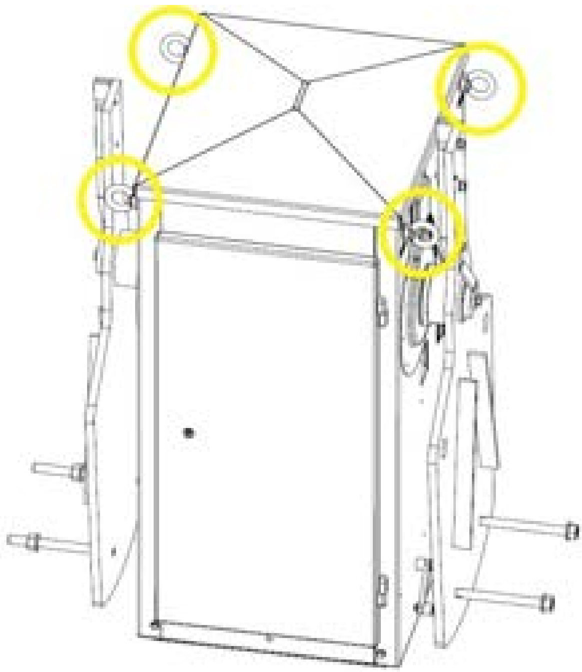


Figure 7 – Lifting Eyes

Boom Assembly Length	Estimated Total Assembly Weight (kg)	Boom Weight (kg) *=inc boom brace	Pedestal with side arms and weights (kg)
3600mm	599	28.5	570
4100mm	621	32	589
4600mm	643	35	608
5100mm	665	38	627
5600mm	687	41	646
6100mm	719	45	674
6600mm	751	48	703
7100mm	869	65*	804
7600mm	909	67*	842
8100mm	943	72*	871
8600mm	984	75*	909
9100mm	1025	78*	947

7. Replacement of Damper Cylinder or Hydraulic Hose

7.1 Isolate the barrier machine at the LXP fuse links.

7.2 Visually check for signs of oil seepage.

7.3 Remove barrier machine locking pin.

7.4 Release plunger on manual hand pump.

7.5 Release motor brake leaver and secure in manual position.

7.6 Remove and replace Damper Cylinder or Hydraulic Hose.

In order to take the strain off of the “Damper Cylinder Assembly”, and ease its replacement the barrier locking pin should be removed and the barrier lowered by hand to the ¾ raised position.

7.7 Top up hydraulic oil.

7.8 Check hand pump for ease of operation.

7.9 Toggle pump direction leaver to the left to raise the boom.

7.10 Manually pump to raise barrier.

7.11 Manually raise and lower the barrier a minimum of three times. Leaving the barrier in the raised position.

7.12 Recheck oil level again.

7.13 Recheck for leaks from cylinder pipes and couplings.

7.14 Reconnect machine to power supply.

7.15 Raise and lower the barrier a minimum of three times on power. Leaving the barrier in the raised position.

7.16 Check for leaks from cylinder pipes and couplings.

7.17 Check oil level is correct.

7.18 Dispose of any contaminated items as per NR Environmental policy.

8. Barrier Cage Removal, Replacement and Clearance’s

Front Guard Removal

8.1 Isolate barrier machine power from supply.

8.2 Switch supply MCB's to off position. Check with a multi-meter there is no mains supply from the output of the circuit breaker to check it is switched off before proceeding with the work.

8.3 Remove M8 bottom fixings and side fixings with 13mm A/F spanner from front guard. (See Figure 8).

8.4 If fitted remove Bolt on Infill, remove fixings M8 fixings using 13mm A/F spanner.

8.5 Remove bolts on infill.

Figure 8 – Infill bolts

8.6 Carefully remove Top M20 fixing with 30m A/F spanner, note guard is now loose. (See Figure 9).

8.7 Re-fitting is the reverse of removal, torque M8 fixings to 29Nm.

8.8 Reconnect the power supply.

Figure 9 - Top M20 fixing

<u>Side Arm Guard Removal</u>

8.9 Isolate barrier machine power from supply.

8.10 Switch supply MCB's to off position. Check with a multi-meter there is no mains supply from the output of the circuit breaker to check it is switched off before proceeding with the work. (See Figure 10).

Figure 10 – Isolation MCB's

8.11 Lift sliding door panel vertically until it is clear of door guides, the spring-loaded plungers will need to be retracted to allow the door to pass by the panel support brackets and enable complete removal. (See Figure 11).

Figure 11 - Sliding Door Panel

8.12 If fitted remove Bolts on Infill, remove fixings M8 fixings using 13mm A/F spanner.

8.13 Remove bolts on infill. (See Figure 12)

Figure 12 – Infill Bolts

8.14 Remove M8 bottom fixings and side fixings with 13mm A/F spanner from front guard. (See Figures 13 & 14)

Figure 13 – Bottom Fittings

Figure 14 – Bottom fittings 2

8.15 Carefully remove Top M20 fixing with 30m A/F spanner, note guard is now loose.

Figure 15 – Top M20 Fixings

Remove front guard.

8.16 Remove Side Arm Guard by removing two M8 fixings fitted either side of barrier machine. Use 13mm A/F spanner or 13 A/F socket. (See Figure 15)

Figure 16 – M8 Side arm fixings

8.17 Remove remaining M20 fixings with 30mm A/F spanner. (See Figure 17)

8.18 Carefully lift machine guard away from barrier machine.

Figure 17 – Remaining M20 Bolts

8.19 Re-fitting is the reverse of removal, torque M8 fixings to 29Nm.

8.20 Reconnect the power supply.

END

1. Balise

All Balise are the same pieces of equipment but can be used in one of two modes.

The most common is the fixed mode configuration; this is where the Balise contains a programme applicable to its location and has no physical link with any other equipment.

The second type is the switchable configuration which is only used at locally monitored level crossings on the Cambrian. In this configuration the Balise contains a permanent programme applicable to its location which can be temporarily suppressed.

The suppression is in the form of an input received via a fixed cable link from a controlling Lineside Encoder Unit located at the crossing.

The train reads the Balise in either configuration by telepowering. This is where the train transmits a signal into the Balise, the signal energises the Balise and allows the same antenna to read the information stored in the Balise.

2. Fixed Mode Balise

These are passive programmable devices that are only energised and read by the systems fitted to the train.

Balise groups are arranged in the following configurations, a single balise, two Balise and four Balise. N_PIG=0 is always located at the higher Kilometric number.

Balise groups are used to pass the following information to trains:

<u>General</u>

a) Odometry.

b) Direction of travel.

c) Stop if in Shunt Mode.

d) Stop if in Staff Responsible Mode.

e) Text Messages, “AOCL Ahead, ABCL Ahead, TMOB Ahead”.

f) Awakening function.

Transition Area

g) Registration.

h) Connection.

i) Annunciation.

j) Annunciation Boarder.

Balise Groups BG12001 and BG12003 at Sutton Bridge consist of four Balise and are described as Duplicated Balise; these groups consist of two pairs of Balise containing the same information.

They are duplicated because of their critical function in the transition process. As long as the train has read one pair in each group, no error message is generated for transmission to the RBC and it transitions correctly.

Because no error message is transmitted it is necessary to manually test the operation of the Duplicated Balise Groups as part of the annual maintenance regime.

Balise Groups BG12000 and BG12002 at Sutton Bridge each consist of a single Balise. They are provided to reset and synchronise the on board odometry before a train entering the Cambrian reads BG12001.

These two Balise Groups are identical in terms of the effect they have on the on board systems and are duplicated for redundancy purposes.

A train entering the Cambrian Line would be unaware of the existence of Balise' so should a fail to read occur, no error message is transmitted from the train. It is therefore necessary to manually test the operation these Balise Groups as part of the annual maintenance regime.

3. Automatic Wheel Diameter Calibration

For a train to accurately calculate its position along the route, it is critical that the on-board systems have accurate information of wheel diameter, this can be achieved in one of two ways.

The first is by manual measurement of the wheel which is carried out as part of the train's normal maintenance programme and the second is carried out automatically whilst the train is in service.

Using automatic calibration, the train counts the revolutions of the wheel whilst travelling over a known distance. Having this information allows the on board systems to calculate the wheel diameter.

The advantage of the automatic calibration over manual calibration is that it does not require a maintenance intervention to carry out the task, it is more accurate and the interval between updates of wheel diameter is more frequent.

On the Cambrian certain Balise Groups are designated for Automatic Wheel Calibration. This makes the distance between these groups critical to achieving accurate wheel diameter calculations.

The identity of Balise Groups at the start and termination of the calibration areas are stored in the on-board system, and markers are provided track side at the designated Balise Groups to assist in accurate calibration of the N_PIG=0 Balise.

4. Switchable Balise

Balise in this configuration are only provided on the approach to locally monitored level crossings. The purpose of these Balise is to impose a pre-set temporary speed restriction when the conditions to illuminate the Drivers Crossing Indicator (DCI) white flashing indication are not met.

The TSR Balise has data permanently programmed into them in the same way as a fixed mode Balise.

The TSR message is suppressed when the conditions to illuminate the DCI white flashing indication are met.

To effect the suppression an output is fed from the level crossing controlling relays via a Lineside Encoder Unit (LEU) to the TSR Balise.

The LEU acts as an interface between the crossing relays and the Balise, this converts the relay logic into a message transmitted via a cable connection to the TSR Balise.

The Balise responds to messages and this response forms part of the health monitoring available at the LEU.

An output of the LEU health monitoring is used to operate a BR930 series relay, the relay is energised when the LEU is healthy and de-energised when it is not healthy.

Contacts of this relay are used in the DCI control circuits, when energised it is possible for the DCI to display a white flashing indication if all other conditions are met. If the relay is de-energised the DCI is only be capable of displaying a red flashing indication.

5. Positioning of Balise

a) On the signalling plan the kilometric positions of the N_PIG=0 and N_PIG=1 balise are shown in the tables and the spacing is always shown as the 3m nominal. The precise location of the N_PIG=1 balise is less relevant whether it is used for calibration or not.

b) N_PIG=0 is always the ‘reference’ location for the group and shall be maintained at the designed location shown on the signalling plan +/- 30cm.

c) For the Cambrian the nominal design spacing between individual Balise within a group is 3m.

The absolute minimum spacing is 2.6m and the maximum is 5.6m for reliable operation.

6. Balise Brackets

Individual Balise brackets are designed for the various types of sleepers and rail fixings in use on the Cambrian.

All brackets are designed to vertically position the Balise at the correct height relative to the rail head.

When mounting a Balise on steel sleepers an additional spacer is required between the bracket and the Balise. The spacer is required to increase the air gap between the top of the sleeper and base of the Balise to confirm correct operation of the Balise.

END

Includes:	EFOY - Fuel Cells
Excludes:	All other types of Fuel Cell

Do not smoke in the vicinity of the Pro fuel cell or fuel cartridge.

Protect from heat and ignition sources. Methanol is highly flammable!

Do not inhale exhaust gases directly for prolonged periods.

Do not touch leaked methanol.

The EFOY Pro fuel cell shall not be opened.

Gloves and eye protection shall be worn during this task.

System Overview

1. Connections - General

1. Connection for charge line.
2. Connection for operating panel.
3. Connection for data interface.
4. On/Off Reset Button.
5. LEDs.
6. Connection for exhaust hose and fill opening for EFOY service fluid.
7. Connectors for EFOY fuel cartridges.
8. Cooling inlet (reverse).
9. Warm-air outlet and connection for off-heat duct.

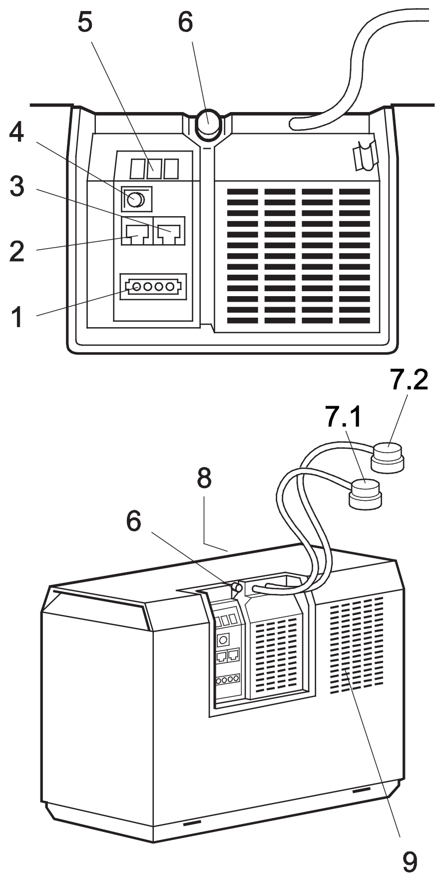


Figure 1 - Connections

2. Connection - Remote Control

Pin	Description
1.	DuoCartSwitch DCS1
2.	RxD (Operating panel OP2)
3.	TxD (Operating panel OP2)
4.	GND, Ground
5.	Battery +
6.	Fuel Cartridge Sensor FS1
7.	Remote On
8.	M/S (Master/Slave) & Hybrid

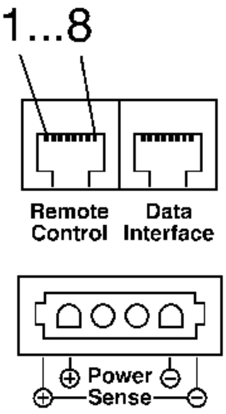


Table 1 - Pin Configuration

3. Connection – Data Interface

Pin	Description
1.	DuoCartSwitch DCS1.
2.	RS232 RxD (Receive Data).
3.	RS232 TxD (Transmit Data).
4.	GND, Ground.
5.	Battery +.
6.	Fuel Cartridge Sensor FS1.
7.	Remote On.
8.	M/S (Master/Slave) & Hybrid.

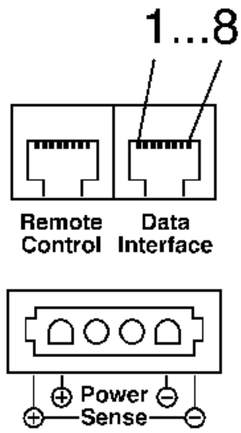


Table 2 - Pin Configuration

4. Indications Panel

The integrated LEDs provide an overview of the operating status of the EFOY Pro fuel cell. You operate the device using the buttons.

1. Button.
2. Green LED.
3. Yellow LED.
4. Red LED.

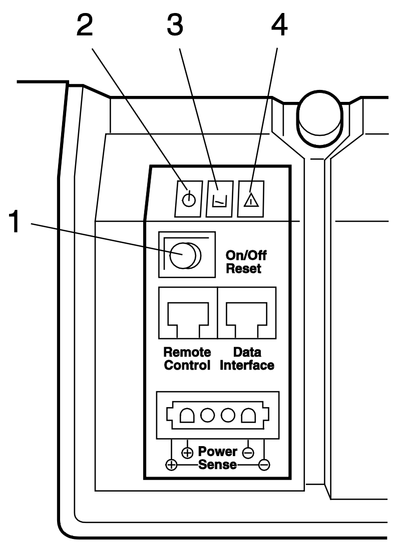


Figure 2 – Panel Indications

Button action	Result	Starting state	Resulting state
Push briefly (< 0.5s)	Reset	On, Off or Automatic	Automatic
Push longer (> 3s)	Switch On / Off	On or Automatic	Off
		Off	On

Table 3 – Button Pushes

LED state	Green LED	Yellow LED	Red LED
On	Ready	Add service fluid	Error
Flashing	Shutting down or antifreeze mode	Fuel empty	Interruption
Off	Off or error	No error	No error

Table 4 – LED Indication Meanings

5. Operation via the Operating Panel

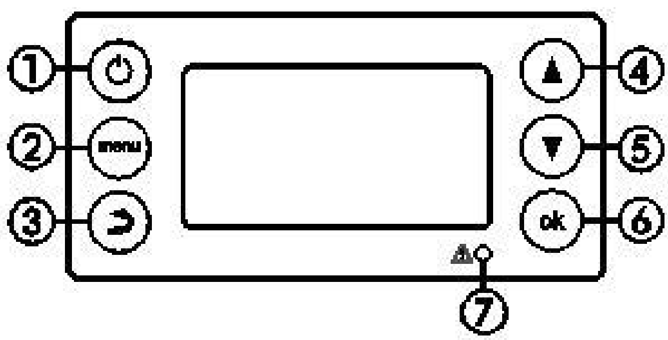
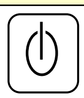


Figure 3 – Operations Panel

5.1 Buttons and symbols on the operating panel Buttons/LEDs.

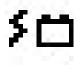
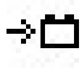
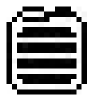
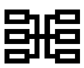
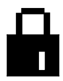
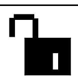
No.	Symbol	Description
1.		Switch EFOY Pro fuel cell on/off.
2.	[menu]	Display the main menu.

No.	Symbol	Description
3.	[⮌]	Scroll back one level in the menu.
4.	[▲]	Scroll up one line in the display.
5.	[▼]	Scroll down one line in the display.
6.	[ok]	• Open the selected menu. • Confirm a selection.
7.		Red LED lights up to indicate a fault.

Table 5 – Button Meanings

5.2 Symbols on the Display.

The display shows different symbols depending on the operating status and operating mode of the EFOY Pro fuel cell:

Symbol	Description
	Current battery voltage.
	Current charging current of the EFOY Pro fuel cell.
	Fill level of the fuel cartridge. The fuel gauge for the fuel cartridge is just an indicator and calculates the methanol consumption. The FS1 fuel cartridge sensor should be used to measure the actual fill level. The fuel cartridge should only be replaced once it has been completely emptied.
	A cluster icon is displayed for EFOY Pro devices that run in parallel (Not Used on NR Equipment).
	If want to operate the EFOY Pro fuel cell using an external controller, the external control function shall be enabled (see "External control" clause 6.4). If this is not enabled, a padlock symbol appears.
	If the external control is switched on, an open padlock appears at the bottom right of the display.
RC	If you have switched external control on and the device is in "Remote Control" mode, "RC" (Remote Control) appears at the bottom right of the display.
LiFe	Lithium iron phosphate (LiFePO4) was selected as battery type. “LiFe” appears at the top right of the display.

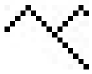
Symbol	Description
	EFOY GO! was selected as battery type. “GO!” appears at the top right of the display.
	The altitude was set above 1500 meter. An icon appears at the bottom right of the display.
	MODBUS RTU was selected as communication protocol. “M” appears at the bottom right of the display.

Table 6 - Symbols

6. Operating Modes

The EFOY Pro fuel cell can be operated in one of the following modes:

- Automatic.
- Manual On.
- Manual Off.
- External control.
- Hybrid.

6.1 Automatic

Automatic mode starts as soon as you connect the device to the battery.

The device monitors the battery voltage independently.

The EFOY Pro fuel cell switches on automatically if the battery voltage drops below 12.3 V / 24.6 V (factory setting: Lead batteries).

The battery is then charged until the cut-off threshold of 14.2 V / 28.4 V is reached (factory setting: Lead batteries).

When the device is started, it goes through a start phase, which might last up to 20 minutes. It only reaches its full rated output after this phase.

During normal operation, the EFOY Pro fuel cell briefly interrupts power generation several times each hour.

A charging current of 0.0 A is displayed when this occurs. This interruption lasts maximum 30 seconds.

If the device fails to start, check that the cap is not still attached to the exhaust hose connector. Remove the cap.

To optimise the battery maintenance, the charging current should not be stopped abruptly when the cut-off threshold is reached.

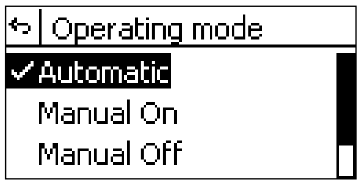
For this reason, the EFOY Pro fuel cell continues charging the battery for up to three hours at a reduced current after the configured cut-off threshold is reached (factory default lead batteries: 14.2 V / 28.4 V).

The length of the recharging period depends on the battery voltage and power consumption.

6.2 Manual On

You can switch the device on manually if the battery voltage is below 13.2 V / 26.4 V (Lead batteries).

a) Press ⏻ on the operating panel, or select "Operating mode" in the main menu. The operating mode selection appears.



b) Select the "Manual On" operating mode.

c) Press [ok] to confirm your selection.

After the start phase, the device is then in "charging mode".

The device operates independently of the configured switch-on voltage, and charges the battery until the cut-off threshold is reached.

$(U_{batt} > 14.2\ V / 28.4\ V \text{ and } I_{off} < 4.0\ A / 2.0\ A)$

After reaching the switch-off threshold the EFOY Pro fuel cell should switch into automatic mode.

NOTE: *The EFOY Pro fuel cell can only start if it is connected to an intact battery and a filled fuel cartridge. The EFOY Pro fuel cell does not switch on if the battery is damaged or has been deeply discharged.*

If the device fails to start, check that the cover lid is not still attached to the exhaust hose connector. Remove the cover lid.

6.3 Manual Off

To protect the components, the device should not be switched off until it has been running for at least 30 minutes since it was started.

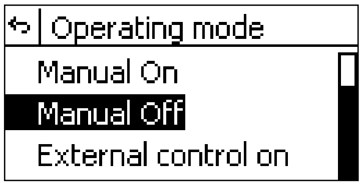
If the device is switched off before this period has elapsed, it should continue running for the remainder of the required running time.

The message "Shutdown procedure" is shown on the display. Do not disconnect the fuel cartridge or battery during the shutdown procedure.

The battery protection and automatic antifreeze functions remain active after the device is switched off.

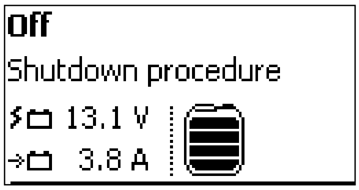
a) Press on the operating panel, or select "Operating mode" in the main menu. The operating mode selection appears.

b) Select the "Manual Off" operating mode.



c) Press [ok] to confirm your selection.

d) Wait until the shutdown procedure has finished and "Shutdown procedure" is no longer displayed on the info screen.



The EFOY Pro fuel cell shuts down in a controlled manner when you press [ok]. This might take some time, to check that all protective features are applied.

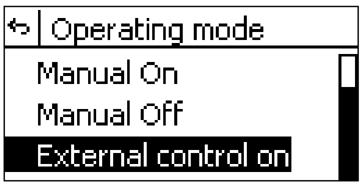
6.4 External Control

The EFOY Pro fuel cell can also be controlled externally. In that case, the automatic charge control mechanism should be partly or totally deactivated.

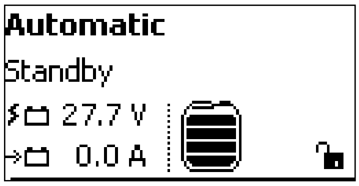
For an external control the operation mode "External control" shall be enabled.

a) Press on the operating panel, or select "Operating mode" in the main menu. The operating mode selection appears.

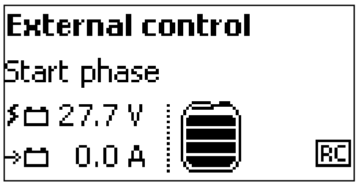
b) Select the "External control on" operating mode.



c) Press [ok] to confirm your selection.



An open padlock is displayed at the bottom right of the display.



If the controller now receives an external signal, e.g. on Pin 7 (Data Interface), "RC" (Remote Control) is displayed at the bottom right of the display.

If you have not enabled external control, a closed padlock is displayed at the bottom right of the display when an external signal is being received.

NOTE: *Incorrectly set operating parameters might damage the device. This could nullify your warranty. Only use the precise values permitted for the battery parameters and battery protection settings.*

6.5 Remote On / Off

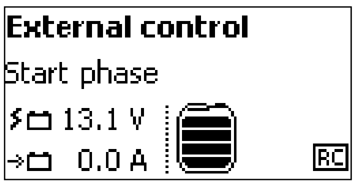
The EFOY Pro fuel cell can be switched on or off externally using one of two methods. One option is by using a switching contact on Pin 7 at the Data Interface plug, e.g. a solar charger.

The second option is a software signal. (See Connections Section 3 for the pinning).

The "External control" operating mode shall be enabled (see External control 6.4).

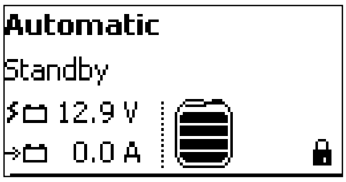
Remote on/off signal via Pin 7 (Data interface)

An open padlock is displayed at the bottom right of the display.



If the EFOY Pro receives an external positive voltage signal on Pin 7, "RC" (Remote Control) is displayed at the bottom right of the display.

The EFOY Pro starts charging, regardless of the switch-on voltage and charges the batteries until the set switch-off parameters are reached.



If you have not enabled external control, a closed padlock is displayed at the bottom right of the display when an external signal is being received.

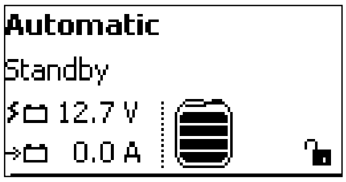
If the external signal on Pin 7 is always active, the EFOY Pro starts when the battery voltage is below 13.2 V / 26.4 V (Lead batteries) or 14.0 V / 28.0 V (LiFePO4) and stop when the switch-off voltage is reached.

The charging starts again at 13.2 V / 26.4 V (Lead batteries) or 14.0 V / 28.0 V (LiFePO4). The EFOY Pro does not stop charging in this operation until removing the external signal on Pin 7.

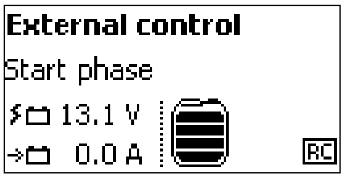
If the external signal is removed (off), the EFOY Pro charges the battery until the set switch-off parameters are reached and switch back in automatic mode.

Remote on/off signal via software command

An open padlock is displayed at the bottom right of the display.



If the EFOY receives a software signal via SIO command REMOTE ON or via Modbus address 41030, "RC" (Remote Control) is displayed at the bottom right of the display.



The EFOY Pro starts charging, regardless of the switch-on voltage and charge the batteries until the set switch-off parameters are reached.

The signal only has to be sent once. The EFOY Pro completes a charging cycle and switch off if the set switch-off parameters have been reached.

After the charging cycle the EFOY Pro switches again into automatic mode.

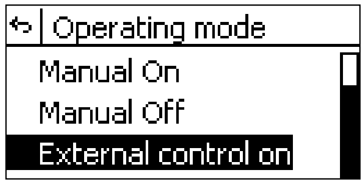
In the case of a software command, the charging cycle can be stopped by sending the SIO command REMOTE OFF or via Modbus address 41030.

6.6 Hybrid

The EFOY Pro can be set into Hybrid mode by a voltage signal or a software control. In this operation mode all parameters are disabled, like switch-on voltage or battery protection.

Only the frost protection mode is an exception, this re-mains enabled.

The "External control" operating mode shall be enabled (see External control 6.4).



The hybrid mode has to be separately activated.

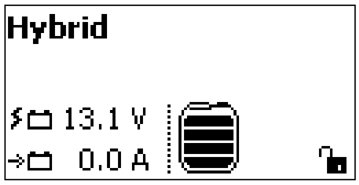
Activation via voltage signal:

Connect Pin 4 (GND, Ground) or the negative battery pole with Pin 8 (Hybrid).

Activation via software control:

Send at least every 15 seconds the SIO command HY-BRID or Modbus address 42002 Hybrid to the EFOY Pro fuel cell.

The operation mode “Hybrid” displays, and the open padlock shows at the bottom right of the display.



To start and stop the EFOY Pro fuel cell a positive voltage signal shall be connected to Pin 7 (Remote On) or via software SIO command REMOTE ON/OFF or Modbus address 41030 (see Remote On / Off Clause 6.5).

The battery voltage shall not exceed the set value switch-off voltage (Hybrid).

If the voltage signal on pin 7 or the “Remote ON” software commands is continuous, the EFOY Pro fuel cell charges the battery continuously in full and part load mode as a constant voltage (CV) charger.

7. Automatic Anti-Freeze Feature

The device has an intelligent automatic antifreeze feature.

This operating status switches on automatically as soon as the temperature drops below +3 °C / +37.4 °F.

This prevents the device from freezing. If the device is operating in antifreeze mode, the message "Antifreeze" is shown in the second line of the display.

NOTE: *The automatic antifreeze feature only works when the fuel cell is connected to a filled EFOY fuel cartridge and an intact battery.*

For a five-month winter period in Central Europe, the device requires approx. 10 litres / 2.64 gallons of methanol in antifreeze mode.

NOTE: *Charging Lithium (LiFePO4) batteries is not always possible at temperatures below 0 °C. The instructions from the battery manufacturer should be observed.*

8. Battery protection

The EFOY Pro fuel cell has automatic battery protection when the EFOY Pro fuel cell is switched off.

Battery protection is enabled automatically if the battery voltage (Lead-batteries) drops below 11.2 V / 22.4 V for more than 15 minutes.

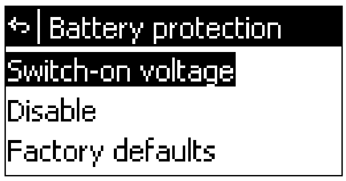
"Battery protection" mode ends as soon as the voltage reaches 13.2 V / 26.4 V.

If the battery protection is activated, the standard switch-off criteria are ignored.

The battery protection function provides deep discharge protection for the battery, even when the EFOY Pro fuel cell is switched off and does not take over the charging function.

8.1 You can select the following menu options in the "Battery protection" menu:

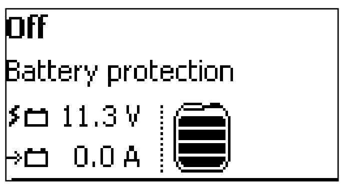
- Switch-on voltage.
- Enable/Disable.
- Factory defaults.



This option allows you to undo all the battery protection settings.
Press [ok] to confirm or [] to cancel.

8.2 If you want to switch off the EFOY Pro fuel cell after the battery protection function has started, press.

The function is re-enabled automatically when the device is switched on or is operated in automatic mode.



8.3 Check your system if the fuel cell repeatedly switches back to battery protection.

Either the battery has already been damaged or too much energy has been discharged.

Battery protection only works if a full EFOY fuel cartridge is connected.

9. Battery Value Ranges

Lead-acid, -gel & AGM batteries	**ID**	**Factory defaults**	**Min.**	**Max.**
Battery protection (12 V)	46	11.2 V	10.5 V	12.0 V
Battery protection (24 V)	47	22.4 V	21.0 V	24.0 V

LiFePO4 batteries	**ID**	**Factory defaults**	**Min.**	**Max.**
Battery protection (12 V)	48	11.0 V	10.5 V	12.5 V
Battery protection (24 V)	81	22.0 V	21.0 V	25.0 V

Permitted value ranges for EFOY GO!	**ID**	**Factory defaults**	**Min.**	**Max.**
Battery protection	14	11.2 V	10.5 V	12.5 V

Table 7 – Battery Ranges

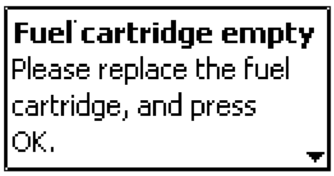
10. Fuel cartridges

Completely empty fuel cartridges can be disposed of with your plastic waste.

Partly full or damaged fuel cartridges shall be treated as hazardous waste and returned to the supplier for reuse.

10.1 Fuel Cartridge Indications

When the fuel cartridge is empty, the yellow LED on the device flashes and the red LED on the operating panel. "Fuel cartridge empty" also appears on the operating panel.

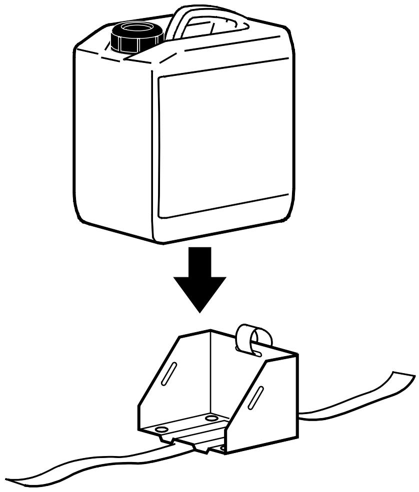


The fuel cartridge can be changed while the device is in operation.

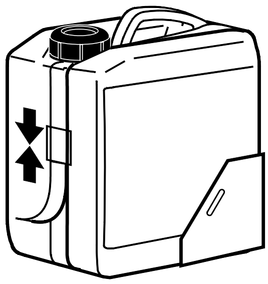
EFOY fuel cartridges are intended for single use only and cannot be refilled.

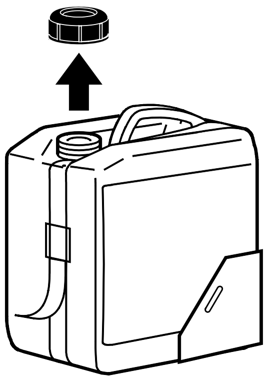
10.2 Inserting the fuel cartridge

a) Insert a new, full, and sealed fuel cartridge into the fuel cartridge holder (if fitted).



b) Fasten the belt on the fuel cartridge holder.





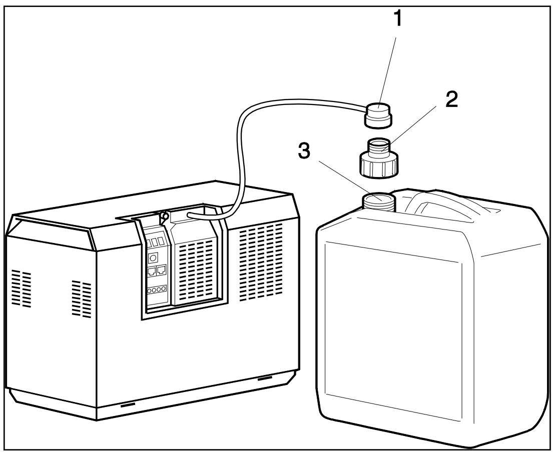
c) Do not remove the child-proof screw cap until the new EFOY fuel cartridge has been inserted into the fuel cartridge holder.

<u>Connecting the M28 Fuel Cartridge Only</u>

The M28 fuel cartridge can only be connected using the M28 adapter.

When connecting an M28 cartridge the M28 Adapter (2) is first screwed onto the Fuel Cartridge (3).

Then the Fuel Cell Connector (1) is screwed into the M28 Adapter (2).



Connecting Other Fuel Cartridges

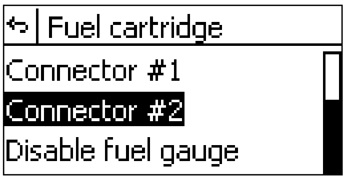
d) Screw the fuel cartridge connector onto the new EFOY fuel cartridge.

e) Press [ok] on the operating panel so that the red warning light and error message are no longer displayed.

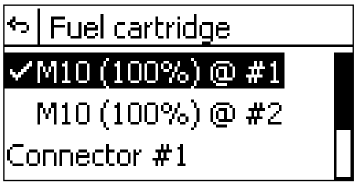
f) Select the installed fuel cartridge on the operating panel.

10.3 Selecting a fuel cartridge

a) When you select the "Fuel cartridge" submenu in the main menu, the display shows the fuel cartridges already enabled and the device connectors.

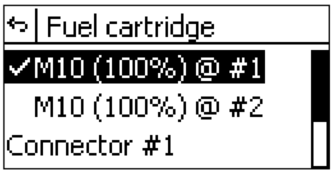


b) The connectors are displayed according to whether you are using an EFOY Pro or EFOY Pro Duo device.



c) If you have not connected a full fuel cartridge, disable the fuel gauge by selecting "Disable fuel gauge" in the menu.

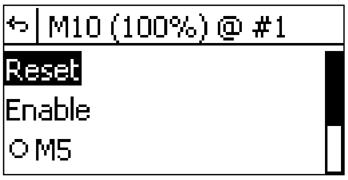
d) Select an active fuel cartridge to edit it directly.



e) Press [ok] to confirm your selection.

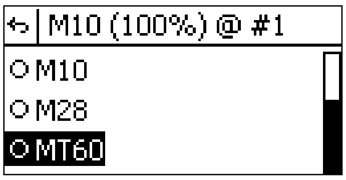
f) You can select the following actions in the fuel cartridge submenu:

- Reset: Resets the counter after the fuel cartridge has been changed.



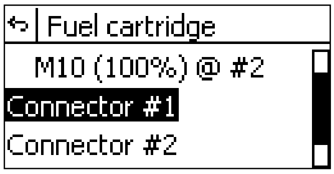
- Enable: Enables the fuel cartridge.

- M5 / M10 / M28 / MT60: Changes the fuel cartridge type for the respective connector.



g) Select a connector to edit the connector and any associated fuel cartridges.

Press [ok] to confirm your selection.

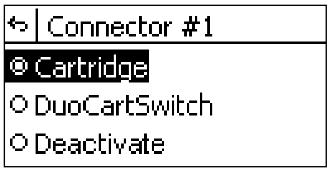


h) You can select the following actions in the connector submenu:

- Cartridge: A single fuel cartridge is to be used at the connector. The associated fuel cartridge is displayed at the highest level of the menu.

- DuoCartSwitch: A DuoCartSwitch is to be used at the connector.

- Deactivate: Disables the connector.



i) Press the menu button once to return to the front screen.

11. DuoCartSwitch DCS 1

The DuoCartSwitch enables you to connect two fuel cartridges to the cartridge connector of one EFOY Pro fuel cell.

The switching valve switches automatically from the fuel cartridge in operation to the reserve fuel cartridge.

This means that the autonomy of the application can be doubled.

Figure 4 - DuoCartSwitch

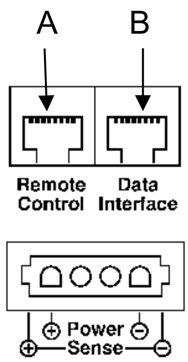
11.1 Connecting the DuoCartSwitch

a) Screw the fuel-cartridge connector of the EFOY Pro on the DuoCartSwitch.

b) Connect one DuoCartSwitch via a Port Doubler to each RJ45-plug of the EFOY Pro:

- A: Remote Control plug.

- B: Data Interface plug.



11.2 If a DuoCartSwitch is added it needs to be activated, for instructions explaining how this is done see Clause 10.3.

12. Fuel cartridge sensor FS1

Figure 5 – FS1 Sensor

a) By default, the EFOY Pro does not monitor the actual fill level of the fuel cartridge.

b) The fuel gauge for the fuel cartridge is just an indicator and calculates the methanol consumption.

c) The FS1 fuel cartridge sensor shall be used to measure the actual fill level.

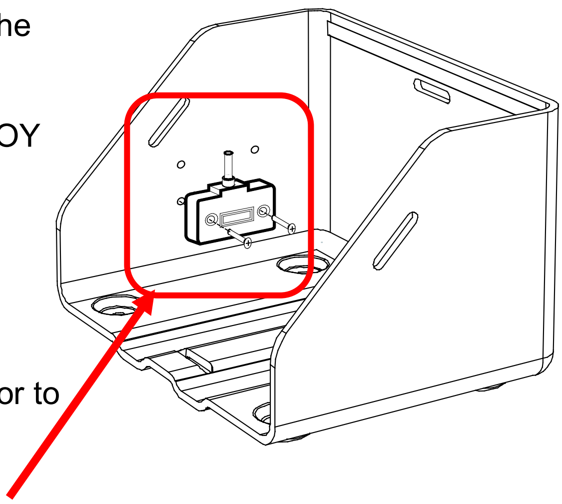
d) The EFOY Pro reports a fuel level error if the cartridge is used up.

e) The optional fuel cartridge sensor FS1 indicates if the fuel level drops below the position of the sensor.

f) This early warning gives the user time to change the cartridge before it is completely empty.

g) The fuel cartridge sensor FS1 may also be used with fuel cartridges that are partly empty.

h) It sends a signal to the EFOY Pro fuel cell when the fill level falls below the sensor.



i) You connect the sensor to the EFOY Pro data interface.

j) The sensor should be combined with a remote monitoring system, e.g. the GSM modem.

k) You fasten the fuel cartridge sensor to the fuel cartridge holder using two screws.

12.2 You can choose from two different heights to mount the FS1.

13. Long term storage

13.1 Store the EFOY Pro fuel cell in a cool place, but at a temperature over +1 °C / +34 °F.

13.2 If the EFOY Pro fuel cell is exposed to temperatures below 0 °C / 32 °F without connected batteries and filled fuel cartridges, it shall be defrosted for approximately 24 hours at room temperature before use.

13.3 After long term storage over 6-month SFC recommends to check the functionality of the EFOY Pro fuel cell before installation.

a) For that purpose, connect the fuel cell to a battery to run a charging cycle.

b) A charging cycle can last several hours.

c) After successfully passing the charging cycle run the transport lock procedure.

d) Press the [menu] and [▼] button on the Operating panel at least 3 seconds and follow the instructions on the display.

Note that liquid can drop out of the exhaust hose tube when running the transport lock procedure.

14. Old devices

Old devices shall be treated as hazardous waste and disposed of in line with NR Environmental Policy.

For advice on returning old devices, please contact the EFOY hotline.

END

Sequence for replacing an WSD Wheel Detector

1. Disconnect the wheel detector cabling in the corresponding disconnection box.

2. Remove the cable securing clips from the WSD cable.

Refer to Figure 1 and Figure 2 for steps 3 to 8.

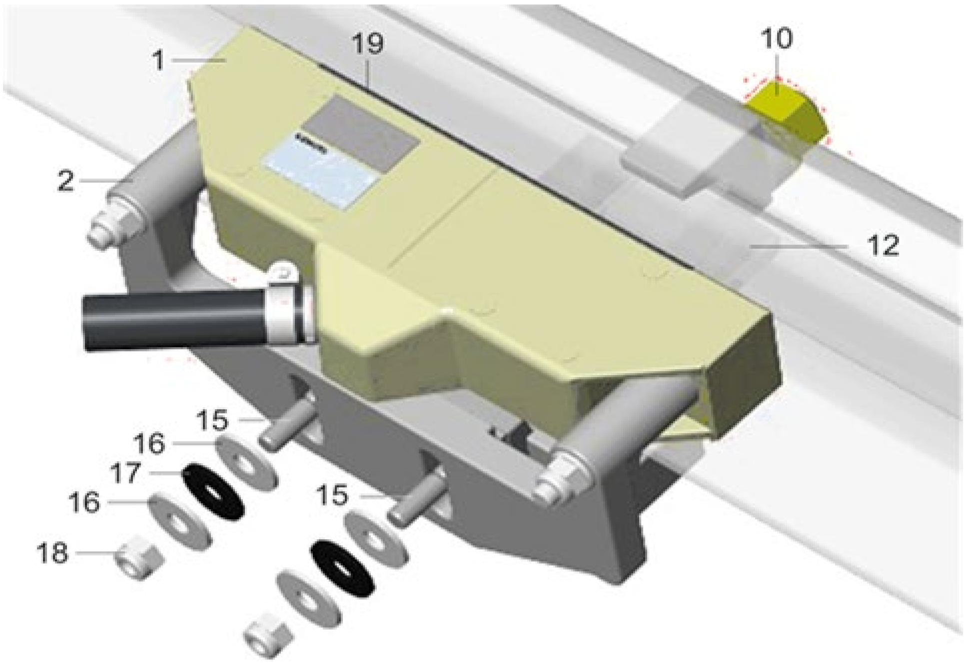


Figure 1 - Parts Identification

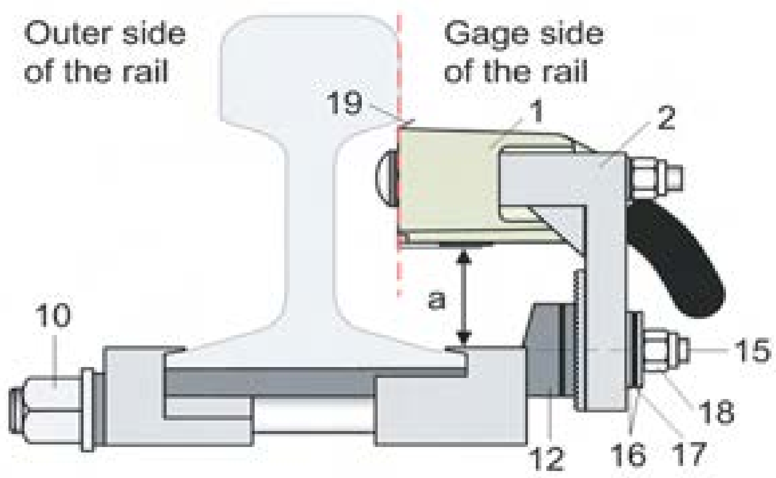


Figure 2 – Mounting Layout

3. Remove the WSD (1) and the height mount (2) from the rail:

   a) Remove two M12 hexagon nuts (18) along with six washers (16 and 17).

   b) Remove the WSD and height mount from the remaining clamp metalwork.

Optionally, if the remaining components of the clamp is to be removed from the rail then:

   c) Remove the M24 collar nut (10) and spring washer (11), see Figure 3.

Figure 3 – M24 Collar Bolt

   d) The clamp metalwork on the non-gauge side could require a tap from a hammer to release the remaining clamp from the bottom of the rail, See Figure 4.

Figure 4 - Removed Clamp Metalwork

4. Remove the WSD (1) from the height mount (2) by removing two M12 hexagon nuts (6), two washers (5), two separators (4) and two bolts (3).

5. Install the replacement WSD to the height mount by refitting the two bolts (3), two separators (4), two washers (5) and two M12 hexagon nuts (6).

6. Tighten the two hexagon nuts (6) using a torque wrench (torque setting of 45 Nm).

   If step 8c has been performed, then:

   a) Fit the bearing assembly (8) on the gauge side of the rail base.

   b) Fit the counterholder (9) on the outer side of the rail base onto the threaded rod of the bearing assembly (8).

   c) Loosely bolt the M24 collar nut (10) onto the threaded rod of the bearing assembly (8) with the spring washer (11) in between.

   d) Insert the bearing plate (12) between the rail base and the bearing assembly (8).

7. Install the height mount (2) with replacement WSD to the rail:

   a) Fit the height mount (2) with the wheel detector (1) onto the studs (15) of the bearing plate (12).

   b) Fit a 36mm washer (16), a damping washer (17), another 36mm washer (16) and an M12 prevailing torque-type hexagon nut (18) onto each stud (15) and tighten them finger-tight.

   c) Move the bearing plate (12) horizontally until the reducing plate (19) of the wheel detector is flush with the side of the rail head (viewed from above).

   d) Tighten the M24 collar nut (10) using a torque wrench (torque setting of 200 Nm). As you do so, make sure the bearing plate does not move horizontally and that the wheel detector is parallel to the rail.

   e) Place the adjustment gauge on the top of the wheel detector. The green sheet-metal strip is located on the top of the adjustment gauge. The inscription "Cal." faces the rail head and is thus not visible.

   f) Loosen the two hexagon nuts (18) again to allow the height mount to be moved vertically with the wheel detector.

   g) Adjust the height mount using the adjustment gauge so that the top of the wheel detector to 45mm (tolerance +0mm/-2mm) below the top of the rail. The mounting height of 45mm below the top of the rail has been reached

When the top of the adjustment gauge is on the same level as the top of the rail. For an accurate measurement place a straight edge across both rail heads.

h) Tighten the two hexagon nuts (18) using a torque wrench (torque setting of 40 Nm).

i) Check that the reducing plate (19) is still flush with the side of the rail head (seen vertically from above). If necessary, loosen the collar nut (10) and readjust the bearing plate.

8. Reconnect the wheel detector wires in the corresponding disconnection box referring to cabling wiring diagrams.

9. Clamp the WSD cable to the securing clips.

END

Includes:	Siemens S21, Ansaldo, Alstom Atlas 200, TASS and Tracklink III Balises
Excludes:	All other Balises and Beacons

SECTION A - SIEMENS S21 PROGRAMMING

Further information can be found in the Siemens S21 A6Z00032385088 (Operating Instructions TPG-Eurobalise).

Programming the Eurobalise Using the TPG.

Warning: Strong electromagnetic fields are generated during the use of the TPG. These might interfere with cardiac pacemakers and might have long-term detrimental effects on health. When the TPG is active keep a minimum distance of 200mm from the unit.

NOTE: *Before starting the programming or verification process, it is recommended to check that the TPG housing battery is fully charged. When the TPG housing red light is on, the battery charge is low.*

1. Hand-held Terminal

1.1 Check the hand-held terminal is switched on.

1.2 To switch on the Hand-held - press the On/Off button in the bottom left corner of the keypad for about three seconds.

1.3 The LED in the top right corner of the keypad flashes green once.

1.4 The display of the Hand-held Terminal is switched on. Either the desktop or the last page used is displayed.

If the Hand-held Terminal has no system time or an incorrect system time due to a discharged battery, set the correct date and the time of day.

This can be done through the start menu, select settings followed by Control Panel.

Further details are contained within the manual.

Figure 1 – Hand-held Terminal

1.5 Setting the date and time is important because the file names contain the system time.

1.6 It is only by entering a system time that various files can be distinguished.

To switch off the device press the On/Off button in the bottom left corner of the keypad.

NOTE: *switching off the Hand-Held Terminal during Eurobalise programming leads to incorrectly programmed Eurobalises.*

Do NOT switch off the hand-held terminal while any function is being executed.

When the Hand-held Terminal is switched on again, the TPG continues the operating step where it left off.

If the Hand-held Terminal is switched off during the execution of a function, the TPG attempts to resume the functional sequence.

For safety reasons, however, the TPG then aborts the functional sequence and issues an error message.

The Hand-held Terminal is now switched off.

NOTE: *The Hand-held Terminal features a touch screen which can be used to call up most of the functions. The touch screen can be operated either by finger (or fingernail) or with the supplied stylus. The stylus is found in a slot above the touch screen.*

Figure 2 – Stylus Location

2. Transferring the telegram to the handheld

NOTE: *This process requires an NR laptop or desktop PC which has a DVD drive and "windows Device Mobile Centre" software installed.*

2.1 Insert the CD-ROM with the correct telegram into the PC or Laptop.

2.2 Connect the hand-held terminal to the PC Dock using the USB cable and wait for Windows Mobile Connect to launch.

2.3 Once windows mobile has started, click [connect without setting up your device] hover the mouse over [file management] and select the drop-down menu [browse contents of your device].

Figure 3 – Hand-held Terminal

2.4 The computer drives are now shown, select [Flash Disk] select a folder or make a new one in preparation of file transfer from the DVD.

2.5 Drag and drop the telegram file from the DVD into the folder on the Flash Drive, once completed, the hand-held terminal is ready to programme a balise.

NOTE: *the MD4 Checksum paperwork is stored in the same file as the telegram, this is needed later.*

3. TPG Base Unit on the Eurobalise

3.1 Place the TPG base unit on the Eurobalise and align the TPG base unit using the housing feet see Figure 4.

Figure 4 - TPG Base Unit Positioned on Eurobalise.

or

3.2 Turn the TPG base unit upside down and lay it on its upper side.

Figure 5 - Eurobalise Positioned on TPG Base Unit

3.3 Position the Eurobalise with the upper side (Siemens logo) facing downward on the TPG base unit and align the Eurobalise using the housing feet.

4. TPG Start-up (Battery Operation)

4.1 Press the “On” button on the TPG base unit.

Figure 6 – Power Switch and Indications

The TPG base unit switches on, and the green “Power” LED is illuminated.

5. TPG Start-up (External Power)

5.1 Use the “External power” socket to connect the TPG base unit with a 110V or 230V at 50 Hz or 60 Hz external power source.

5.2 The TPG base unit switches on, and the green “Power” LED is illuminated.

6. Programming

6.1 In the functional area EUROBALISE, select the PROGRAM command, a selection dialog opens.

6.2 Select the telegram file provided for the Eurobalise in the selection dialog, the programming runs automatically. This is indicated by the progress bar.

6.3 When the operation has ended, one of the following messages is shown:

a) MD4: The 16 hexadecimal characters.

The Eurobalise has been correctly programmed and the newly programmed data has been read.

Check the displayed 16 Hexadecimal characters of the MD4 checksum document from the relevant folder on the CD-ROM.

If the checksum is incorrect repeat the programming operation. A maximum of three attempts are allowed.

b) Signal Level too low

The Eurobalise reply level is too weak, the programming is aborted.

Clean the Eurobalise and repeat the programming.

c) Wrong Eurobalise Identifier or not a Siemens Balise.

d) The Eurobalise type cannot be programmed or the unit is faulty.

6.4 Complete the Certificate of Conformity (CoC) when the Balise has been correctly programmed. Place the CoC in a plastic sleeve and attach to the Balise.

7. Checking the Programming

7.1 Make sure that the Eurobalise is correctly placed and that the TPG is switched on.

7.2 In the BALISE functional area, select the TLG COMPARISON command, a selection dialog opens.

7.3 Select the telegram file on the hand-held for the comparison, the TPG reads the Eurobalise telegram and compares it with the selected telegram file.

This is indicated by the progress bar. When the operation has ended, one of the following messages are shown:

a) Compared Telegrams are Identical:

The Eurobalise telegram corresponds to the telegram file, programming is successful.

b) Compared telegrams are NOT identical:

The Eurobalise telegram fails to correspond to the telegram file, the wrong telegram might have been programmed into the Balise or the system has failed.

c) Signal level too low:

Clean the Eurobalise and repeat the process.

8. Verification

Determination of Signal Level

8.1 The TPG should be correctly placed and switched on.

8.2 In the BALISE functional area, select the SIGNAL LEVEL command.

NOTE: *the TPG measures the level of the reply signal from the Eurobalise. The status of the measuring operation is shown by a progress bar on the display.*

8.3 On completion, one of the following messages is displayed:

a) Signal Level OK.

b) Signal Level too Low.

Clean the Eurobalise and repeat the measurement.

9. MD4 Checksum

9.1 The TPG should be properly connected and switched on.

9.2 In the Eurobalise functional area, select the DISPLAY MD4 command, the TPG reads out the Eurobalise telegram and calculates the MD4 checksum.

This is indicated by the progress bar. When the operation has ended, one of the following messages are shown:

a) MD4: the 16 hexadecimal characters, check the displayed characters of the MD4 checksum against the checksum on the programming and verification form from the DVD folder.

If correct – confirmation of the correctly programmed telegram, complete the Certificate of Conformity (CoC).

If incorrect – Check the function of the hand-held against a known working Balise, if OK fail the programming.

b) Signal level too low, clean the Eurobalise and repeat the process.

SECTION B - ANSALDO BALISE PROGRAMMING

Further information can be found in the Ansaldo CL-OM-00323 (Manual for Balise Programming).

NOTE: *prior to use the battery level of the VPT should be confirmed, this is achieved by setting the external switch to [programming] then to [verification] and check the corresponding LED turns on. There are 3 LEDs to show the charge status 100%, 66% and 33%. If the indication 33% or the discharge LED is on recharge the VPT as soon as possible.*

Warning: Do not use the equipment to program or check Balise's while the battery is on charge.

Check the battery status of the Pocket PC, the charge percentage is visible in [Start]-[Settings]-[System] -[Power].

1. Loading Telegrams into The Pocket PC

NOTE: *A PC, on which the files are already installed is to be used for programming and/or checking the Balise telegrams.*

The telegram files have the extension TGO; the name of the file should correspond with the Balise identifier.

The ActiveSync software for the handheld computer should already be installed on the same PC.

1.1 Connect a null modem cable, to the serial port on the PC and to the serial port of the Pocket PC.

1.2 Clip on the protector of the Pocket PC on the connector cable 2. Use the cable equipped with RS232 connectors to make the serial link between the Pocket PC and the PC.

1.3 Communication between the Pocket PC and the PC is established automatically.

1.4 On the PC, when the "Definition of a partnership" window appears, select [NO] at the request "Do you wish to establish a partnership?" on the PC, then select [Next].

1.5 Once connected, the window shown in Figure 7 appears:

Figure 7 – PC Connection Window

1.6 In the PC window, open the Pocket PC folder, to which the file(s) is transferred, by clicking on the “Explorer” icon.

1.7 On the PC, select the files (or the whole folder) to be transferred and insert them into the destination folder on the Pocket PC.

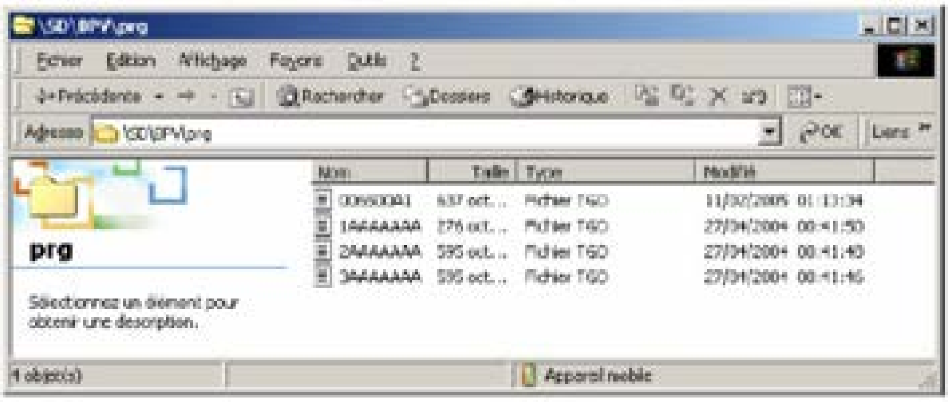


Figure 8 – File Transfer

1.8 Check, in the Pocket PC folder, that the necessary files have been downloaded.

1.9 Close the ActiveSync application on both computers and disconnect the Pocket PC from the PC (disconnection of the cable closes the ActiveSync application automatically).

CHECK CORRECT WORKING OF THE VPT BY USING A “SPECIMEN” BALISE.

1.10 Check the VPT operation against a known working Balise for correct telegram reading.

1.11 Switch the Pocket PC on by pressing the key (top right) and the display should appear.

Figure 9 – Location of On/Off Switch

NOTE: *It is not necessary to restart the BPV application for each balise. If there is no image, recharge the batteries located in the Pocket PC.*

1.12 Run the application by clicking on [START]-[Programs]-[File Explorer]-[SD]-[BPV] then on “bpv”.

Figure 10 –Application Sequence

NOTE: *The Balise Part Number, Serial Number and Version Number are necessary. This is indicated by a sticker on the balise.*

Figure 11 – Balise Details

1.13 Check the Balise part number corresponds with the part number on the screen. If they do not match, click on the X to exit the program, and modify the part number in the file pn.txt.

Figure 12 – Balise Part Number

1.14 Enter the balise serial number (S/N, 7 to 9 characters) and then click okay.

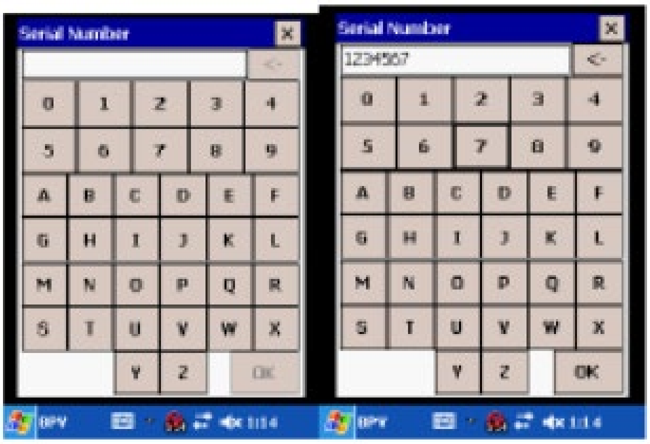


Figure 13 – Entering the Serial Number

1.15 Enter the balise Version Number and then click okay.

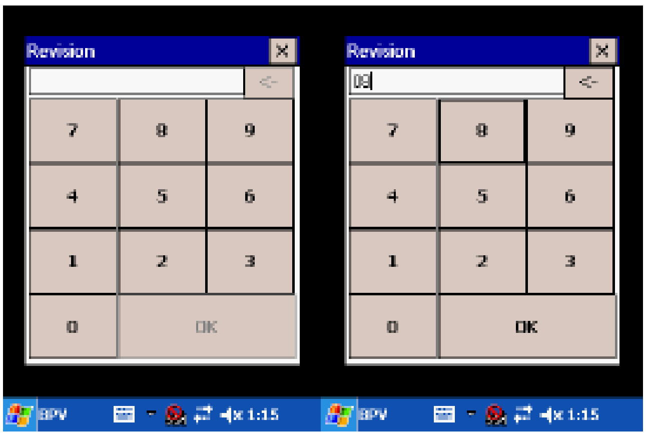


Figure 14 - Entering Version Number

1.16 Enter the 8-digit ID-BOA comprised of the N_BG+A+N_PIG i.e. BG123456A0 and then click okay.

Figure 15 - 8-digit ID-BOA

1.17 When the data input phase is finished, the display shows the version of the application software installed in the Pocket PC, as well as the names of the files < >.TGO which are in the Pocket PC in sub-folders PRG. Verify that the correct .TGO file is available for the balise being programmed.

2. Functions available via the menu

2.1 When the phase of inputting data relating to the Balise has finished, the Pocket PC screen displays the following window:

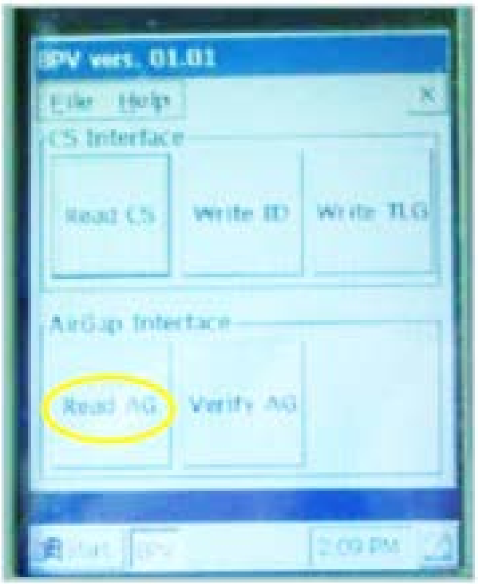


Figure 16 – Inputting complete Screen

2.2 To check the Balise across the air-gap, it is necessary to position the rack above the Balise, in direct contact with it, as close to the centre as possible.

Figure 17 – Checking the Air Gap

2.3 In the case where the selected function ends incorrectly, (with a message "ERROR [rack inactive / defective]"), before trying again, first set the external switch to the centre position.

3. Activation of Menu Functions

Reading a Telegram (C5)

3.1 Set the switch on the inside of the rack to "ON", and the external switch to "PROGRAMMING" [P].

3.2 This operation (which can be selected by clicking on [Read C5] in interface C5 in the Main Menu (Figure 16) allows data stored in the Balise to be read.

3.3 It is necessary to wait about 10 seconds before the data stored in the Balise is displayed on the screen.

3.4 The following data appears in the first line (in hex):

a) The 16 bits hard-wired in the Balise (E89C).

b) The Balise ID the telegram shown in 256 Hex characters.

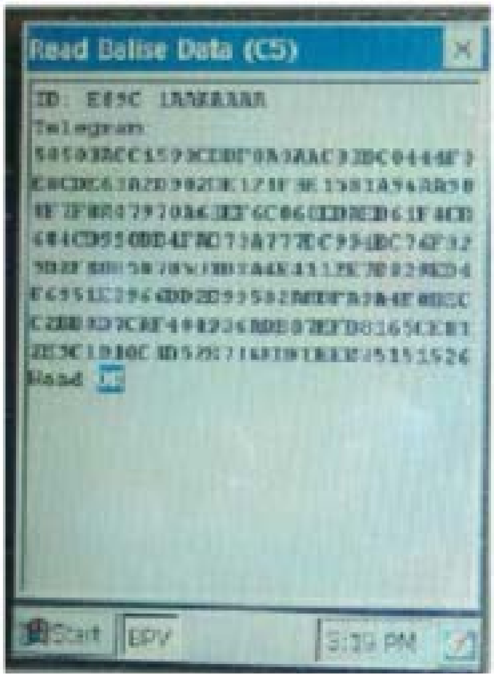


Figure 18 – Balise Data

NOTE: *During this operation, the data stored in the Balise is read but no check is made on them. If the data link is disconnected, or if there is no message in the balise, it reads as all 'F'.*

3.5 A read OK message states that the ID_BOA and the telegram can be read.

3.6 A Read NOK message states that either the ID_BOA or the telegram cannot be read.

<u>Writing ID BOA (C5)</u>

3.7 Set the switch on the inside of the rack to “ON”, and the external switch to “PROGRAMMING” [P].

3.8 Select [Write ID] to write the Balise ID.

NOTE: *writing the Balise ID is subject to entering the correct login (User Identification) and password, just after clicking on [ID boa].*

Figure 19 – Entering the Balise ID

3.9 A successful write is shown by an on-screen message, for example: “Write AAAAAAA2... OK”.

<u>Writing A Telegram to A Balise (C5)</u>

3.10 Set the switch on the inside of the rack to “ON”, and the external switch to “PROGRAMMING” [P].

3.11 Select [Write Telegram] to write the Telegram.

NOTE: *this operation is only possible if the Balise ID of the Balise corresponds to the telegram that you want to write.*

3.12 After the balise ID is checked the telegram to be written is displayed on the Pocket PC. Select [confirm] to write the telegram if correct or [cancel] if the wrong telegram is displayed.

NOTE: *when the write phase has ended, the data stored in the Balise is read back automatically and then displayed; confirmation (OK) of the result of the comparison between the telegram to be stored and the telegram actually stored then appears (see Figure 20).*

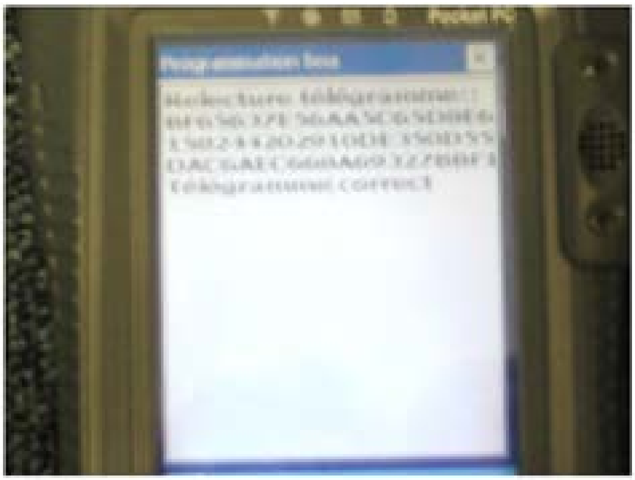


Figure 20 - Telegram

Reading A Telegram (Air-Gap)

3.13 This operation can be selected by clicking on [Read AG] in the AIR-GAP interface in the Main Menu (Figure 16).

3.14 Position the rack above the Balise, in direct contact, taking care to maintain a distance of at least 1 metre from any metallic object likely to affect the performance of the radiating elements in the rack and in the Balise.

3.15 Connect the Pocket PC to the rack; then set the switch inside the rack to the “ON” position and the external switch to “VERIFICATION”.

3.16 Select [Read AG] in the AIR-GAP interface in the Main Menu of the Pocket PC which activates the Balise and reading of the telegram.

Figure 21 – Read AG

<u>Verification</u>

NOTE: *Position the rack above the Balise, in direct contact, taking care to maintain a distance of at least 1 metre from any metallic object likely to affect the performance of the radiating elements in the rack and in the Balise.*

3.17 Set the switch inside the rack to “ON” and the external switch to “VERIFICATION”.

3.18 Select [Verify AG] in the AIR-GAP interface in the Main Menu (Figure 16), the telegram sent by the Balise is read, but is also compared with the telegram contained in a pre-loaded file in the Pocket PC.

3.19 Choose fixed Balise [PRG] which activates the Balise and reading of the transmitted telegram.

3.20 Select [OK], the corresponding “User bit” are displayed and the result of the comparison appear in the last line (see Figure 22).

Figure 22 – Balise Testing Air Gap

SECTION C - ALSTOM ATLAS 200 EUROBALISE PROGRAMMING AND VERIFICATION

Warning: Strong electromagnetic fields are generated during the use of the BEPT, these might interfere with cardiac pacemakers and should not be used by anyone with a pacemaker fitted.

Further information can be found in the Alstom Atlas 200 ALS/UK/ATLAS200-SYS-MAN-00005 (BEPT User Manual).

1. Connecting the BEPT to the Handheld PC

1.1 Verify that no USB media is connected to the BEPT before the power up sequence has finished, if fitted the BEPT attempts a factory reset.

1.2 Switch-on the BEPT Core, ON/OFF indicator is lit.

1.3 After the booting delay, PC Ready indicator is lit.

1.4 BEPT Core is now ready to be used.

1.5 Insert the USB stick to the BEPT, with the relevant telegram files to be programmed.

NOTE: *Do not insert the USB stick before the BEPT has finished its start-up process, this causes the BEPT to try and enter a recovery mode and the BEPT cannot boot.*

1.6 Place the BEPT on the top of the Balise locating the feet of the test set in the recess on the Balise.

1.7 Start the handheld PC and wait for it to boot up.

1.8 Use the WiFi connection tool to connect the handheld to the BEPT using the SSID and Password.

NOTE: *The WiFi code matches the serial number on the BEPT.*

1.9 Once connected to the WiFi open internet explorer 11 and navigate to the following address http://192.168.10.1/BEPT.

1.10 The handheld now shows a login window.

2. Programming

2.1 Select the [programming] account and login using your credentials.

2.2 On the left-hand menu select [Write Eurotelegram] and the following window opens:

Figure 23 – Write telegram screen

2.3 Confirm the interface drop down menu is set to [Compact] then left click [Browse] and a pop-up window appears.

2.4 Scroll to the bottom of the left-hand window to select the last drive letter, usually the ‘F’ drive. Once selected the telegrams on the USB stick are available in the right-hand window.

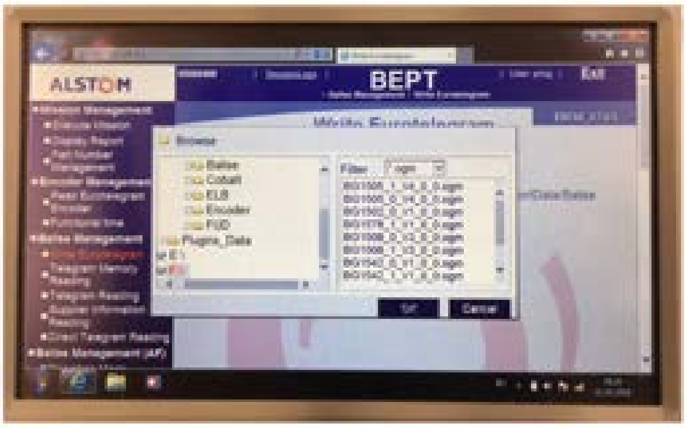


Figure 24 – Telegram selection

2.5 Scroll the right-hand window until you see the telegram file you are looking for, select the file with the touch screen pen and click [ok].

2.6 The pop-up window closes, and the handheld displays the telegram file that is to be programmed into the Balise.

NOTE: *Confirm the telegram being loaded is the correct telegram for the Balise being programmed and it matches the certificate of conformity.*

2.7 Confirm the check tick box is selected and click [Write] the telegram is written to the balise.

Two possible results are returned:

a) ✓ Eurotelegram written successfully.

b) × An error has occurred.

Figure 24 – Telegram written successfully

2.8 Providing the write was successful you can now check the telegram by selecting [telegram reading] in the left-hand menu.

NOTE: *Do not select Telegram Memory reading as this does not show the signal strength meter.*

Figure 25 - Telegram reading

2.9 Confirm the [Check Telegram] tick box is NOT selected and click [Read], it takes approx. 10 seconds to read the telegram in the Balise. Once read the following window appears (Figure 26).

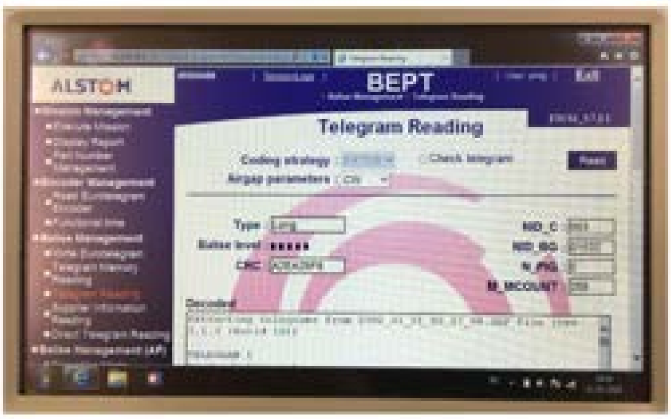


Figure 26 – Telegram check

2.10 In this window you can check the correct telegram has been loaded by checking the following:

a) NID_C – Country Code (UK is 003).

b) NID_BG – The Balise Group Number.

c) N_PIG – Position in Group.

d) M_MCOUNT – Should show 255 which is the packet number for End of Telegram.

e) Balise Level - minimum 4 out of 5 bars.

f) CRC - checksum code.

2.11 Complete all programming paperwork and complete the programming section of the certificate of conformity which shall be attached to the Balise.

3. Verification.

3.1 Select [verification] account and login using your credentials.

3.2 On the left-hand menu select [Telegram Reading].

NOTE: *Do not select Telegram Memory reading as this does not show the signal strength meter.*

Figure 27 – Telegram reading

3.3 Confirm the [Check Telegram] tick box is NOT selected and click [Read], it takes approx. 10 seconds to read the telegram in the Balise. Once read the following window appears (Figure 28).

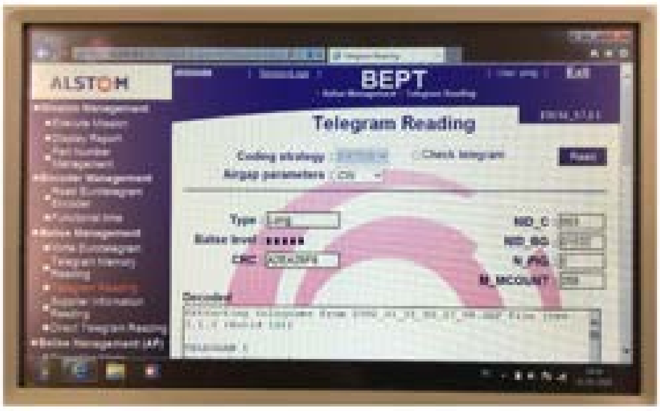


Figure 28 – Telegram check

3.4 In this window you can confirm the correct telegram has been loaded by checking the following against the programming paperwork and certificate of conformity entries:

a) NID_C – Country Code (UK is 003).

b) NID_BG – The Balise Group Number.

c) N_PIG – Position in Group.

d) M_MCOUNT – Should show 255 which is the packet number for End of Telegram.

e) Balise Level - minimum 4 out of 5 bars.

f) CRC - checksum code.

3.5 Complete all programming paperwork and complete the verification section of the certificate of conformity which shall be attached to the Balise.

4. Erasing

NOTE: *An Alstom Atlas 200 Balise cannot be over written with a new Telegram, in-order to change the telegram it needs to be erased first.*

4.1 Select [Eraser] account and login using your credentials.

4.2 On the left-hand menu select [Write Telegram].

Figure 29 - Write Telegram

4.3 Confirm the interface drop down menu is set to [Compact] and click [Browse].

4.4 The Balise erase telegram is pre-loaded to the BEPT and is shown in the right-hand side of the pop-up window.

Figure 30 – Erase telegram

4.5 Select the [Reset_Balise_ID.tgm] file and then select [OK].

4.6 Once the pop-up window has closed select [Write] two possible results are returned:

a) ✓ Eurotelegram written successfully.

b) × An error has occurred.

4.7 Providing the write was successful the Balise is now ready to receive a new telegram.

SECTION D – TASS PROGRAMMING

Further information can be found in the TASS Balise C80056-SPEC-SYS-00166-07 (BEPT User Manual).

Warning: Only the supplied stylus is to be used on the display, Pens, Nails Paper Clips etc can damage the surface of the display and should not be used.

NOTE: *Before closing the handheld case, disconnect the battery charger. The display battery charger lead may be left connected if the display is inside the case, but the case cannot be closed or locked.*

NOTE: *The power supply cable and balise programming cable should only be connected in the depot environment and should be disconnected and stored before proceeding trackside.*

1. Powering Up the Toughbook PC and Display

1.1 Open the case, check the floppy disk drive (FDD), mounted in the BEPT case lid, to verify that no floppy disk is present.

1.2 Press the power button on the Toughbook PC and hold until a tone is heard. The Power status LED should be lit solidly, and the Hard Disk Access LED should light intermittently.

1.3 Once the “Display Ready” LED on the Toughbook PC illuminates, remove the stylus from the rear of the display next to the battery charger socket and use it to press and hold the monitor power button until the Power Status LED illuminates. The display should be present on the monitor within 5 seconds, once present, the BEPT is now ready for data input.

1.4 Connect the balise programming cable to the BEPT and the balise via the socket on the outside of the BEPT and the Balise connection socket.

Caution: Before proceeding with the BEPT operation verify the locking (pull to unlock) toggle switch is in the BEPT position.

To disconnect, use the key to unscrew the plug from the socket.

1.5 Position the BEPT on the Balise longitudinally with the handles of the carry handle at right angles to the balise X Axis.

1.6 Double tap on the desktop shortcut using the stylus.

1.7 Or in Windows Explorer, select C:\ProgramFiles\ATIS_TASS_BEPT\BeptTass.exe.

1.8 Enter your user name into the text field on the display, this unlocks the functions of the BEPT.

NOTE: *The entered user name remains valid for all operations until the TASS BEPT application is shut down.*

2. Programming

NOTE: *Balise programming should only be performed in the office/depot environment. The handheld case is to remain open throughout the operation.*

2.1 Select the DEPOT button, The DEPOT screen with four buttons is displayed.

2.2 Connect the balise programming cable between the case socket and the balise.

2.3 Select the PROGRAM BALISE button.

2.4 Inter-connection checks are performed; PC to BEPT reader connection and BEPT to balise connection present and correct. STATUS = “Connection Check”.

If the PC to BEPT reader connection is faulty:

- RESULT = “FAILED, PC to BEPT connection faulty”, and the programming operation is halted. Refer to section 4 for user action.

If the connection between the BEPT and the balise is faulty:

- RESULT = “FAILED, BEPT to Balise connection faulty”, and the programming operation is halted. Refer to section 4 for user action.

If the two connections are correct:

- RESULT = “Connection OK”.

2.5 Select the telegram to be programmed either from an inserted Floppy Disc or if the telegram is in the local memory of the BEPT carry out this process:

a) When prompted to insert a Floppy Disk click [Cancel].

b) A file browser window pops up which defaults to the desktop, browse the folders on the PC to the stored location and select the telegram to be programmed.

NOTE: *Selection of the file browser window Cancel button closes the file browser window, stop the current process and re-enable all buttons, RESULT = "Cancellation of TGM file selection".*

2.6 The selected telegram file is submitted to coding strategy check, STATUS = "Telegram Coding Check".

If the coding strategy check fails:

- RESULT = "FAILED, telegram file corrupt" and the programming operation is halted.

If the coding strategy check is successful,

- RESULT = "Telegram file OK".

NOTE: *If the coding strategy check is passed, the STATUS and RESULT fields might change too quickly to notice.*

The selected telegram data is written to the balise via the cable and balise connector, STATUS = "Writing telegram".

If the write operation is unsuccessful:

- RESULT = "FAILED, write operation unsuccessful" and the programming operation is halted. Refer to section 4 for user action.

If the write operation is successful:

- RESULT = "Write operation OK".

NOTE: *If the write operation is successful, the STATUS and RESULT fields might change too quickly to notice.*

2.7 The telegram data is read from the balise via the cable and balise connector, STATUS = "Reading telegram".

If the read operation is unsuccessful i.e. no telegram is read from the balise:

- RESULT = "FAILED, read operation unsuccessful" and the programming operation is halted.

If the read operation is successful,

- RESULT = “Read operation OK”.

NOTE: *If the read operation is successful, the STATUS and RESULT fields might change too quickly to notice.*

2.8 The read telegram data is compared with the selected telegram file data, STATUS = “Comparing telegrams”.

If the comparison is unsuccessful i.e. the read data and the selected data are not identical:

- RESULT = “FAILED, Write telegram not same as Read telegram” and the programming operation is halted.

If the comparison is successful i.e. the read data and the selected data are identical:

- RESULT = “Write telegram same as read telegram”.

NOTE: *If the comparison operation is successful, the STATUS and RESULT fields might change too quickly to notice.*

2.9 The user is prompted to disconnect the balise programming cable, STATUS = “Disconnect programming cable”. The disconnection can either be at the BEPT case socket, or at the balise connector. Check that the handheld case is located on top of the balise.

2.10 When the handheld case is correctly located on the balise, and the cable is disconnected, the user selects the OK button.

2.11 If the BEPT to balise connection is still detected as being present, the user is presented with the disconnection prompt again, up to a maximum of three times.

- RESULT = “FAILED, cable not disconnected”, and the programming operation is halted.

2.12 If the BEPT to balise connection is detected as being removed, the BEPT telepowers the balise. The balise transmits the telegram data currently held in memory, and the BEPT receives and logs this data. STATUS = “Reading via airgap”.

If no telegram data is received:

- RESULT = “FAILED, no telegram received via airgap” and the programming operation is halted.

If telegram data is received:

- RESULT = “Read operation OK”.

NOTE: *If the airgap read operation is successful, the STATUS and RESULT fields might change too quickly to notice.*

2.13 The received telegram data is compared with the selected telegram file data, STATUS = “Comparing telegrams”.

If the comparison is unsuccessful i.e. the received data and the selected data are not identical:

- RESULT = “FAILED, Read telegram not same as selected” and the programming operation is halted.

If the comparison is successful i.e. the received data and the selected data are identical:

- RESULT = “PASSED, balise programming successful”. This result confirms that the selected telegram data has been successfully programmed into the balise, and the balise is functional.

NOTE: *The user is presented with a popup requesting whether the selected telegram file is to be deleted. If YES is selected, the telegram file is deleted from where it was selected, if NO, it is not. Selection of either button ends the programming operation, and all buttons in the DEPOT screen are enabled.*

3. Reading a balise

3.1 Confirm that the programming cable is disconnected.

3.2 Check that the BEPT case is located on top of the balise.

3.3 After power up, start up and the entry of a user name, select the DEPOT button. The DEPOT screen with four buttons is displayed.

3.4 Select the READ BALISE button.

3.5 Inter-connection checks are performed; PC to BEPT reader connection present and correct, BEPT to balise connection NOT present. STATUS = “Connection Check”:

If the PC to BEPT reader connection is faulty:

- RESULT = “FAILED, PC to BEPT connection faulty”, and the read operation is halted.

If the connection between the BEPT and the balise is present:

- RESULT = “FAILED, BEPT to Balise connection faulty”, and the read operation is halted.

If the two connections are correct:

- RESULT = “Connection OK”.

3.6 A popup is displayed for the user to select whether a telegram comparison is required. Select YES if comparison is required, NO if not.

If Yes is selected choose the telegram to be compared either from an inserted Floppy Disc, or if the telegram is in the local memory of the BEPT carry out this process:

a) When prompted to insert a Floppy Disk click [Cancel].

b) A file browser window pops up which defaults to the desktop, browse the folders on the PC to the stored location and select the telegram to be compared.

NOTE: *Selection of the file browser window Cancel button closes the file browser window, stop the current process and re-enable all buttons, RESULT = “Cancellation of TGM file selection”.*

3.7 The selected telegram file is submitted to a coding strategy check, STATUS = “Telegram Coding Check”.

If the coding strategy check fails:

- RESULT = “FAILED, telegram file corrupt” and the read operation is halted.

If the coding strategy check is passed,

- RESULT = “Telegram file OK”.

NOTE: *If the coding strategy check is passed, the STATUS and RESULT fields might change too quickly to notice.*

3.8 The user is prompted to enter the ID number of the balise being read, the OK button is enabled only if an ID has been entered in the Balise ID text field. No more than 14 characters can be entered.

Clicking on Cancel removes the popup, stop the current process and re-enable all buttons, RESULT = “Cancellation of Balise ID selection”.

3.9 The BEPT telepowers the balise. The balise transmits the telegram data currently held in memory, and the BEPT receives and logs this data. STATUS = "Reading via airgap".

If no telegram data is received:

- RESULT = "FAILED, no telegram received via airgap" and the read operation is halted.

If telegram data is received:

- RESULT = "Read operation OK".

NOTE: *If the airgap read operation is successful, the STATUS and RESULT fields might change too quickly to notice.*

3.10 The received telegram data is compared with the selected telegram file data, STATUS = "Comparing telegrams".

If the comparison is unsuccessful i.e. the received data and the selected data are not identical:

- RESULT = "FAILED, Read telegram not same as selected" and the read operation is halted.

If the comparison is successful i.e. the received data and the selected data is identical:

- RESULT = "PASSED, balise read successful". This result confirms that the selected telegram data is present and not corrupt in the balise, and the balise is functional.

3.11 The user is presented with a popup requesting whether the selected telegram file is to be deleted. If YES is selected, the telegram file is deleted from where it was selected, if NO, it is not. Selection of either button ends the programming operation, and all buttons in the DEPOT screen are enabled.

If NO selected:

a) The user is prompted to enter the ID number of the balise being read, see figure 15. The OK button is enabled only if an ID has been entered in the Balise ID text field. No more than 14 characters can be entered.

b) Clicking on Cancel removes the popup, stop the current process and re-enable all buttons, RESULT = "Cancellation of Balise ID selection".

3.12 The BEPT telepowers the balise. The balise transmits the telegram data currently held in memory, and the BEPT receives and logs this data. STATUS = “Reading via airgap”.

If no telegram data is received:

- RESULT = “FAILED, no telegram received via airgap” and the read operation is halted.

If telegram data is received:

- RESULT = “Read operation OK”.

NOTE: *If the airgap read operation is successful, the STATUS and RESULT fields might change too quickly to notice.*

3.13 The received telegram data is submitted to a coding strategy check, STATUS = “Telegram Coding Check”.

If the coding strategy check fails:

- RESULT = “FAILED, telegram file corrupt” and the read operation is halted.

If the coding strategy check is passed:

- RESULT = “PASSED, balise read successful”. This result confirms that a non-corrupt telegram is stored within the balise, and the balise is functional.

4. Commissioning a Balise (Trackside)

NOTE: *Before proceeding trackside, verify that both the power supply cable and the balise programming cable have been disconnected from the unit, and that the handheld case is closed.*

CAUTION: When operating trackside, balise programming or reading should only be initiated when the BEPT is in place, on the balise, which is properly fixed in the four foot.

4.1 Power up the PC and monitor as per section 1-8 inclusive.

4.2 Check that the programming cable is disconnected.

4.3 Close and seal the case, ensuring that the monitor is not still in the case.

4.4 Check that the BEPT case is located on top of the balise.

4.5 After start up and the entry of a user name, select the TRACKSIDE button.

4.6 Select the COMMISSION button.

4.7 Inter-connection checks are performed; PC to BEPT reader connection present and correct, BEPT to balise connection NOT present. STATUS = “Connection Check”:

If the PC to BEPT reader connection is faulty:

- RESULT = “FAILED, PC to BEPT connection faulty”, and the commission operation is halted.

If the connection between the BEPT and the balise is present:

- RESULT = “FAILED, BEPT to Balise cable connected”, and the commission operation is halted.

If the two connections are correct:

- RESULT = “Connection OK”

4.8 A file browser window defaulting to the c:\Program Files\ATIS_TASS_BEPT\Telegram.

4.9 The file directory is be displayed, select the telegram to be programmed either from an inserted Floppy Disc or if the telegram is in the local memory of the BEPT carry out this process:

a) When prompted to insert a Floppy Disk click [Cancel].

b) A file browser window pops up which defaults to the desktop, browse the folders on the PC to the stored location and select the telegram to be programmed.

NOTE: *Selection of the file browser window Cancel button closes the file browser window, stop the current process and re-enable all buttons, RESULT = “Cancellation of TGM file selection”.*

4.10 Clicking on the file browser window Cancel button closes the file browser window, stop the current process and re-enable all buttons, RESULT = “Cancellation of TGM file selection”.

4.11 The selected telegram file is submitted to a coding strategy check, STATUS = “Telegram Coding Check”.

If the coding strategy check fails:

- RESULT = "FAILED, telegram file corrupt" and the commission operation is halted.

If the coding strategy check is passed:

- RESULT = "Telegram file OK".

NOTE: *If the coding strategy check is passed, the STATUS and RESULT fields might change too quickly to notice.*

4.12 The user is prompted to enter the ID number of the balise being commissioned, the OK button is enabled only if an ID has been entered in the Balise ID text field. No more than 14 characters can be entered.

4.13 Clicking on Cancel removes the popup, stop the current process and re-enable all buttons, RESULT = "Cancellation of Balise ID selection".

4.14 The BEPT telepowers the balise. The balise transmits the telegram data currently held in memory, and the BEPT receives and logs this data. STATUS = "Reading via airgap".

If no telegram data is received:

- RESULT = "FAILED, no telegram received via airgap" and the commission operation is halted.

If telegram data is received:

- RESULT = "Read operation OK".

NOTE: *If the airgap read operation is successful, the STATUS and RESULT fields might change too quickly to notice.*

4.15 The received telegram data is compared with the selected telegram file data, STATUS = "Comparing telegrams".

If the comparison is unsuccessful i.e. the received data and the selected data are not identical,

- RESULT = "FAILED, Read telegram not same as selected" and the commission operation is halted.

If the comparison is successful i.e. the received data and the selected data are Identical:

- RESULT = "PASSED, balise read successful". This result confirms that the selected telegram data is present and not corrupt in the balise, and the balise is functional.

The user is presented with a popup requesting whether the selected telegram file is to be deleted. If YES is selected, the telegram file is deleted from where it was selected, if NO, it is not.

Selection of either button ends the programming operation, and all buttons in the TRACKSIDE screen are enabled.

5. Reading a Balise (trackside)

NOTE: *Before proceeding trackside, verify that both the power supply cable and the balise programming cable have been disconnected from the unit and that the handheld case is closed.*

CAUTION: When operating trackside, balise programming or reading should only be initiated when the BEPT is in place, on the balise, which is properly fixed in the four foot.

5.1 Power up the PC and monitor.

5.2 Check that the programming cable is disconnected.

5.3 Close and seal the case, ensuring that the monitor is not still in the case.

5.4 Check that the BEPT case is located on top of the balise.

5.5 After start up and the entry of a user name, select the TRACKSIDE button. The TRACKSIDE screen with four buttons is displayed.

5.6 Select the READ BALISE button. Inter-connection checks are performed; PC to BEPT reader connection present and correct, BEPT to balise connection NOT present. STATUS = "Connection Check":

If the PC to BEPT reader connection is faulty:

- RESULT = "FAILED, PC to BEPT connection faulty", and the read operation is halted.

If the connection between the BEPT and the balise is present:

- RESULT = "FAILED, BEPT to Balise cable connected", and the read operation is halted.

If the two connections are correct:

- RESULT = “Connection OK”

5.7 The user is prompted to enter the ID number of the balise being read. The OK button is enabled only if an ID has been entered in the Balise ID text field. No more than 14 characters can be entered.

5.8 Clicking on Cancel removes the popup, stop the current process and re-enable all buttons, RESULT = “Cancellation of Balise ID selection”.

5.9 The BEPT telepowers the balise. The balise transmits the telegram data currently held in memory, and the BEPT receives and logs this data. STATUS = “Reading via airgap”.

if no telegram data is received:

- RESULT = “FAILED, no telegram received via airgap” and the read operation is halted.

If telegram data is received:

- RESULT = “Read operation OK”. Note: If the airgap read operation is successful, the STATUS and RESULT fields might change too quickly to notice.

5.10 The received telegram file is submitted to a coding strategy check, STATUS = “Telegram Coding Check”.

If the coding strategy check fails:

- RESULT = “FAILED, telegram file corrupt” and the read operation is halted.

If the coding strategy check is passed:

- RESULT = “PASSED, balise read successful”. This result confirms that a non-corrupt telegram is stored within the balise, and the balise is functional.

6. Checking Telegram Coding

6.1 Power up the PC and monitor.

6.2 After start up and the entry of a username, select the TELEGRAM CHECK button. The TELEGRAM CHECK screen with two buttons is displayed.

6.3 Select the TELEGRAM CHECK button. The Result and File name fields are cleared.

6.4 Files directory is displayed, Select the telegram to be programmed either from an inserted Floppy Disc or if the telegram is in the local memory of the BEPT carry out this process:

a) When prompted to insert a Floppy Disk click [Cancel].

b) A file browser window pops up which defaults to the desktop, browse the folders on the PC to the stored location and select the telegram to be programmed.

NOTE: *Selection of the file browser window Cancel button closes the file browser window, stop the current process and re-enable all buttons, RESULT = "Cancellation of TGM file selection".*

6.5 A single telegram file or multiple telegram files, in a single directory, may be selected by highlighting them and selecting Open. Selection of multiple directories is not possible.

6.6 Clicking on the file browser window Cancel button closes the file browser window, stop the current process and re-enable all buttons, RESULT = "Cancellation of TGM file selection".

6.7 Once selected, the file browser window closes, and each selected telegram file is checked in turn. The FILENAME field displays the telegram filename currently being checked.

If the current file passes the telegram check:

- RESULT = "Telegram File OK". Note: If the check operation is successful, the FILENAME and RESULT fields might be updated too quickly to notice.

If the current telegram file is corrupt i.e. the check fails:

- RESULT = "FAILED, telegram file corrupt".

A popup is displayed detailing the filename of the corrupted telegram, and a prompt for the user to select the OK button to continue.

Once OK is selected; the check on the remaining files recommences until complete. If other corrupt telegram files are encountered, the error message and popup are repeated.

When all selected telegram files have been checked,

If all the selected telegram files have passed the coding check:

- RESULT= “PASSED, all telegram files correct”, FILENAME = name of the last telegram file checked.

If X number of telegram files have failed the coding check:

- RESULT = “FAILED, X telegram file(s) corrupt”, FILENAME = name of last telegram file checked.

7. Closing Screens and Shutting Down

7.1 Select START – SHUT DOWN

7.2 Select Shutdown in the popup menu.

SECTION D – TRACKLINK III READING AND TESTING

Further information can be found in Tracklink III HSD2300_095-SWT (Tracklink III Beacon Programmer and Tester).

1. Checking the Programmer / Test Tool

1.1 Switch on the portable tag programmer / tester tool at the power on button by pressing and holding for 4 seconds.

1.2 After a short power up period, the display shows the standard windows start up screen.

1.3 Confirm that the antenna is connected to the USB port on the Left side of the tablet. To run the Tracklink III Software program double tap on the icon.

Figure 31 – Tracklink III Icon

1.4 Prior to reading an installed beacon, check that the reader is functional, by using the supplied Test Tag.

1.5 Connect the antenna, place the Test Tag on top of the antenna and select the 'Read Tag' button. '1264400C6300' should be displayed in the Page 1 field on the PC screen.

1.6 Once the Programmer / Tester has successfully read the test tag, locate the beacon to be tested / programmed.

1.7 Place the antenna over the centre of the beacon and within 0.8m of the beacon under test and select the "Read Tag" button.

NOTE: *Check no other beacons or test tags are within 2 metres of the beacon.*

1.8 To clear the data that has been read from a previous tag, select 'Read Tag' with the antenna facing away from the tag. This clears the tag data.

1.9 If any of the tags are not read, repeat the process, if unsuccessful, verify programmer/tester operation by reading the red test tag. If operation with the red test tag is okay, then the beacon might need replacing. Refer to Tag Reading/Verifying Flowchart for further details.

2. Programming a Tracklink III Beacon

2.1 Programming is required when there is a need to create a new beacon for replacement of a faulty beacon.

2.2 To write a beacon, the Operator first Logs on. Select the 'Logon' button, and the logon window appears.

2.3 Enter 'PASSWORD' in the password field and select 'OK'.

2.4 Once logged on, the 'Open File', "Write Tag', 'Log Off" buttons become available.

2.5 Select the 'Open File' button, this should open the 'Master File' (Default), if not, select the 'Set Root Directory' button and select the 'Master File' for use.

***NOTE: Master (Default)** — The master directory contains data which are the files that are* to be used for programming the beacons.

***NOTE: User** — The user directory is available if files need to be saved i.e. for investigative purposes.*

2.6 A window displaying a list of data files (abbreviated by station, platform and platform end) is displayed. Double tap the required file on the list with the Programmer/Tester stylus.

Once a file has been selected, locate the beacon to be programmed, place the antenna directly on top of the centre of the beacon and select the 'Write Tag' button to program the new beacon with the required data.

***NOTE:** Check no other beacons or test tags are within 2 meters of the beacon under test. The Programmer/tester is designed to test/read/write only one beacon/tag at a time and two beacons/tags in close proximity affect its ability to write.*

2.7 Confirmation that the pages (address) 0001 to 0007 have been written show as 'Pass'.

2.8 Confirmation that the correct data has been written to the beacon/tag may be obtained firstly by repeating the 'Read' function and confirming Page 1 and the "Operational Data, are correct, then by pressing the 'Verify' button.

2.9 In the "Verification of Written Data Screen", check the data in address 000F begins with 0314, the "Hex Data" for addresses 0001 to 0004, match "Page 1", data and that addresses 0005 to 0007 equals 0000000000000000.

NOTE: *by pressing the "Verify" button, the data contents of all pages in the beacon/tag is displayed and then, the "Lock" button is available to use, as shown below in Screen-8.*

NOTE: The Lockinq process sets the beacon/taq data to read only and cannot be chanqed once the beacon/taq has been locked!

2.10 Once the beacon/tag has been successfully written, and subsequently verified as correct using the "Read" button then the "Verify" button, the beacon/tag data, can then be locked.

NOTE: The Lock process sets the beacon/tag data to read only, and cannot be changed again!

2.11 If the beacon/tag has NOT been successfully written, an error message appears when using the "Verify" button. If the "Verification Failed" message appears, repeat the process to re-write the data to the tag/beacon.

Once the beacon/tag has been successfully written, select the 'Lock' button. A prompt window shall be displayed as shown below in Screen-10.

NOTE: The "Lock" button is unavailable until the beacon/taq data has been verified usinq the "Verify" button.

2.12 Confirm that the unique beacon/tag serial number and 'Page 1' Hex Data are correct before selecting 'Yes'.

2.13 When the beacon/tag has been locked, an asterisk shall appear next to each page in the event window, and the "Lock" button becomes unavailable to use.

NOTE: This beacon cannot now be re-programmed, if it has been incorrectly programmed and locked by selecting the incorrect file. It should be quarantined immediately to avoid the accidental installation of an erroneous beacon.

2.14 Following the tag write & lock process, the operator can select "Read Tag" and confirm that the data has been written successfully.

END

1. General

This module contains guidance on three types of Instead Logger the 3, 64 and 64 Active. Confirm which type you have before proceeding.

2. Instead Data Logger Disk Analysis

2.1 After a failure / incident, and when instructed to do so, the logger disk should be removed and replaced by the attending staff.

2.2 The logger disk should be analysed by staff competent to Level 2 or equivalent.

2.3 If the disk has been changed as part of routine maintenance, it should be checked to confirm each channel is recording correctly and that the time / date is correct.

2.4 Each disk should be marked with the site name.

2.5 If the disk has been removed as part of an Investigation then in addition to the checks listed above consideration should be given as to what is known to have occurred (by what is recorded on the disk) and what testing is required to eliminate any possible causes not covered by the data on the disk.

For example, the fact that a lamp proving relay is energised does not mean that the lamp is lit, a fault in the tail cable can cause sufficient current flow to energise the relay but prevent the lamp from lighting.

This kind of analysis can both focus and reduce the amount of testing required.

2.6 Copies of the data relating to WSF / incident investigation, shall be submitted as evidence along with any other supporting test records.

3. Remove or Replace an Instead Logger Disk

(All Types)

3.1 The unit depends on having a usable disk in the drive for correct operation.

3.2 Recording always continues into the memory, even when there is not a disk in the drive.

Be aware that if the unit is left without a disk for a long time, the memory eventually fills up. If this happens, data is lost and an ‘overrun’ error message is be added to the system event log.

3.3 Never eject the disk from the drive without first pressing the ‘Change Disk’ button and waiting for the unit’s instructions. The unit stores events in memory until it has stored 256 events, at which point it writes them to the disk.

3.4 When ‘Change Disk’ is pressed, any events remaining in memory are written to the disk. If the disk is removed without pressing ‘Change Disk’ button, the last events are not be recorded. Also, the system event log is not updated on the disk.

3.5 The unit might not respond immediately to your press of the ‘Change Disk’ button under the following conditions:

a) If it is currently writing to the disk, it does not respond until the disk write is completed. This can take up to 2 seconds.

b) If the unit is in menu mode, this should be exited before the disk can be changed. Keep pressing ‘No’ until the time is displayed, then press ‘Change Disk’ again.

c) If the modem link is in use, the unit displays “Logging out remote user - WAIT”. The remote user is then logged out at the end of their current operation. This can take some time.

4. Changing the Logger Disk

For Instead Logger type 3 and 64 (Only)

4.1 A 720K formatted disk is required to replace the one which is currently in the unit. It does not necessarily have to be blank, but anything on it is erased.

For Instead Logger type 64 Active (Only)

4.2 A 1.44M formatted disk is required to replace the one which is currently in the unit. It does not necessarily have to be blank, but anything on it is erased.

All Types

4.3 Before starting the disk changing procedure, the site name and the current date and time shall be written on the label of the new disk.

4.4 If the unit is in a location case, take steps to reduce the ingress of moisture and dirt while the front door is open.

4.5 Open the transparent door on the front of the unit and press the ‘Change Disk’ button. The unit displays:

a) Writing disk WAIT (Type 3 & 64) or

b) Appending data (Type 64 Active).

The unit is writing any left-over events from its memory onto the disk. After a second or so, the display changes to:

c) Remove disk now (Press no to cancel)

Press the eject button on the disk drive and remove the disk.

While there is no disk in the unit, it beeps quietly to remind you to put a new disk in. If you take more than 2 minutes to replace the disk, the beeping becomes more urgent. You can lose data if you leave the unit without a disk for too long.

4.6 The display now shows:

a) Disk removed insert new disk (Type 3 & 64) or

b) Insert formatted 1.44m disk (Type 64 Active).

Take the new disk and insert it into the drive, with the label facing towards the display. As soon as the disk clicks into the drive, the display changes to:

c) Checking Disk

4.7 The unit is now checking the disk to make sure it is correctly formatted, whether it has any data on it, and if there are any faults on it.

4.8 If the disk is OK and is blank, the unit clears the screen and returns to displaying the time and date.

5. Data on Disk

For Instead Logger type 3 and 64 (Only)

5.1 If Data is found on the entered disk the following messages are displayed, depending on the results of the disk check.

a) Disk is not Blank OK to Erase?

The disk has got some DOS or Windows data on it. Press ‘Yes’ to wipe the disk, or ‘No’ if you want to remove the disk and try another. If you do not respond at all, the unit wipes the disk after 60 seconds.

b) Disk is from another logger, OK to erase?

The disk has previously been used in another Instead 3 unit and might have recorded events on it.

If you press ‘Yes’, the unit wipes the disk.

If you press ‘No’, the unit asks you to replace the disk with another one. If you do not respond at all, the unit wipes the disk after 60 seconds.

c) Old disk from this logger, OK to erase?

The disk has previously been used in this Instead 3 unit and might have recorded events on it.

If you press 'Yes', the unit wipes the disk.

If you press 'No', the unit asks you to replace the disk with another one.

If you do not respond at all, the unit wipes the disk after 60 seconds.

d) Instead data on disk, add data on to end?

The disk has just been removed from this Instead 3 unit (the disk you have put in is the one that you just took out).

If you press 'Yes', the unit carry's on recording on the same disk, adding new events onto the end of the previous ones.

If you press 'No', the unit asks whether you want to wipe the disk (press '9') or replace it (remove the disk).

If you do not respond at all, the unit carry's on using the disk, adding new events on the end of the file.

If you change your mind after removing a disk, or if your replacement disk turns out to be unsuitable, this option allows you to put the original disk back in. No data is lost.

<u>Instead 64 Active Logger Disk (Only)</u>

5.2 The disk contains DOS, Windows or unknown file(s). After 4 seconds the display asks for removal of this disk.

a) New config on disk. Update my config?

The disk contains the same site and new site configuration details.

Press 'Yes' to change the system configuration, or press 'No' to cancel.

The unit asks for confirmation and if there is no response within 30 seconds, the new system configuration is loaded and used as the new default.

b) Old config on disk. Change my config?

The disk contains the same site and old site configuration details.

Press ‘Yes’ to change the system configuration, or press ‘No’ to cancel. The unit asks for confirmation and if there is no response within 30 seconds, the new system configuration is loaded and used as the new default.

c) Change my config to Blank Site

The disk contains another site configuration details.

Press ‘Yes’ to change the system configuration, or press ‘No’ to cancel.

The unit asks for confirmation and if there is no response within 30 seconds, the new system configuration is loaded and used as the new default.

d) Use this disk as a data disk?

The disk contains the same site and new site configuration details.

The unit then requires confirmation to use this system site configuration disk as a site data disk.

Press ‘Yes’ to erase this disk and use it as a data disk, or press ‘No’ to cancel.

The unit asks for confirmation and if there is no response within 30 seconds, the unit then examines the disk to determine what files are present and if any errors exist on the disk.

e) Data already on disk 9-Erase Y-Keep

The disk has previously been used in this Instead 64 Active unit and might have events on it.

Pressing ‘9’ erases the disk.

By pressing ‘Yes’, the unit appends any events onto the end of the last event on the disk.

If there is no response after 30 seconds, the unit assumes that ‘Yes’ was intended.

f) Erase all I64 files on disk?

This message requires confirmation before erasing a disk.

Press ‘Yes’ to wipe this disk, or press ‘No’ to cancel, whereupon the unit prompts you to remove of the disk and waits for the disk to be removed.

g) Verify disk? (recommended)

This message requires confirmation before verifying a disk, i.e. checking the disk for any bad sectors.

This process can take up to 90 seconds.

Press ‘Yes’ to verify the disk, or press ‘No’ to cancel.

The unit verifies the disk after 30 seconds if there is no response to this message.

6. Disk not Usable

For Instead Logger type 3 and 64 (Only)

6.1 If the disk is unusable the following messages are displayed, depending on the results of the disk check.

a) Disk is wrong format, please replace

The disk is not 720K DOS formatted (it might be formatted at the wrong capacity or not formatted at all).

The unit cannot use the disk, it is to be replaced.

This message is accompanied by a fault indication, which is cancelled automatically when you remove the faulty disk.

b) Disk has bad sectors, please replace

The unit has detected some bad sectors on the surface of the disk. The unit cannot use the disk, it is to be replaced. This message is accompanied by a fault indication, which is cancelled automatically when you remove the faulty disk.

Place the new disk into the drive, with the label towards the display.

The display clears to show the current date and time.

Recording continues as normal.

Instead 64 Active Logger Disk (Only)

6.2 If the disk is unusable the following messages are displayed, depending on the results of the disk check.

a) Disk wrong format or bad sectors

The disk is not 1.44MB DOS formatted or the unit has detected some bad sectors.

It might be formatted at the wrong capacity or not formatted at all.

The unit cannot use the disk, it is to be replaced.

This message is accompanied by a fault indication, which is cancelled automatically when the faulty disk is removed.

b) Error reading disk directory

An error occurred while reading the disk. After a few seconds the unit requests the removal of the disk.

c) Load config failed. Blank Site

An error occurred while reading system configuration from the disk. The unit displays an error message and any code(s).

d) Disk error xxxxxxxxxxxx

After a few seconds the unit requests the removal of the disk.

e) Error writing config Disk write protected

An error occurred while reading system configuration from the disk.

The unit displays an error message and any code(s).

f) No. of channels = xx Incorrect!

The system configuration site disk contained an incorrect number of channels in the set-up file(s).

The display shows the incorrect number of channels on this disk.

This site configuration disk is ignored.

After a few seconds the unit requests the removal of the disk.

7. After the Disk has been changed

All Types

7.1 Write the current date and time on the removed disk and check the site name is also marked on it.

7.2 Close the front door of the unit.

END

1. Replacing Control and Evaluation Unit Components

1.1 All Control and Evaluation Unit components are replacement parts and cannot be repaired.

1.2 The UPS is an exception to this as the spent batteries can be replaced. This task shall only be undertaken by specialist personnel.

1.3 Any item requiring replacement should be replaced using the correct SMTH Test Plan.

2. Start-up Procedure

2.1 Connect the load with the UPS system without switching them on. Make sure that the UPS system has two groups of output sockets. The programmable output sockets can be switched independently of the remaining sockets. The programmable output sockets are primarily designed for less critical load which cannot be brought down using software. Critical load should not be connected to the programmable output sockets.

2.2 Connect the power supply cable (supplied with the XANTO 2000 and 3000) for the UPS system into a socket. The display on the UPS system shows “Sb”,

2.3 Hold the “ON / 🔇 / ▲” button on the UPS system down until you hear a short beep.

2.4 The UPS system carries out a self-test, after which “OK” appears on the display. The UPS system is now operating in normal mode and supplying the load with reliable power.

2.5 If an additional emergency power off switch has been installed, the emergency stop function needs to be tested.

2.6 Switch the load on one by one.

NOTE: *The internal batteries charge up to 90% of their full capacity in less than four hours. ONLINE recommends charging the batteries for 48 hours after installation or extended periods of non-use.*

The batteries start to charge as soon as the UPS system is connected to the supply network and supplied with power, irrespective of the operating mode.

3. Starting in battery mode

3.1 Hold the “ON / 🔇 / ▲” button on the UPS system down until you hear a beep.

3.2 The UPS system is starting; the display then shows the battery status and supplies the load connected with reliable power.

3.3 If the display is lit, fix all warnings and restart the UPS system.

4. Switching off

4.1 Hold the “OFF / ” button on the UPS system down for 2 seconds. When the continuous beep ends, the UPS system switches to standby mode.

NOTE: *If the “OFF / ” button is released after less than 2 seconds, the unit is not switched off.*

4.2 Disconnect the mains connection cable of the UPS system from the socket. The display on the UPS system goes out after a short time and the UPS system switches off completely.

5. Replacing an EPOS Unit

<u>Unregistering and removing the defective EPOS-Unit</u>

5.1 Open the EPOS configuration by double-clicking on the SAT GUI icon. First a login window appears.

5.2 Enter the login data.

5.3 The EPOS configuration window opens:

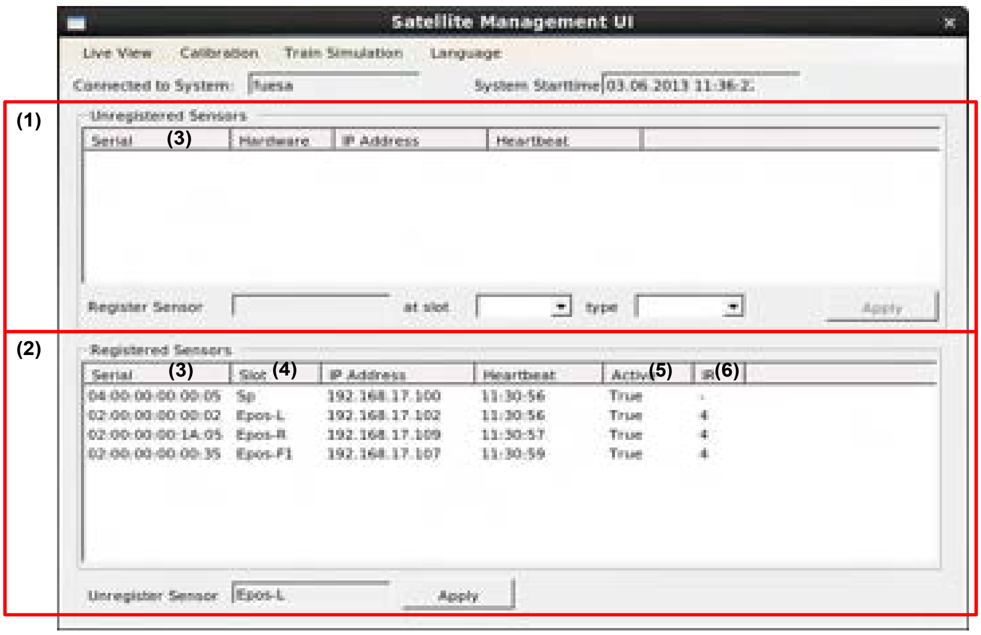


Figure 1 - "EPOS configuration" window

Number	Function Description
(1)	"Unregistered Sensors" area (SLSC modules as EPOS units, SP board).
(2)	"Registered Sensors" area (SLSC modules).
(3)	"Serial" column: Display of the MAC address.
(4)	"Slot" column: Display of the functional allocation (e.g., measurement position) of the sensors.
(5)	"Active" column: Display of the connection status.
(6)	Number of detector elements (for EPOS units).

Table 1 – Key to Figure 1

5.4 Unregister the defective EPOS-Unit:

a) Select the defective EPOS-Unit in the "registered sensors" at the bottom.

b) Click on the "Apply" button (item (1) in Figure 2).

The module that has been unregistered disappears in the "registered sensors" area at the bottom and now appears in the "unregistered sensors" area at the top.

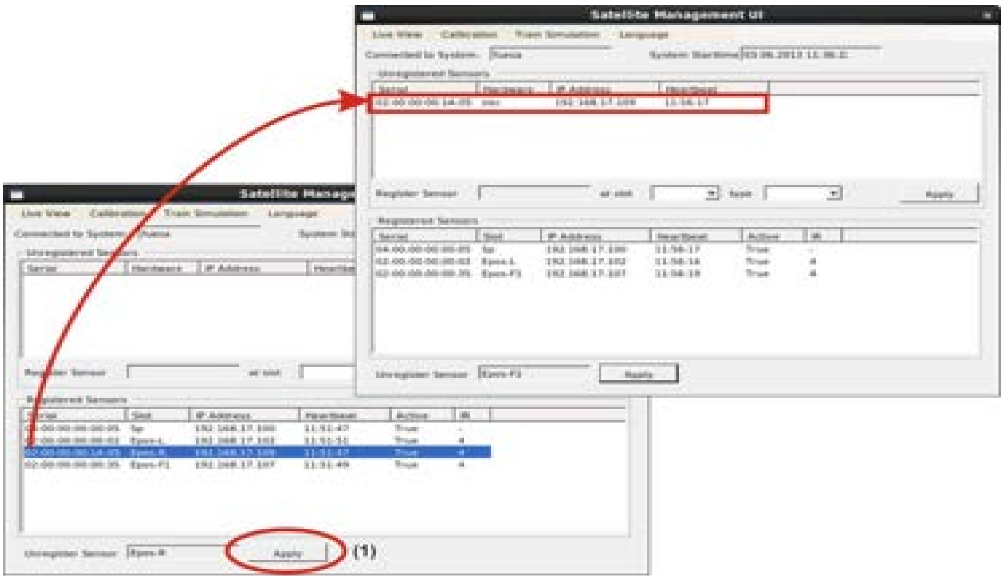


Figure 2 - Logging out the defective EPOS-Unit

Removing the HBD EPOS-Units

5.5 Loosen the two bolts of the inner cover plate (Figure 3, marked (1)) and slide the plate (Figure 3, marked (2)) away from the HBD, in the direction of the red arrow.

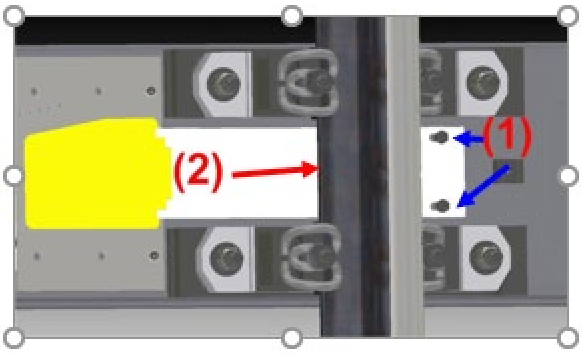


Figure 3 – Removal of the Inner Cover Plate

5.6 Loosen and remove the HBD-L and HBD-R EPOS-Unit fastening screws (each of four M12, SW19 screws, with washer and spring-lock washer) on the base plate and remove. See Figure 4.

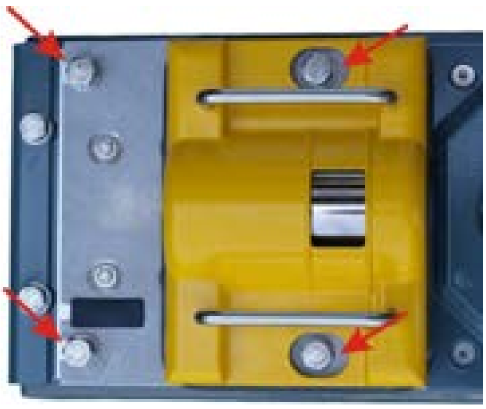


Figure 4 - HBD EPOS-Unit screw connections

5.7 Pull both HBD EPOS-Units out of the measuring sleeper and move them downwards using the shutter, putting them onto or next to the measuring sleeper (see Figure 5).

- Do not loosen the long cable.
- Do not unscrew the adjustment frame.

Figure 5 - HBD EPOS-Unit placed on the sleeper

5.8 If the EPOS Unit is being disconnected/removed from site or replaced, push the plug protection to one side and disconnect the plug connection.

The entry for the EPOS-Unit which has been disconnected shown in the "unregistered SLSC modules" area (seen in Figure 2) disappears.

5.9 Secure and protect the disconnected ends of the cable.

Re-assembly of the HBD EPOS-Units

5.10 If the EPOS Unit is being re-connected after being removed from site or replaced, reconnect the cable and replace the plug protection.

5.11 Re-insert the HBD EPOS units into the measuring sleeper.

5.12 Grease the screws before assembly to protect them from corrosion.

5.13 Reposition the inner cover plate so there is no gap at the HBD (Figure 6).

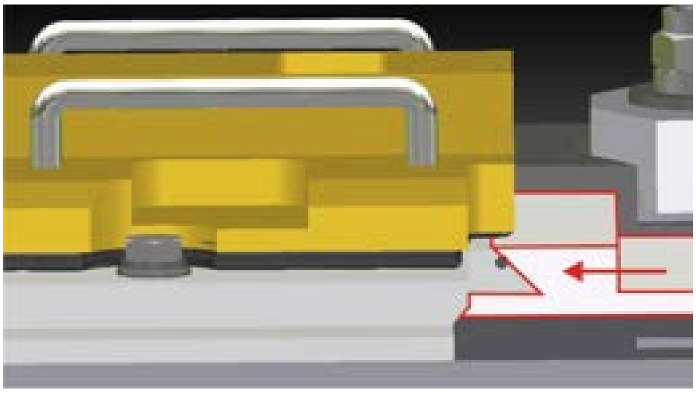


Figure 6 - Inner Cover Plate Replacement

5.14 Fasten the HBD EPOS unit with the M12 x 45 mm screws, including the washers and spring rings (tightening torque 70 Nm).

5.15 Confirm while doing so that the plug protection is not moved out of place.

(1) Position of the plug connection inside the plug protection
(2) Plug protection assembled in the correct position

Figure 7 - Plug protection

Removing the HWD EPOS-Unit

5.16 Loosen and remove the HWD EPOS-Unit fastening screws (each of four M12, SW19 screws, with washer and spring lock ring) on the base plate and remove. See Figure 8.

5.17 Pull the HWD EPOS-Unit out of the measuring sleeper carrier and move it downwards using the shutter, putting it onto or next to the measuring sleeper (see Figure 9).

Figure 8 - HWD EPOS-Unit screw connections

5.18 If the EPOS Unit is being disconnected/removed from site or replaced, push the plug protection to one side and disconnect the plug connection.

The entry for the EPOS-Unit which has been disconnected shown in the "unregistered SLSC modules" area (seen in Figure 2) disappears.

5.19 Secure and protect the disconnected ends of the cable.

Figure 9 - HWD EPOS-Unit placed on the sleeper

Re-assembly of the HWD EPOS-Units

5.20 If the EPOS Unit is being re-connected after being removed from site or replaced, reconnect the cable and replace the plug protection.

5.21 Insert the HWD EPOS unit into the measuring sleeper.

5.22 Grease the screws before assembly to protect them from corrosion.

5.23 Fasten the HWD EPOS unit with the M12 x 45 mm screws, including the washers and spring rings (tightening torque 70 Nm).

5.24 Confirm while doing so that the plug protection is not moved out of place.

Registering the EPOS unit

5.25 If you are not already logged into the "Satellite Management UI" system, open the EPOS configuration by double-clicking on the icon and logging in when the login window appears.

5.26 The new EPOS-Unit (SLSC module) appears automatically in the "unregistered sensors" area at the top as soon as it is plugged in.

5.27 Assign the new EPOS-Unit (SLSC module) to the previous function (measurement position) by following steps:

a) Open the “at slot” drop-down list as shown in Figure 10, and select the measurement position.

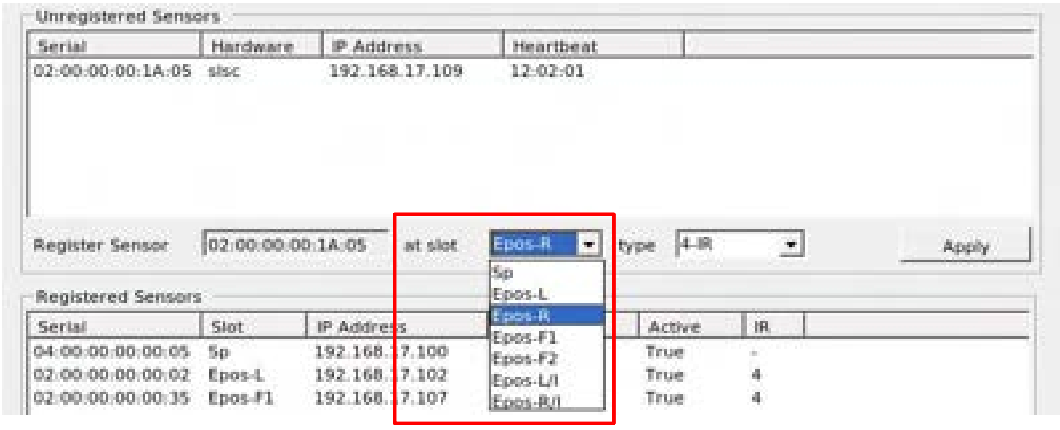


Figure 10 - Assigning the EPOS-Unit to a measurement position

b) If necessary, change the detector type (4 or 8 elements) using the "Type" drop-down list.

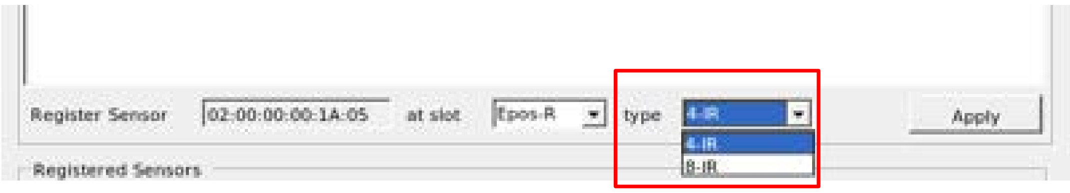


Figure 11 – Selecting the detector type

c) Mark the new EPOS-Unit (SLSC module).

d) Click on the "Apply" button (item (1) in Figure 12).

5.28 The new EPOS-Unit disappears from the "unregistered sensors" area at the top and now appears in the "registered sensors" area at the bottom.

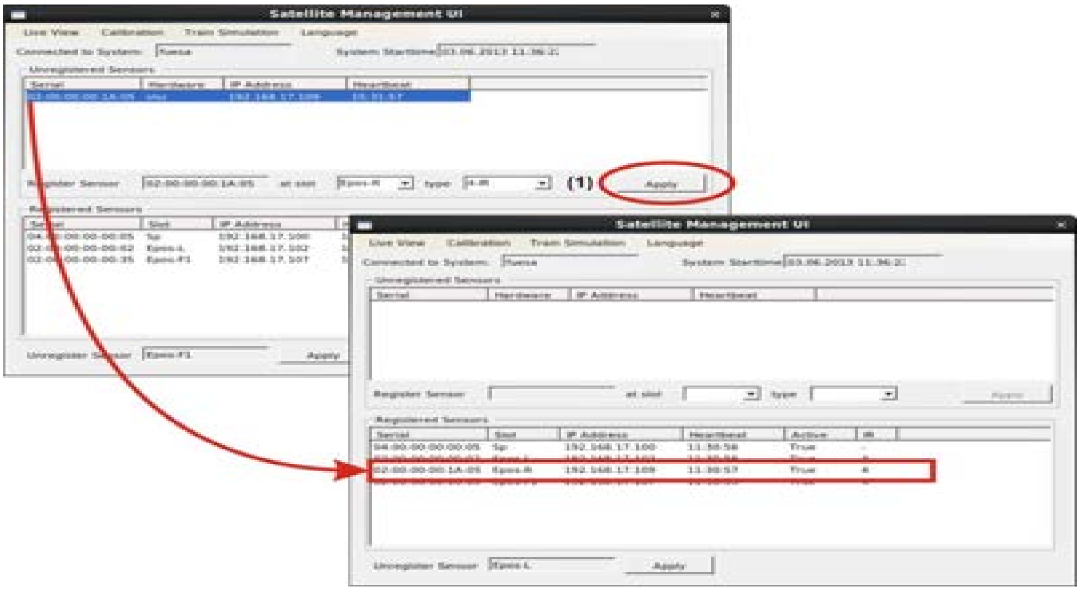


Figure 12 - Logging in the new EPOS-Unit

5.29 The new EPOS-Unit (SLSC module) is now registered in the FUES-EPOS system.

5.30 Check the connection status of the EPOS-Unit in the "Active" column. If "True" appears in this column, the connection is OK.

<u>Transferring calibration data of the new EPOS-Unit</u>

5.31 Open the EPOS configuration by double-clicking on the icon. The "EPOS configuration" window opens:

The following actions can be reproduced in the screen shown in Figure 13.

a) Click on the "Calibration" menu.

b) A pull-down menu opens.

c) Move the mouse pointer to the "Read Curve from Satellite" menu item.

d) A pull-down list for selecting an EPOS-Unit opens simultaneously.

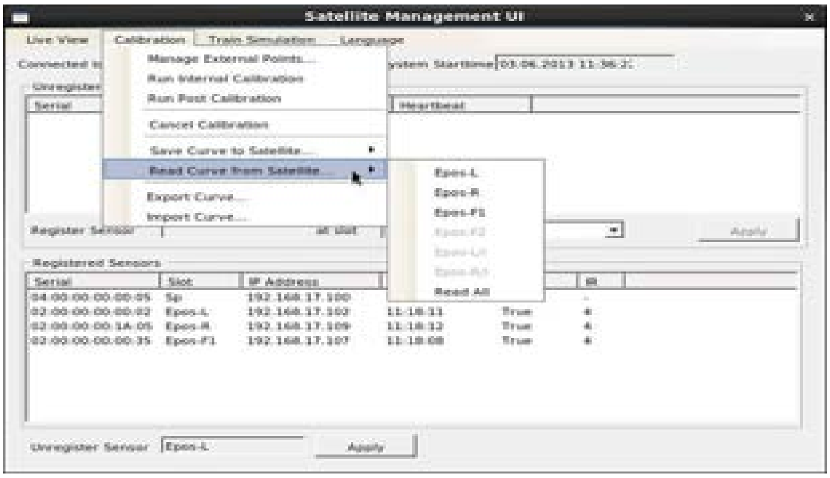


Figure 13 - "Internal Calibration" pull-down menu

5.32 Move the mouse pointer to the EPOS-Unit you want in the pull-down list and start the calibration data transfer with a mouse click.

The progress of data transfer is displayed.

Figure 14 - Data transmission progress display

All the calibration data of the new EPOS-Unit has now been transferred to the system database.

5.33 Carry out NR/SMS/PartB/Test/180 (EPOS - Manual Post Calibration Test).

6. Wheel sensor RSR123

6.1 Remove the wheel sensor in the following order:

a) Loosen connector flange and remove connection cable.

b) Mark the exact position of the rail clamp on the rail.

c) Dismantle the rail claw together with the wheel sensor from the rail.

d) Remove the fastening screws of the wheel sensor.

6.2 Re-installing the wheel sensor in the following order:

a) Attach the new wheel sensor to the rail claw.

b) Tighten the fastening screws according to the installation instructions for the wheel sensor manufacturer.

c) Screw the wheel sensor together with rail claw on the previously marked position on the rail.

d) Perform position control of the wheel sensor at the rail.

e) Re-mount the connection cable and the connector flange.

6.3 Carry out NR/SMS/PartB/Test/184 (EPOS – RSR123 Wheel Sensor Voltage Adjustment).

6.4 Carry out NR/SMS/PartB/Test/181 (EPOS - Wheel Sensor Occupancy Detection Capability Test).

END

1. Replacement Sequence

1. Before removal of the old circuit controller, check that the machine is placed into the approximate mid-stroke position.

2. Check that each wire is identifiable as it is removed. If this is not the case, check the installer correctly marks/identifies the unidentifiable wires as they are removed.

3. Check that the installer unlocks the two locking plates, removes the four bolts securing the machine and lifts the circuit controller clear of the machine.

4. Check that the installer removes the ballscrew cover and uses the datum marks on the machine driveslide, located under the ballscrew cover, to confirm that the machine is in mid-stroke (Figure 1).

5. Check that the installer identifies the space between teeth 16 and 17 of the toothed rack (counting from either end) and makes a mark from the rack to the edge of the case of the machine (which can be seen once the circuit controller is offered up).

6. Check that the installer inserts two new pushrods into the circuit controller with the step faces uppermost and the large washers outside the controller chassis.

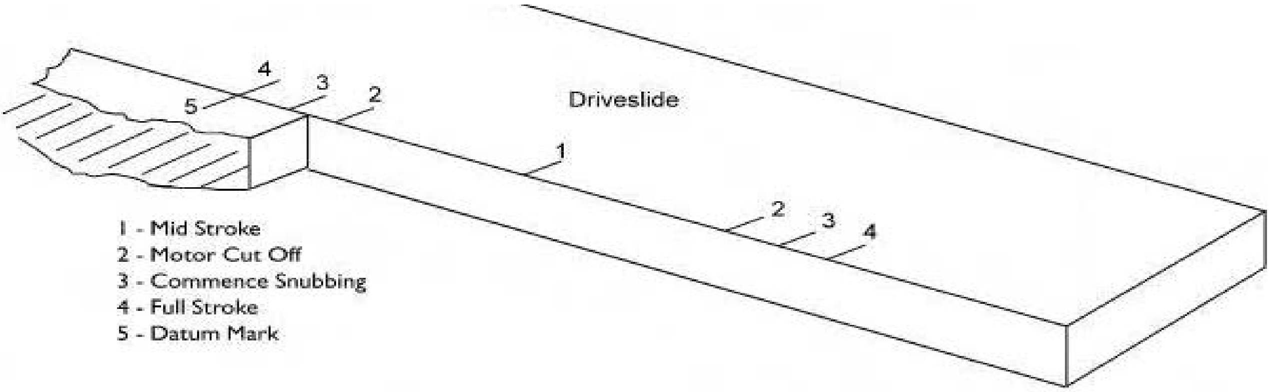


Figure 1 – Drive Slide Position Points

7. Check that the installer rotates the shaft on the controller.

   NOTE: *the moulded arrowhead mark on the rim of the nylon gear wheel is positioned at 6 o'clock with the gear wheel just clear of the toothed rack.*

8. Check that the installer inserts the two pushrod ends into their respective operating levers and moves the circuit controller sideways to compress the detector pushrod springs.

   NOTE: *The moulded arrowhead mark on the gear wheel is directly above the marked space between teeth 16 and 17 on the rack.*

9. Check that the installer lowers the controller onto its support pillars and replaces the four bolts using new locking plates.

10. Before the installer finally tightens the bolts, check that the moulded arrowhead mark on the gear wheel is aligned with the mark next to the rack.

    Check both the detector pushrods can be freely pushed into the circuit controller and that their return springs operate correctly.

    NOTE: *the pushrods sticking indicate improper alignment with the rotary lock detection segments. Remedy is by slacking off the four bolts and moving the circuit controller slightly sideways within the tolerance/clearance permitted between the four bolts and the holes in the circuit controller chassis through which they pass.)*

11. Check the installer tightens the bolts and turns up the locking plates.

12. Crank the machine to one end of its stroke and check that the pushrod roller is resting on the bottom of the detector blade notch, clear of the sloping cam face.

13. Insert 2mm gauge (Figure 2) between the roller and the bottom of the detector blade. Check the detection contacts just break. If necessary, adjust the nuts on the pushrod.

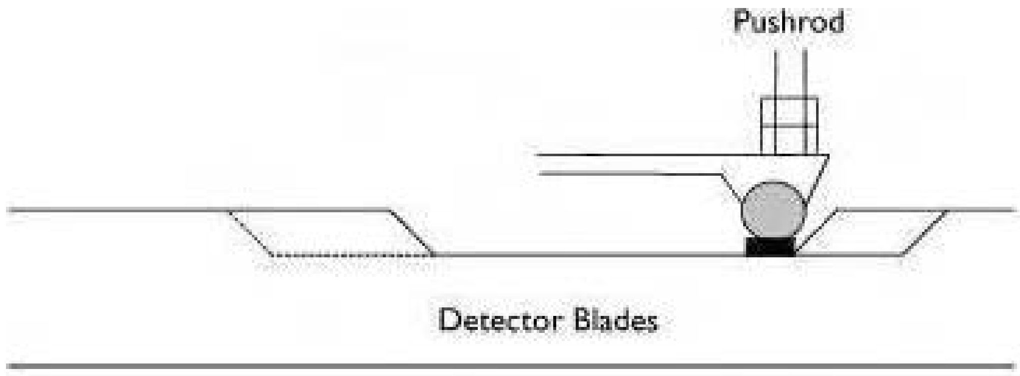


Figure 2 – Positioning of the 2mm Gauge

14. Crank the machine to the other end of its stroke and repeat steps 16 and 17.

15. Check that both nuts on each pushrod are fully tightened.

16. Crank the machine to mid-stroke.

17. Check the nominal 1mm gap on the quick acting motor cut-off contact (Figure 03).

18. If adjustment is required, loosen the 0BA nuts of the stud terminals and slide the moveable contacts as necessary.

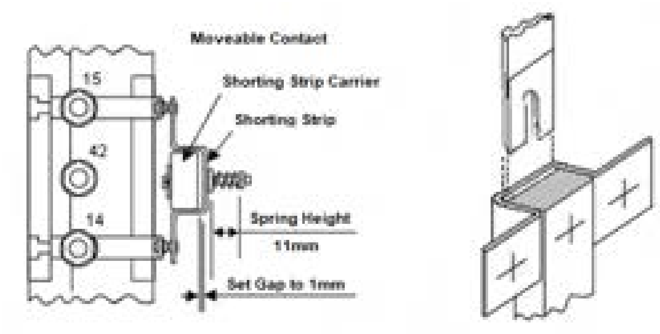


Figure 3 – Cut Off Motor Contact Details

19. Previous circuit controller changes have not always resulted in marks 2 and 3 on the driveslide of the machine being altered.

    However, the mid-stroke mark 1 is correct. The following process allows for the marks 2 and 3 not necessarily being in the correct place.

20. Check that mid stroke to motor cut-off (mark 1 to 2) is 93.5mm to 95mm and motor cut-off to snubbing (mark 2 to 3) is 1.5mm minimum to 3.0mm maximum.

    If the marks are incorrect, make your own marks with pencil or felt tip and use those marks in steps 21 to 24.

    Always crank the machine from mid-stroke towards the setting marks to eliminate gearing backlash.

21. Align mark 2 with mark 5. Check that the motor cut-off contact is just broken.

22. Align mark 3 with mark 5. Check that the snubbing control contact is just made.

    There should be a quarter to half a turn of the crank handle between the cut-off breaking and the snubbing contact making.

23. Check that the lock proving, and detection contacts do not make until 97mm from mid-stroke.

24. Check that the lock proving, and detection contacts are open at least 2mm throughout the whole travel.

25. Repeat steps 21 to 24 for the opposite lie of the machine.

    The detection on the machine is arranged so that the closed switch furthest from the machine is always detected by the roller/pushrod nearest the track, and vice versa

26. Crank the machine to the end of its stroke to close the switch furthest away from the machine. Check that the switch rails are fully closed.

27. Insert a 3.5mm gauge between the pushrod roller and the cam face of the detector blade notch (Figure 4). Adjust the ¾" nuts on the detector rod until the correct detector contacts are just broken.

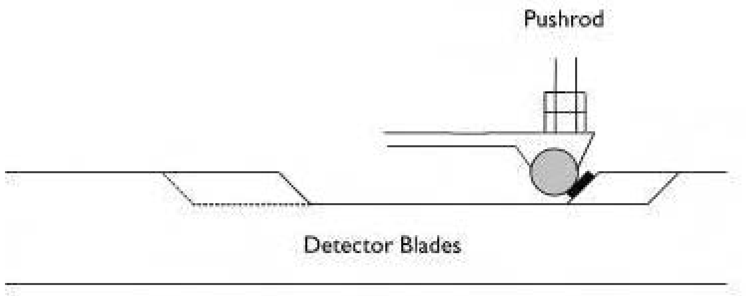


Figure 4 – Positioning of the 3.5mm Gauge

28. Substitute a 2mm gauge, and check that the correct detector contacts remain made.

29. Substitute a 5mm gauge and check that the detection contacts are open by at least 2mm.

    No adjustment of the detection contacts is possible. A new circuit controller shall be fitted.

30. Crank the machine to the opposite end of its stroke. Check the switch rails are fully closed. Repeat steps 27 to 29 for the other pushrod and detector contacts.

31. Check that all relevant nuts are tightened and ballscrew cover replaced.

END

Includes:	Siemens TRAINGUARD FUTUR 2500 Series E Radio Block Centre (RBC) Cubicle
Excludes:	All other type of RBC/RBC Cubicles

GENERAL

Before undertaking any work within an existing/operational RBC cubicle, the Signaller needs to be informed before doing so.

The ESD wrist strap should be worn while carrying out tasks within the RBC Cubicle.

The integrated RBC system is housed in a cubicle with all the associated equipment (Figure 1).

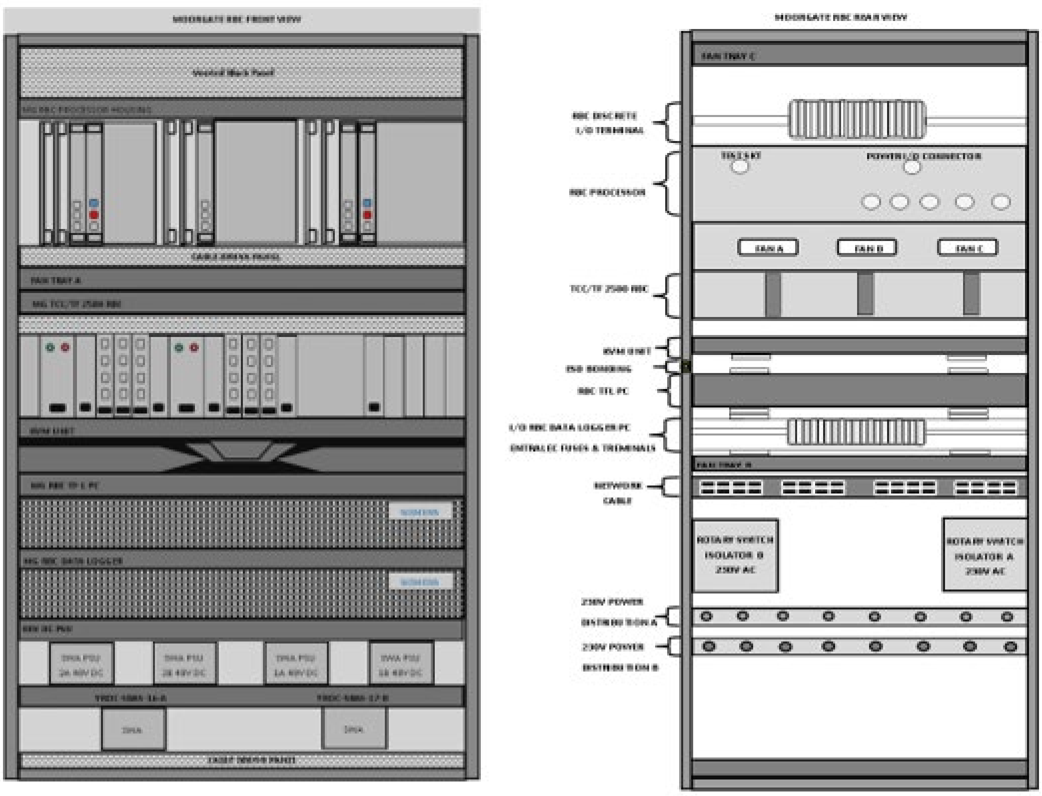


Figure 1 – RBC Cubicle Front and Rear

The TRAINGUARD FUTUR 2500 RBC cubicle is composed of the following elements:

Control Elements:

a) 1 RBC Processor MKII.

Cooling Elements:

a) 3 FAN Tray Modules (1 at the front; centre of the cubicle, 2 at the rear, one at the top, one at the bottom).

Maintenance Elements:

a) 1 KVM. The KVM is made up of:
   - 1 KVM Switch.
   - 1 KVM Rack Console

b) 1 Keyboard

c) 1 Patch Panel

d) Dual TCC Info - The TCC comprises two of each:
   - Power Supply Unit.
   - Processing Card.
   - Quad Fast Ethernet Interface.
   - Memory Card Carrier.
   - ISDN Board.

e) RBC Common Technicians Facility (CTF) – Blue Chip C110 PC.

f) Dual Power Supply Unit (PSU) 48V.

g) 2 Network Switches (SWITCH A and SWITCH B).

h) Dual Power strip 230V AC PSUs – A and B supply.

i) 3 Fan Modules.

j) Moorgate RBC Data Logger PC Blue Chip C110.

RBC RIF:

The RBC-RIF is part of the WESTCAD-E(SS) architecture and is co-located in the ECML South Cubicle and includes the Temporary Speed Restriction (TSR) functionality.

The RBC-RIF will also handle the RBC arming process by passing indications to the Control Centre operator.

RBC Processor:

The RBC Processor is built on Ethernet IP Network (LAN/WAN). This provides flexibility to the system and an easy way to connect the RBC to other vital modules

KVM Switch:

The 'KVM Switch' interconnects the TCC with the 'KVM Rack Console' and the 'Keyboard'.

TCC :

The TCC receives messages from the RBC Processor through the Ethernet interfaces and sends them to the train through the ISDN module.

In addition, it receives messages from the train through the ISDN modules and transmits these messages to the RBC Processor using the LAN network.

The TCC comprises two of each:

- Power Supply Unit
- Processing Card
- Quad Fast Ethernet Interface
- Memory Card Carrier
- ISDN Board

The Server is dual-redundant (CPU A and CPU B), and it is fault tolerant.

Each CPU has got an ISDN Board mounted. "ISDN A" is housed in "CPU A" and "ISDN B" is housed in CPU B.

Common Technicians Facility

This is a local Technician's workstation comprising of a Blue Chip C110 PC loaded with the CTF software. The local TF application is automatically executed when the PC is turned on. The CTF is a diagnostic tool that offers the user fault indications of the system and replay functionality.

Check the name, the software version, the version of the resources and the active username appear in the frame of the main window.

Check the data base has an MDB format and belongs to the installation in which the replay is to be carried out.

Check the main window is configured by, the installation bar, the status bar, the mode selection bar, the replay bar, the action bar and the buttons. These bars enable access to the application functionality.

Power Supplies:

A Dual Power supply Unit (48V) is provided as a back-up to the RBC and Network Switches.

The cubicle is supplied by two 230V AC supplies. Each 230V supply comes into the cubicle via a rotary isolator switch. From the rotary switch, each supply feeds a 230V AC IEC Power Strip (Power Distribution A and B).

The 230V AC Supplies the TF, TCC, Fan Units and the PSUs. The PSUs transform/rectify the 230V AC voltage to 48V DC that supplies the RBC Processors and the Cisco Network Switches. To isolate the 230V AC equipment, the IEC C14 plug should be disconnected from the power distribution units as per application design.

CISCO 16 Port Network Switches SWA and SWB:

This connects with the RBC Cubicle and provides remote communication from YROC

Datalogger (Test tool)

A data-logger will be attached to the RBC via the Network Switches in the same cubicle. This is a test tool and no maintenance is needed to be provided.

NOTE: *When the RBC or CIP is powered down, the ETCS Enable button will need to be pressed as part of the arming process.*

This will be done as per instruction from the Signaller Shift Manager as part of the NCL RBC Start up Process - 156905-SIR-NOT-ESG-000001

END

INDEX

END

General

This Handbook gives information needed to maintain signalling equipment to the necessary standard.

The manual is divided into separate parts as follows:

Part A:

Describes the general responsibilities and conditions for maintaining equipment.

Part B:

Contains the specified tests that are referred to in the signalling maintenance specifications. These are identified in sections A, C, E, & T of this document by means of a hyperlink.

For Example: NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine))

Specified tests on assets not owned by signalling are in their designated sections along with the maintenance specification.

Part C:

Contains the approved maintenance specifications for signalling assets. These are packaged as units of work; each unit being designed around a physical asset. If a part or all of that asset is owned by different function (e.g. SPTs on signals) the maintenance specification for that asset is in the relevant section.

Part D:

Contains the indexes and references to the level crossing annual tests (details of how the obtain the annual test documents are detailed here).

Part E:

Contains the approved maintenance specifications and specified tests for assets owned by functions other than Signalling or Telecoms that are maintained by signalling (e.g. HABD systems).

Part R:

Contains the standard NR/SMS record cards associated with the tests and tasks in part B & C.

Part T:

Contains the approved maintenance specifications and specified tests for Telecom assets that are maintained by Signalling.

Part Z:

Contains listings of commonly used voltages and measurements on all assets as a ready reference guide.

Part Appendix:

Contains information on equipment that is not direct preventative or corrective maintenance but provides background information which will assist in carrying out these tasks but is too large or detailed to fit in the generic '00' series of NR/SMS parts C, E, or T.

Each maintenance specification is divided into services, tests, and tasks that relate to the frequency of the maintenance.

The frequency for each NR/SMS service is stated in NR/L2/SIG/10661.

DAILY SERVICES:

Services and/or tasks that are performed daily.

REGULAR SERVICES:

Services, tests or checks that are performed at a frequency greater than daily but can be equal to or less than Service A.

SERVICE A:

Relates to the routine inspection and testing of equipment (typically four times a year).

SERVICE B:

Relates to the heavy maintenance or testing (typically once a year).

SERVICE RA / RB / R1 / R2 / R/3 / R4 or RE:

These relate to the Reliability - Centred Maintenance Tasks, the intervals on these tasks are in excess of the standard frequencies.

PERIODIC TASKS:

Relates to tasks that are carried out periodically (usually between two and five years) as opposed to cyclic. (e.g. periodic tasks might include memory battery replacement on PC boards or returning an item for re-servicing at an approved service centre).

ROLE DESCRIPTIONS:

Role descriptions within NR/SMS refer to Network Rail post and titles. Companies other than Network Rail might use different posts and titles. It is the responsibility of the individual companies to map the Network Rail posts and titles within NR/SMS to the equivalent ones within their own company.

MANDATING OF TASKS AND TESTS:

Some tasks and tests within NR/SMS have the following comments as part of their description:

a) Local Policy Requirement:

b) If provided:

c) If fitted:

If the details of a task or test having this comment are applicable to you, it will be on your work order, or if not your SM(S) will tell you. If you are in any doubt, ask.

Any task that does not have these comments attached to them is mandatory.

IMPERIAL AND METRIC MEASUREMENTS:

Some older signalling equipment (especially mechanical) was designed, built, and installed to imperial measurements.

This also applies to new equipment built in the United States of America (USA).

These do not always easily convert or make sense in metric units. If a piece of equipment is from the ‘imperial’ era, or from the USA, the equivalent imperial measurement is used.

If it is a new piece of equipment metric measurements are used. If you are unsure about any imperial or metric measurements stated in NR/SMS, ask your SM(S).

END

The safe passage of trains is the top priority, if you find any item than can or will affect this, immediate action shall be taken up to and including blocking the line.

More details can be found in GE/RT8000 (rule book).

Preventative Maintenance

The scheduling of preventative maintenance is the responsibility of the maintenance function within Network Rail. This is performed by the Ellipse system which produces work orders.

For signalling, electronic handheld devices are used for scheduling and inputting in place of paper.

Completion or partial completion of any work should be recorded on the electronic "Work orders" or Work Arising Identification Forms (WAIFs) displayed on the handheld device.

Staff carrying out tests that have a related record card(s) should also check that card as all the appropriate details fully completed.

Any work undertaken other than that stated on your work order including any adjustments that have to be made as a result of carrying out a task/test shall be classed as corrective maintenance and dealt with as detailed in the next section.

Inform your SM(S) if you find any conflict between what is stated on your work order, such as:

- asset you have to maintain (e.g. work order states a WRSL 63 point machine but the asset is actually a HW point machine) or
- find an asset that should be maintained but is not on your work order (e.g. the point system has a supplementary drive but there is no job for it on the work order) or
- the work order states maintain an asset that has been removed or the work order states an incorrect job for the asset

If you have any problems or queries with the maintenance you are scheduled to undertake, inform your SM(S).

Corrective Maintenance

Some of the tasks/test within NR/SMS asks you to rectify any defects you find or undertake adjustments, tightening etc. This shall be classed as corrective maintenance.

All corrective maintenance items shall be recorded in Ellipse using the WAIF process. This shall apply to:

- Work identified and completed
- Work identified but not completed
- Work identified that is undertaken by other functions (e.g. Track, E&P etc).

Corrective maintenance items that are causing a failure that will have an impact on the running of trains, shall also be reported to the Integrated Control Centre or Infrastructure Fault Control (both covered by the generic acronym ICC) of the details.

This is so that it can be entered into the Fault Management System (acronym FMS) and appropriate action taken.

End

General

The following terms appear in this Handbook to describe particular actions that should be used when maintaining equipment.

Term	Definition
Brush	Brush all loose dirt from apparatus and foundations using a brush which has no exposed metallic surfaces
Check	Visually inspect for alignment, obstructions, breakages, decay, obvious damage, and/or operation within its defined tolerances, and/or fulfilment of purpose.
Clean	Remove moisture, dirt, corrosion, or roughness (e.g. from contact faces).
Dust	Dust lightly with a brush with no exposed metallic surfaces or duster
Examine	Closely inspect apparatus and connections for wear, security, corrosion, deterioration, decay, and damage.
Isolate	Electrically disconnect from working circuitry as detailed in NR/SMTH/Part-03/Check A05.
Lubricate	Oil or grease parts to reduce friction or provide protection and wipe off excess.
Measure	Apply an approved, calibrated measuring instrument/gauge, then read, and record the result.
Note	Make a physical record of the visible state, the position, or displayed indications of the equipment or item and its associated controls or operating system(s).
Observe	Look at the equipment in use to make sure it is working correctly and is not faulty.
Protect	Apply an approved protecting agent.
Rectify	Make good any faults discovered and/or adjustments required as a corrective maintenance item.
Record	Enter the obtained measurement readings or observations on a suitable record card or in a site log book.
Scrape	Scrape all dirt and surplus grease off apparatus and foundations.
Test or Gauge	Examine apparatus and run it (or use the appropriate tool, gauge or instrument) to make sure it is working correctly and is adjusted within the specification.
Wash	Remove contaminated oils, greases, and dirt by applying an approved cleaning agent, or by using a detergent and water and then drying.
Wipe	Rub apparatus with a cloth to remove dirt, grease etc.

END

General

This single generic method statement covers preventative and corrective maintenance activities and is based on best practice.

It does not supersede any mandated documents you may currently be using (this includes local method statements or risk control sheets) or any local policies.

Your SM(S) shall explain the documents applicable to you. The points to be considered are as follows:

1. Scope of work
2. Competence of staff
3. Safety of staff and briefing arrangements
4. Communications and emergency plans
5. Protection arrangements and equipment
6. Railway and public ‘interfaces’
7. Associated hazards and risks
8. Tools and plant
9. Personal protection equipment
10. Environmental issues
11. Working at height

The following sections explain these main points.

1. Scope of Work

Before starting any activity:

a) Consider all the work involved
b) Check that you are protected by a safe system of work
c) Select the correct maintenance specification
d) Obtain the signallers permission before starting any work that will interfere with signalling equipment.

When you communicate with the signaller, confirm that your and their messages are clearly understood. GE/RT8000 HB1 specifies the requirements for safe communication.

GE/RT8000 HB19 allows you to carry out certain maintenance activities without making an entry in the train register providing that:

a) The work does not affect the safety of train working
b) The work does not affect the normal passage of trains
c) The work can be carried out between trains
d) This generally equates to lubricating and cleaning equipment, taking non-intrusive meter readings.

NR/L3/SIG/10064 (General Instructions to Staff Working on S&T Equipment) section NR/GI/B002 clarifies the permissible work that can be carried out under these circumstances.

GE/RT8000 HB19 does not provide protection for staff. It is only concerned with the protection of trains

Consideration shall be given to systems affected by work on individual items of equipment. For instance, work on a piece of equipment that might affect an erroneous release on a system.

When resetting or restoring equipment back into service, consideration should be given to other systems that will be affected by this action.

2. Competence of Staff

Staff should be trained, and deemed competent work on the specific equipment that they will be undertaking preventative and corrective maintenance on, or have authorisation endorsed by their line manager. These will be recorded on your individual competency records.

Staff should have:

a) A current or be working towards an IRSE licence, where appropriate;
b) Certificates in safety activities, as appropriate (for example, PTS, SWL, COSS, Lookout, Working at Height etc);
c) Training in manual handling;
d) Knowledge of the Rule Book, particularly the Handbooks related to the Signalling activity they are undertaking.
e) Knowledge of HASAW, the Electricity at Work Regulations and COSHH.

3. Safety of Staff and Briefing Arrangements

Always carry out preventative/corrective maintenance using a safe system of work set up by the SWL (Safe Work Leader) or COSS (Controller of Site Safety).

Use a Safeguarded system whenever possible but other systems can be used as conditions permit.

Trackside briefing shall be given by the SWL/COSS before the work can start.

Site briefings, the nature of the work, any possible dangers, Rule Book protection etc. shall be recorded on a Company Site Assessment Briefing Sheet at the time of the briefing.

4. Communications and Emergency Plans

You should have a communication list for normal weekday working, weekend working, and on-call arrangements.

The list should include contacts for Network Rail, emergency services, hospitals and other contractors, as appropriate.

5. Protection Arrangements and Equipment

When working in a non-safeguarded area, as well as normal protection arrangements, for certain activities equipment will need to be disconnected or an alternative protective measure used. This is to prevent the signaller from accidentally using the equipment being worked on.

Points

When working on points, there are two risks that you need to protect against.

The signaller could accidentally set a route involving (calling) the points and so cause a risk of injury to the person working on the points.

The signaller may set a route with the points set in a particular position. If you then move the points to check or test them, you will disrupt the set route and this could cause a signal to revert to danger.

Before moving any points manually, request the Signaller to move them and then apply one of the protection options below and confirm the Signaller cannot obtain a proceed aspect over the affected points.

Protection options include the following:

a) Disable signal routes by dropping the track circuit that locks the points. Always confirm the effectiveness of this with the signaller by requesting them to attempt to move the points*

*The EP&RR function can allow signallers to move a set of points even when the track circuit locking the points is occupied, thereby rendering the protection afforded in a) ineffective.

Therefore the protection method defined in paragraph a) above is prohibited in Emergency Point and Route Release (EP&RR) areas. Technicians shall use an alternative method of protection as defined in b) to f) below.

b) For electronic interlockings, apply control(s) via the technicians' terminal to prevent the signaller from setting a route over the points. If the control(s) do not prevent the signaller from moving the points individually (e.g. SSI route bar) the points shall also additionally be switched to manual operation using the crank handle cut out or manual/auto switch.

c) Disconnect the point detection (KR lines) by consulting the wiring diagrams and slipping the appropriate links in the equipment room or apparatus case. The points shall also be switched to manual operation using the crank handle cut out or manual/auto switch.

d) Where all tail cables are connected to the point machine by plug coupler(s), disconnect all tail cable plug coupler(s) at the machine.

e) Place a competent person (as a reminder) with the signaller to oversee the Rule Book arrangements and remind the signaller of the work whenever necessary.

f) Apply a documented local operating arrangement that has been agreed with the Route Asset Manager (Signalling).

When working on points where bolt heads may need to be accessed or debris between the open switch rail and stock rail removed, it is good practice to scotch the open switch. This will prevent any unexpected movement that may be accidentally caused.

6. Railway and Public 'Interfaces'

Railway and public interfaces are areas where the public come into contact with signalling equipment

There are two main interfaces for preventative/corrective maintenance:

a) Level crossings
b) Equipment on platforms

No member of the public is to be put at risk.

7. Associated Hazards and Risks

These include:
a) The risk to staff from trains
b) Failure of signalling equipment.
c) Electrical injury
d) Accidents involving lifting, slipping, tripping, falling and trapping fingers.

Information is available in Hazard Directories, which will include red zone prohibited areas.

Information about dangers is also contained in local Health and Safety Policy Statements.

- Use official access points.

8. Tools and Plant

- See section NR/SMS/Part/A05 ‘Plant, tools and calibration’ for details.

9. Personal Protective Equipment

Personal Protective Equipment (PPE) shall be used at all times.

- Additional PPE may be required depending to the task to be carried out.
- Your SM(S) will supply the correct PPE for the situation and the circumstances that you will be working in.

10. Environmental Issues

- Follow the relevant company standards to dispose of waste material or scrap.

11. Working at Height

- Follow the relevant company standards when working at height.

End

General

Use the correct tools to carry out preventative and corrective maintenance.

When using a test or a measuring instrument (gauge, meter, insulation tester, and so on), it should be calibrated, within date and is fit for the purpose.

All calibrated instruments shall have a calibration label detailing the instruments unique ID and its next calibration date. If this label is not present, it is out of date, any seal is broken or the instrument is found to be faulty then the test will not be valid. You shall return faulty or un-calibrated equipment to your SM(S).

Details of test instruments and calibration requirements for S&T measuring equipment can be obtained via your SM(S).

If you are in any doubt about a gauge or test instrument, ask your SM(S) before use.

List of Approved Tools, Gauges and Test Instruments

The listing of these items is constantly changing with the removal of certain items and new items gaining product approval.

Any listing of these items in this section would be out of date in a short time and could lead to an incorrect item seemingly being approved.

Your SM(S) will be able to give you details of the currently available and approved items.

Plant

Typically includes:

- Bonding machine (powered)
- Drilling machine (powered)
- Disc cutters
- Angle grinders

This equipment shall be inspected and maintained and is identified by an inspection label.

Check before you use any the equipment that it is within the serviceable date.

End

1. General

1.1 Use the correct, approved materials when maintaining equipment.

1.2 Shelf life of materials should be considered, do not use items that are outside their service date or use before date. Inform your SM(S) if you come across any of these items.

1.3 If you are in any doubt about an item, ask your SM(S) before use.

2. Common Approved Materials

2.1 The listing of these items is constantly changing with the removal of certain items and new items gaining product approval.

2.2 Any listing of these items in this section would be out of date in a short time and could lead to an incorrect item seemingly being approved.

2.3 Your SM(S) will be able to give you details of the current available and approved items.

END

1. Security

1.1 Always check that access points to the railway are closed and secured at all times when they are not in use.

1.2 Equipment shall be secured against unauthorised access.

1.3 Refit and secure all locking devices, access doors, covers and plates before leaving the site.

1.4 Replace missing or ineffective locks.

2. Padlocks

2.1 Leave the padlock hanging vertically to reduce rain ingress to the key mechanism.

2.2 Do not put a padlock down on the ground when removed. Hang it on the lock staple or place it somewhere it will not get dirty.

3. Door Locks

3.1 If door locks are stiff or badly fitting, arrange for them to be repaired.

3.2 Do not remove or file out striker plates as this weakens the lock.

3.3 Lock mechanisms are not to be oiled as this attracts dirt. They should be lubricated with the correct type of graphite powder.

3.4 If keyhole cover plates are provided, confirm they drop when the key is removed. This keeps out dirt and insects.

4. Keys

4.1 Keys should be securely kept and not be labelled with their purpose; this greatly reduces the chances of misuse if they are lost.

4.2 After locking, check that the lock is effective by gently testing the door or tugging the padlock.

4.3 The following keys are in standard range:

a) JW 442 Grand Master for YS and YW locks for S&T personnel only.

b) JW 442 Sub-master YS for YW locks.

c) RKB 221 For S&T personnel only.

d) RKB 222 For Operating Dept. personnel only.

e) BR No.1 For Trainmen's access.

f) Triangular For wooden cupboards.

Many regional variations to the above list still exist. Special keys are required for some token and key release instruments and lifting barriers.

5. User Worked Crossings

5.1 Lower or close barriers or gates at user-worked crossings and report if you see any barriers or gates that have been left open or not lowered properly.

6. Lineside Fences

6.1 If you come across damaged or missing fencing, you should attempt to secure it if you can do this safely and report it to Control.

7. Extra Security

7.1 Your SM(S) will consider the need for extra security measures in the following circumstances:

a) Areas, which are being vandalised.

b) Places which the public use (such as stations, level crossings etc.).

7.2 Protection measures will be taken as appropriate. This could include:

a) Mesh cages.

b) Poly-carbonate signal lenses.

c) Anti-vandal guards.

d) Fencing.

e) Using lid fixing systems on cable troughs (bands, glue, channel rodding and so on).

f) Alarm systems.

g) Re-routing or burying cables.

h) Ladder Guards.

END

GENERAL

1. Renewals

1.1 Maintenance of Signalling equipment shall be planned at the required intervals using Ellipse. These intervals are set so equipment is maintained in a safe condition and remains fit for purpose.

1.2 Equipment may be maintained at different intervals depending on the regime being applied and this may alter from time to time with the application of the RBM initiative.

1.3 Give enough attention to equipment during each visit so it meets the required standard of maintenance.

1.4 As equipment ages, normal maintenance activities might not be able to maintain it to the necessary standard.

1.5 Similarly, equipment might be damaged or fail due to vandalism or interference by others.

1.6 When making repairs of a temporary or permanent nature, it is your responsibility to confirm that the equipment remains safe and reliable.

1.7 If it is not possible to maintain equipment to the necessary standard, or a temporary repair has been made, you shall report this on a WAIF to your SM(S). Identify the failed equipment and the reason for your request.

Your SM(S) is responsible for assessing each request, and prioritizing any action needed. Examples of problems are:

a) Wire Degradation.
b) Corroded Supports or Structures.
c) Rotten Bases or Boards.
d) Damaged Cable Routes.
e) Illegible or Missing Labels and Equipment Number Plates.
f) Equipment Seals or Gaskets.
g) Relay Bases.
h) Equipment Needing re-servicing.
i) Overgrowth or Infestation.
j) Worn Fittings.
k) Vandalism.
l) Silver migration.

END

GENERAL

1. Approved Lubricants

1.1 Only use approved lubricants on signalling equipment.

1.2 Dry film lubrication is the preferred lubricant type and should be considered for reduction of contamination and ease of inspection.

1.3 Dry film lubrication should also be supplemented at the maintenance frequency and the use of degreaser removed.

2. Teflon Dry Film Lubrication

2.1 Interflon Lube TF and Lube EP is a dry film lubricant that can be used to replace mineral oil, PTFE grease and Rocol.

2.2 Lube TF should be treated as a preparation light use lubricant including locks and hinges.

2.3 Lube EP should be the main maintenance lubricant for heavier use (standard for clamplocks).

2.4 Lubricant is suitable to replace grease in certain applications.

2.5 It is important to follow the manufacturer’s instructions, particularly those relating to preparing parts before applying the lubricant.

3. Mineral Oil

3.1 This is used for lubricating mechanical connections (unless grease points are provided) to reduce wear and make the connection work smoothly.

3.2 Apply oil sparingly and wipe away any excess or spillage.

3.3 Do not allow oil to come into contact with electrical equipment or wiring.

4. Lithium-Based Grease

4.1 This is generally used for greasing mechanical bearings (cranks, pivots, bushes, and so on) via grease nipples.

4.2 Remove excess grease to prevent the build-up of dirt. Teflon impregnated lithium grease (Grease MP1) is also available and is pumpable to very low temperature.

5. Adhesive-Type Grease

5.1 This is used to protect exposed mechanical parts (for example lock and detector slides) from the environment. Interflon Grease MP1 is suitable as adhesive grease.

6. PTFE Grease

6.1 Nulon QH90 grease contains Teflon and is suitable for use on clamp locks instead of Rocol. It is also suitable for use on other mechanical parts including cranks and slide chairs.

6.2 It is important to follow the manufacturer's instructions, particularly those relating to preparing parts before applying the grease.

7. Automatic Lubrication System

7.1 The Simalube (sliver/grey) automatic lubrication system can be used in various applications. Yellow end cap units are for use with Interflon liquid lubricants. Green end cap units are for use with Interflon grease.

7.2 Cartridges should be set to 12 months for standard application.

7.3 Reference should be made to the manufacturer's instructions relating to application and fitting.

8. Graphite Powder

8.1 Only to be used on locks and padlocks.

8.2 Avoid mineral oil, as it can allow dust/dirt to adhere inside the lock.

END

1. General

1.1 The painting of signalling equipment is part of maintenance but is usually managed outside of the normal maintenance scheduled tasks.

1.2 During each maintenance visit, make a note of any paintwork or surface treatments (for example galvanizing) that has deteriorated and report to the SM(S). The SM(S) will arrange for equipment to be repainted as necessary.

1.3 The following are examples of surface treatment faults that you should report:

a) Coatings that are cracked, peeling or flaking.

b) Rust, rust staining and blistering.

c) Vandalism and graffiti.

2. Points and Fittings

2.1 Cracks are often initiated from corrosion found around bolts holes and deterioration of galvanising is indicative of deterioration that might be worse on hidden surfaces.

2.2 During each maintenance visit, make a note of any galvanizing that has deteriorated and report to the SM(S). The SM(S) will arrange for equipment to be replaced.

2.3 Painting is not desirable as it can mask crack identification.

END

1. Technicians' Copies

1.1 Technicians' Copy diagrams are issued as an 'as installed' record of signalling systems and to support the testing and maintenance of the equipment.

1.2 It is essential that the diagrams are available, complete, accurate, and in a condition that is fit for use.

1.3 Store diagrams carefully, using the container provided. If any storage container is inadequate, inform your SM(S) so that they can arrange an alternative.

1.4 Diagrams are stamped, signed, and dated by the issuer. If this is not the case, assume the drawings are uncontrolled and ask for replacements.

2. Incorrect Drawings

2.1 Inform your SM(S) of any diagrams which are incorrect so that they can be updated, or replacement copies ordered.

3. Maintenance Work - Changes to Diagram

3.1 Maintenance work can result in a change to a diagram. Examples are:

a) Equipment replacement.

b) Cables renewals.

3.2 In such cases, you should inform your SM(S) so National Records Group can be informed for replacement diagrams.

3.3 Any temporary diversion of circuits is to be shown on the diagrams.

3.4 This is not a permanent change to the diagram and does not need reporting to Network Records Group.

3.5 Any necessary amendments shall be made in red ink and be signed and dated by the Technician.

END

1. GENERAL

1.1 The tasks and tests stated in this section are to be carried out on equipment after incidents of flooding.

1.2 Floodwater or rainwater ingress into equipment can cause tracking on electrical equipment, corrosion on mechanical equipment and contaminate hydraulic oils and lubricants. This can pose a risk to the safe and reliable operation of the equipment.

1.3 Flooding or moisture contamination does not have to be widespread or dramatic to cause serious problems.

1.4 Water is a very good conductor of electricity, therefore a small amount of moisture between terminals or on a printed circuit board can be sufficient to enable current to flow. This can result in a false feed, the shorting out of a vital circuit or provide an earth path.

1.5 Water on or inside metal equipment can lead to rust, lubricants becoming ineffective and equipment becoming seized.

1.6 Water and oil do not mix; any hydraulic oil affected can be made ineffective and lead to rusting inside the hydraulic system.

1.7 During each maintenance visit, check for signs of flooding or moisture contamination (rust streaks, ‘furring’ of terminals, silt deposits, ‘tide’ marks, etc).

1.8 Check gaskets, seals and glands are fitted correctly and show no signs of cracking, bulging or distortion.

1.9 Serious contamination shall require action and be reported to the Signaller and your SM(S).

1.10 If equipment is renewed, follow the SMTH.

1.11 Once debris (silt, twigs, rubbish etc.) has been removed from the equipment, you shall carry out the requirements in NR/SMS/PartB/Test 300 for each piece of affected equipment.

END

1. Waste Disposal

1.1 Waste is classed either as special waste or as non-special waste.

1.2 Keep special waste separate from non-special waste.

1.3 Some contractors will allow different types of special waste to be mixed if full COSHH details are sent.

1.4 You are only licensed to transfer waste from the worksite to your depots.

1.5 Your SM(S) shall provide waste disposal points and also arrange for a licensed contractor to take it away.

1.6 All waste shall be disposed of in accordance with current environmental policy. If in doubt, ask your SM(S).

1.7 Table 1 shows a typical arrangement of waste segregation.

Waste Type	Class	Disposal Point
Primary cells	Special	Depot battery box
Lead acid cells	Special	Depot battery box
Alkaline cells	Special	Depot battery box
Hydraulic fluid tins	Special	Special waste skip
Grease lubricant tins	Special	Special waste skip
Oil lubricant tins	Special	Special waste skip
Metal scrap	Non-special	Scrap metal skip
Plastic scrap	Non-special	Non-special skip
Cable and wire	Non-special	Designated area
Glass	Non-special	Non-special skip
Dirty cloth	Special	Special waste skip
Paper	Non-special	Recycling bin
Concrete	Non-special	Non-special skip
Asbestos cement	Special	Special waste skip
Treated wood	Special	Special waste skip
Wood	Non-special	Non-special skip
Paint tins	Special	Special waste skip
Cleaning agents	Special	Special waste skip
Herbicides and fungicides	Special	Special waste skip

Table 1 – Waste Disposal Classes

2. Recovered Signalling Equipment

2.1 Some signalling equipment can be repaired. Attach a non-conforming product label to it and take it to the depot quarantine area.

2.2 Signalling equipment that cannot be repaired is classed as scrap. You should put it in the appropriate skip.

3. Polychlorinated bi-phenols (PCB)

3.1 Some signalling equipment may contain PCBs. If it does, clearly labelled it.

3.2 If you have to replace the equipment, your SM(S) shall arrange for an approved disposal company to take it away from your depot.

3.3 Always check that you are putting the waste into the right skip.

END

1. General

1.1 Signalling assets can be taken out of use temporary (e.g., in conjunction with signalling or track renewal and enhancement work), permanently pending recovery, or 'moth balled' (e.g., closure of a branch line but assets left in situation with a possible re-instatement of the branch for a different purpose).

1.2 The time an asset can remain in this state can vary from a few days to years or possibly never.

1.3 Due to the asset being in this situation it is sometimes impossible to carry out the full NR/SMS tasks and tests in parts C and B.

1.4 This NR/SMS details the disconnection methods and the reduced tasks and tests.

1.5 In all cases it shall be checked by means of the diagrams and/or control tables that taking a signalling asset out of use does not affect any other signalling equipment that is to remain operational.

Out of Use Assets

1.6 All Out of Use Assets shall still be subject to Ellipse work orders which detail the maintenance requirement on the assets.

1.7 Your SM(S) will inform you of any additional signalling assets that require maintaining to this NR/SMS. If you are in any doubt if any asset is out of use or operational, ask your SM(S).

1.8 Signalling assets that are out of use shall be disconnected in such a way that it cannot be re-instated to service without a signalling Technician being involved in the process (e.g., physical disconnection of mechanical components or physical isolation of electrical circuits).

Assets controlled by electronic interlocking's such as SSI shall be disconnected at the Technicians terminal. Details of disconnections to assets can be found in section 1 to 10.

2. Form RT3187

A form RT3187 shall be issued for signalling assets that are taken out of use.

2.1 A copy of the form shall be kept in the controlling signal box of the asset. It shall be the responsibility of the signalling Technician to carry out the maintenance, to check that the RT3187 exists as authority to carry out this NR/SMS.

If the existence of the form cannot be verified, inform your SM(S).

3. Re-instatement

3.1 Signalling assets that are being maintained to this SMS, shall not be re-instated to full operational service without a method statement endorsed by the RAM(S).

3.2 The processes in SMTH shall be followed for the re-instatement of single or small numbers of simple assets.

For larger collections of assets where there is to be only a partial re-instated or there has been a change to the design of the layout, SWTH shall be followed.

If the asset has been out of use for more than three months, then a full annual service shall be carried out as part of the re-instatement process.

4. Maintenance

4.1 The reduced preventative maintenance for Out of Use Assets is detailed in sections 11 to 20. These tasks shall be carried out in place of the ones detailed in NR/SMS/Part/C.

DISCONNECTIONS REQUIRED TO RENDER AN ASSET OUT OF USE.

5. Points with No Trains Passing Over Them

Includes:	Points on lines that are completely out of use
Excludes:	Points that are used as trap points to a line that is in use or as flank protection for a line that is in use, use 'Points with Trains Passing Over Them'

If you are in any doubt about if the points fall into this category, ask your SM(S).

<u>Power Operated Points:</u>

5.1 Remove the motor and detection fuses; remove all links to the motor and detection circuits.

5.2 Check that reminder appliances are placed over the correct controls in the controlling signal box.

5.3 Power to any heaters can be maintained.

<u>Mechanically Operated Points:</u>

5.4 Remove (if provided) detection fuses and links to the detection circuit.

5.5 Remove the cotter pin to the catch handle on the point operating lever or (if provided) the FPL lever in the controlling signal box.

5.6 Check that reminder appliances are placed over the correct lever(s) in the controlling signal box.

6. Points with Trains Passing Over Them

6.1 The points shall be clamped, scotched and padlocked (or equivalent).

This is usually an operating responsibility to carry out but can be undertaken by signalling Technicians.

6.2 The points shall remain powered (power operated points) or connected (mechanically operated points) with working detection still proved in the interlocking.

More details on securing points out of use can be found in NR/GI/E054 (Securing Points Out of Use).

Power Operated Points:

Electronic Interlocking areas:

6.3 Apply the required controls via the Technicians' Terminal.

6.4 Check that reminder appliances are placed over the correct controls in the controlling signal box.

Relay Interlocking areas:

6.5 Remove the fuse/feed to the point NLR/RLR circuit (or point LR on E10k interlocking).

6.6 Check that reminder appliances are placed over the correct controls in the controlling signal box.

Mechanically Operated Points:

6.7 Place a reminder collar on the point lever and (if provided) the FPL lever.

7. Colour Light Signals which are Not Visible to Drivers

7.1 Where the loss of power to the signal does not affect the indications or aspects of any other signal that is visible to drivers, the signal and indications shall be totally powered down.

Where the loss of power to the signal does affect the indications or aspects of any other signal that might visible to drivers, remove the signal HR and DR links.

Check that reminder appliances are placed over the correct controls in the controlling signal box.

8. Colour Light Signals which are Visible to Drivers

8.1 Remove the signal HR and DR links.

Where it has been published in the weekly operating notice, a black cover with a white St. Andrews cross shall be placed over the signal aspects.

Check that reminder appliances are placed over the correct controls in the controlling signal box.

9. Semaphore Signals which are Not Visible to Drivers

9.1 Remove the signal arm and spectacle plate.

On electrically lit signals where the loss of power to signal does not affect any other signals that might be visible to drivers, the signal lamp, and indications shall be totally powered down.

On oil lit signals, remove the oil lamp. If the signal illumination is indicated in the controlling signal box, power down the indication.

Check that reminder appliances are placed over the correct controls in the controlling signal box.

10. Semaphore Signals which are Visible to Drivers

10.1 Where it has been published in the weekly operating notice, remove the signal arm and spectacle plate, if this is not practical a white St. Andrews cross shall be attached to the front of the arm.

On electrically lit signals where the loss of power to signal does not affect any other signals that might be visible to drivers, the signal lamp, and indications can be totally powered down.

On oil lit signals, remove the oil lamp. If the signal illumination is indicated in the controlling signal box, power down the indication.

Check that reminder appliances are placed over the correct controls in the controlling signal box.

Lamp proving of semaphore signals is often grouped, so that removing one lamp results in the group indicator showing lamp out.

10.2 The lamp proving for the removed lamp might need to be strapped out, this shall only be done once diagrams and method statements have been prepared and approved in accordance with the SMTH.

11. Track Circuits

11.1 Track circuits shall be powered down by removal of the supply fuses or disconnection of the primary cells, providing this does not affect any other signalling equipment that is still operational.

If requested by the Signaller, the indications on the panel might be extinguished along with a legend stating the track circuit is out of use.

12. Level Crossings

Level crossings with gates:

12.1 Gates shall be secured (by means of a chain and padlock or similar) in the closed to rail traffic position.

12.2 Electric gate lights shall be powered down and oil gate lights shall be removed. The road lights (wig-wags) if provided shall be powered down by removal of the supply fuses.

12.3 Check that reminder appliances are placed over the correct controls in the controlling signal box.

Level crossings with booms:

12.4 The road lights (wig-wags) and boom lights shall be powered down by removal of the supply fuses.

12.5 Booms shall be secured in the raised position.

If this is not practical or possible, the booms shall be removed, and the side arm assembles/counter weights secured or removed.

12.6 Check that reminder appliances are placed over the correct controls in the controlling signal box.

13. Ground Frames

Electrical Ground Frames:

13.1 The points shall be dealt with as detailed in the points section of this SMS.

13.2 The switch panel shall be powered down by removal of the supply fuses.

13.3 Check that reminder appliances are placed over the correct controls in the controlling signal box.

<u>Mechanical Ground Frames:</u>

13.4 The points shall be dealt with as detailed in the points section of this SMS.

13.5 The power supply to the release lever lock shall be isolated either at the ground frame or monitoring signal box.

13.6 Check that reminder appliances are placed over the correct controls in the controlling signal box.

14. Trackside Apparatus Cases (Location) and Equipment Rooms

14.1 Where the location or equipment room controls assets that are out of use, it can be powered down by removal of the incoming supply fuses.

14.2 The location or equipment room shall be suitably secured. In vandal prone areas the padlocks can be replaced with a bolt and self-locking nut.

PREVENTATIVE MAINTENANCE TO OUT OF USE ASSETS

15. Points with No Trains Passing Over Them

Includes:	Points on lines that are completely out of use.
Excludes:	Points that are used as trap points to a line that is in use or as flank protection for a line that is in use, use ‘Points with Trains Passing Over Them’

SERVICE A

15.1 Check or verify that a RT/3187 form is available.

15.2 Visually check the points for security of fittings and evidence of vandalism.

Report any degradation to your SM(S).

15.3 Check or verify that the correct reminder appliances are in place in the controlling signal box.

16. Points with Trains Passing Over Them

SERVICE A

16.1 Check or verify that a RT/3187 form is available.

16.2 Report any degradation or evidence of vandalism to your SM(S).

16.3 Check that the points are suitably clamped and scotched.

16.4 Visually check the points for security of the stretcher bars (including the lock stretcher where provided), and associated fittings.

16.5 Check that the FPL is still holding the lock blades or lock stretcher or that the drive lock slide on RCPLs is still fully through the Lock Body Unit. Rectify as necessary.

16.6 Check that the free wheel clearance and the residual switch opening are being correctly maintained. Details of values are in NR/SMS/PartZ/Z02 (Point Reference Values).

16.7 If provided, check that the point machine is secure, and the lid is correctly fitted and padlocked.

16.8 If provided, check that the point rodding and cranks are secure.

16.9 Check or verify that the correct reminder appliances are in place in the controlling signal box.

SERVICE B

These tests shall only be carried out if the points can be unclipped and un-scotched:

16.10 Identify and carry out the correct Facing Point Lock Test for the equipment being serviced NR/SMS/PartB/Test 011 to 013.

16.11 Identify and carry out the correct Detection Test for the equipment being serviced NR/SMS/PartB/Test 011 to 013).

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Power Operated Points:

16.12 If 12.10 is not possible, remove the cover/lid and break each detection contact in turn.

16.13 Check that the relevant detection relay de-energizes with each break.

This check is not be possible on clamp lock and HPSS systems.

Mechanical Points with Electrical Detection:

16.14 If 12.10 is not possible, remove the cover/lid from the electrical detector and break the detection contact in turn.

16.15 Check that the relevant detection relay de-energises with each break.

This might not be possible on all types of electrical detector.

Mechanical Points with Mechanical Detection:

16.16 If 12.10 is not possible, check that the signal reading over the points (if still operational) is mechanically held at danger by the detector.

17. Colour Light Signals which are Not Visible to Drivers

SERVICE A

17.1 Check or verify that a RT/3187 form is available.

17.2 Visually check the signal for security and evidence of vandalism. Report any degradation to your SM(S).

17.3 Cables suspended from the structures above overhead line equipment that are out of use shall be inspected.

17.4 Check or verify that the correct reminder appliances are in place in the controlling signal box.

18. Colour Light Signals which are Visible to Drivers

SERVICE A

18.1 Check or verify that a RT/3187 form is available.

18.2 Visually check the signal for security and evidence of vandalism. Report any degradation to your SM(S).

18.3 If the signal has not been powered down check that it is displaying a red aspect, or if a cover has been fitted over the lenses, it is in place and secure.

18.4 Cables suspended from the structures above overhead line equipment that are out of use shall be inspected.

18.5 Check or verify that the correct reminder appliances are in place in the controlling signal box.

SERVICE B

18.6 If requested by your SM(S) replace the red aspect lamp.

18.7 Carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests) on the red aspect lamp.

19. Semaphore Signals which are Not Visible to Drivers

SERVICE A

19.1 Check or verify that a RT/3187 form is available.

19.2 Visually check the signal for security and evidence of vandalism. Report any degradation to your SM(S).

19.3 Cables suspended from the structures above overhead line equipment that are out of use shall be inspected.

19.4 Check or verify that the correct reminder appliances are in place in the controlling signal box.

20. Semaphore Signals which are Visible to Drivers

SERVICE A

20.1 Check or verify that a RT/3187 form is available.

20.2 Visually check the signal for security and evidence of vandalism. Report any degradation to your SM(S).

20.3 Cables suspended from the structures above overhead line equipment that are out of use shall be inspected.

20.4 If the lamp has not been powered down or the oil lamp has not been removed check that it illuminated. If a St. Andrews cross has been fitted over the arm, check that it is correctly in place and secure.

20.5 Check or verify that the correct reminder appliances are in place in the controlling signal box.

SERVICE B

20.6 If electrically lit and if requested to by your SM(S) replace the lamp.

20.7 If electrically lit, carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests).

21. Track Circuits

SERVICE A

21.1 Check or verify that a RT/3187 form is available.

22. Level Crossings

SERVICE A

Level crossings with gates

22.1 Check or verify that a RT/3187 form is available.

22.2 Visually check the gates and (if provided) road lights for security and evidence of vandalism. Report any degradation to your SM(S).

22.3 Check that the gates are securely locked closed to rail traffic.

22.4 Check or verify that the correct reminder appliances are in place in the controlling signal box.

Level crossings with booms

22.5 Check or verify that a RT/3187 form is available.

22.6 Visually check the crossing infrastructure for security and evidence of vandalism. Report any degradation to your SM(S).

22.7 If the booms are still fitted, check that they are secured in the raised position.

22.8 Check or verify that the correct reminder appliances are in place in the controlling signal box.

23. Ground Frames (Electrical and Mechanical)

SERVICE A

The points shall be dealt with as detailed in the points section of this SMS.

23.1 Check or verify that a RT/3187 form is available.

23.2 Visually check the ground frame infrastructure for security and evidence of vandalism. Report any degradation to your SM(S).

23.3 Check or verify that the correct reminder appliances are in place in the controlling signal box.

24. Trackside Apparatus Cases (Location) and Equipment Rooms

SERVICE A

24.1 Visually check the location or equipment room for security and evidence of vandalism. Report any degradation to your SM(S).

END

1. General

1.1 There are many signal engineering documents that contain detailed and useful information about specific assets. Some of these are listed at the beginning of the relevant NR/SMS tasks and tests. This section lists the documents that may be useful for reference purposes.

1.2 They are available on Connect via the 'NR Standards' link and using the search function to call up the document number. Externally they are available through uk.ihs.com.

1.3 Once a document is downloaded or printed from its electronic source, it is to be considered as uncontrolled.

1.4 The status of these documents can change during the life of this SMS; always check the status of the document on the NR Standards site or uk.ihs.com before use.

Document No.	Title
NR/GN/SIG/19002	Westinghouse Signals Style 63 Point Machine
NR/GN/SIG/19012	Cables and Wiring used for Signalling Systems
NR/GN/SIG/19014	Mechanical Handbook
NR/GN/SIG/19015	Relay Plugboard Problems
NR/GN/SIG/19016	Westinghouse M3 Point Machine
NR/GN/SIG/19019	Westinghouse Signal Machines
NR/GN/SIG/19020	Signalling Relay Problems
NR/GN/SIG/19023	Signal Post Replacement Switches
NR/GN/SIG/19024	Signalling Control Panels
NR/GN/SIG/19025	Electric Lever Locks & Circuit Controllers
NR/GN/SIG/19026	Track Circuit Equipment
NR/GN/SIG/19030	Earth Testing of Bus-bars
NR/GN/SIG/19032	Alignment of Colour Light Signals
NR/GN/SIG/19036	Test and Measurement Meters
NR/GN/SIG/19039	Signals (General)
NR/GN/SIG/19040	Train Protection Systems
NR/GN/SIG/19041	Battery Cells
NR/GN/SIG/19045	Power Supplies
NR/GN/SIG/19046	Treadles
NR/GN/SIG/19048	TPWS Trackside Equipment
NR/GN/SIG/19051	GEC FDM Reed Equipment
RT/E/C/19052	TPWS In Radio Electronic Token Block (RETB) – Faulting Guidance
NR/WI/SIG/00111	Point General - Supplementary Drives – Mechanical

Document No.	Title
NR/SP/SIG/10029	O&M of Non-Intrusive Earth Test Adapter for Reed FDM system
NR/SP/SIG/10081	Preventive and Corrective Maintenance of Lever Frames
NR/SP/SIG/10083	Preventive and Corrective Maintenance of Mechanical Signalling Runs and Rodding
NR/L2/SIG/10157	Signal Sighting
NR/SIG/10661	Signal Maintenance Task Intervals
NR/L2/SIG/10662	Process for Introduction of new or Revised Maintenance Regimes for Signalling Assets
NR/L2/SIG/11213	Signalling Cable Equivalent Sizes
NR/L2/SIG/11400	HPSS Equipment Handbook
NR/SP/SIG/11752	Train Detection
NR/GN/SIG/11772	Supplementary Point Drives and Detection
NR/L2/SIG/11774	Clamp Lock Handbook
NR/L2/SIG/11107	Silver Migration
NR/L2/SIG/11400	HPSS Handbook
NR/L2/SIG/11630	BR930 Series pin Code Allocation and Contact Arrangement
NR/L2/SIG/11655	Management of Signalling Wire and Cable Insulation Degradation
NR/SP/SIG/11752	Train Detection
NR/PS/SIG/11755	DC Track Circuits
NR/PS/SIG/11756	HVI Track Circuits
NR/PS/SIG/11757	AC Phase-Sensitive Track Circuits
NR/PS/SIG/11762	Track Circuit Assister Interference Detectors
NR/PS/SIG/11763	Reed Type RT Track Circuits
NR/PS/SIG/11764	Track Circuit Interrupters
NR/PS/SIG/11765	Impedance Bonds
NR/GN/SIG/11772	Supplementary Point Drives and Detection
NR/GN/SIG/19053	IECC Technicians Manual
NR/GN/SIG/19054	SSI Technicians Manual
NR/GN/SIG/19101	Good Practice Guide - ACIC Track Circuit Leaf Fall
NR/GN/SIG/19800	Bedford-Bletchley: Control and use of VHLC Local Panels
NR/GN/SIG/19801	Sittingbourne - Sheerness: Control and use of VHLC Local Panels
NR/L2/SIG/19608	Level Crossing Infrastructure (Inspection and Maintenance Handbook)
NR/L2/SIG/19807	Prioritisation of Signal Engineering Equipment Defects
NR/L3/SIG/19810	Signal Involvement in Civil Engineering Work
NR/GN/SIG/19808	Alstom SO Hydraulic Supplementary Point Drive System - Installation & Set-up
NR/TRK/6100	The installation and maintenance of stretcher bars

END

General

A glossary of general Signalling terms is given in GK/GN0802. Those terms are not repeated here except where they have been given a more technical definition for use within this document.

Any reference to source indicates that the definition has been taken from an external document.

Glossary of Signalling Terms

Term	Meaning
Adequate sighting	Check that the driver's view of a signal is not obstructed, e.g. by trees, bushes, buildings or other structures, and can be seen for the required reading time on approach (see NR/L2/SIG/10157). Alignment is detailed in NR/SMS/SG00.
Affected lever/locking	Any locking affected by the removal or potential release of any part which could alter the setting or integrity of the locking.
Alterations	Changes to existing installations (including the provision of new Signalling) which form part or all of a self-contained scheme. A single alteration is by definition one which is designed to be commissioned on a single occasion.
Apparatus	A product with an intrinsic function intended for the end-user and supplied or taken into service as a single commercial unit. [source: EMC Regs - modified]
Apparatus case	An apparatus housing which is intended for unprotected outdoor use, is smaller than a building or REB and is usually capable of being transported as a made-up unit. It is usually of metallic construction. The wooden equivalent is commonly known as an apparatus cupboard
Apparatus housing	This is provided to house relays and / or other equipment at lineside locations or interlocking's, and may consist of an apparatus case, apparatus cupboard disconnection box, equipment room, REB, signal box, control center, or other equipment building.
Application criteria	Document(s) specifying the constraints applied to the installation and maintenance of a system or an item of equipment in order that if can be guaranteed to deliver the performance attributes stated in the system or equipment specification.
Approval	The status given by the requisite authority when the product or works complies in all respects with the specification and addresses all identified risks.
Aspect test	See signal aspect test.
Assessment	The undertaking of an investigation in order to arrive at a judgement based on evidence, of the suitability of a product, competence of a person or acceptability of a risk. (source: BS EN 50126 expanded)
Authorisation	The formal permission to use a product within specified application constraints. (source: BS EN 50126)
Automatic function	A Signalling function that, under ordinary operation, is operated automatically by the passage of trains and is not interlocked with any other Signalling function. The function is generally associated with a particular signal box from which its operation is supervised, unless some form of local monitoring is provided. The state of the function when there are no trains present is designated normal.
Back (B) contact	A contact of a relay which is made when the relay is released and broken when it is operated.

Term	Meaning
Back feed	An inadvertent feed which has arisen at an intermediate point within a circuit due to the uncontrolled combination of positions of several piece s of control equipment.
Balise	A track mounted spot transmission unit that uses magnetic transponder technology. Its function is to transmit/receive messages to/from the train passing overhead. A TASS balise is passive with no interface to a Lineside Electronic Unit (LEU) and will therefore only transmit the fixed telegram stored in its memory. This data can only be changed by reconfiguration.
Balise Positioning Form (BPF)	Provides all the necessary information to the installer to allow the accurate trackside positioning and installation of the balise.
Balise Testing Form (BTF)	Provided to allow appropriate checks and tests associated with the balise to be recorded and a record retained.
Block tests (various)	A test to ensure correct operation of specified block equipment.
Bonding plan	A detailed plan of the track layout showing individual rails and position of IRJs, together with track circuit feed and relay connections with polarities, cross bonds, structure bonds, impedance bonds, etc., as applicable. This term may also include track plans and negative Bonding Plans in D.C. electrified areas.
Cable function test	A test to ensure that each circuit in a cable functions correctly after work on that cable.
Change-over contact	See dependent contact
Circuit diagrams	A collection of individual drawings showing the equipment layout and circuit arrangement associated with a location, an interlocking or signal box.
Circuit function test	A test of each individual circuit to verify the presence of the necessary controls.
Class I equipment	Electrical equipment that requires the connection of the exposed- conductive-parts to a protective conductor connected to earth, to ensure personal safety. See BS 2754.
Class II equipment	Electrical equipment with double or reinforced insulation, either to prevent contact with exposed-conductive-parts, or to ensure no contact between such parts and live parts. The insulation is not therefore to be pierced by screws. Such equipment is never connected to earth. See BS 2754.
Closure list	Final Index of design details issued to the tester in charge.
Common cause failure (CCF)	A failure which is the result of an event(s) which, because of dependencies, causes a coincidence of failure states of components in two or more separate channels of a redundancy system, leading to the defined system failing to perform its intended function. (source: BS EN 61508)
Competent person	A person who has the appropriate competence, authority to work, experience and ability to perform a particular task.
Concentrator	A facility to connect several telephone circuits to one terminal and thus avoid the need for a telephone instrument for each circuit.
Configuration control	A procedure to ensure that the functional and physical characteristics of a design or product are adequately identified and that changes to these characteristics are controlled and traceable throughout the life-cycle of the design or product, by recording its version or modification state. Also known as version control.

Term	Meaning
Configuration (system)	The structuring and interconnection of the hardware and software of a system.
Construction	The carrying out of any building, civil engineering or other engineering work, particularly that which falls within the scope of the Construction (Design and Management) Regulations 1994. Also known as installation.
Continuity test	A test to ensure the continuity and correspondence of each individual wire or cable core shown on the wiring diagrams.
Control point	A signal box (including control center), gate box or ground frame (including ground switch panel or shunting frame).
Control table test	A test to ensure that each Signalling function conforms to all the requirements specified in the approved Control Tables. This test applies to Signalling works testing.
Controlled function	A Signalling function that, under ordinary operation, is controlled from the signal box (or other control point) to which the function is allocated and may be interlocked with other Signalling functions.
Correlation	The comparison of the configuration and version status of a system with the design records to ensure that the two are in agreement.
Correspondence	Ensuring that the following all agree: 1 The controlling device, e.g. relay or SSI telegram, AND The operated function, AND 3 The associated signal box indication(s), e.g. repeat relay or SSI telegram.
Custodian (of records)	The organization appointed by the infrastructure owner to take care of master records. Also known as records custodian.
Cut-section (track circuit)	A method of reducing the continuous length of a track circuit by the use of individual track circuits, each one controlling a common final track repeat relay, or equivalent. These are indicated as one track circuit on the Signaller’s panel. This is also known as a multi-section track circuit.
Data (Signalling)	Site specific geographical and control information in an electronic form, which may be of a safety-critical nature or otherwise. In order to be used in an electronic system or sub-system, data from master data files is usually permanently stored in an EPROM (erasable programmable read only memory).
Data link	A serial data transmission system. In SSI systems, this refers to the link between the interlocking and the lineside location and may take the form of a baseband unmodulated trackside data link cable, or a long line link using standard telecommunications PCM equipment. Internal data link cables are also provided between the modules in an SSI cubicle and, where applicable, between modules in adjacent interlocking cubicles.
De-energised (relay)	See released.
Degraded conditions	The state of the part of the railway system when it continues to operate in a restricted manner due to the failure of one or more components.
Dependent contact	A contact set which consists of a front contact, a back contact and one arm shared between them, with not more than one contact path made at any one time. Also referred to as change-over contact.
Design	A wide term including specification and the production of drawings, design details and bills of quantity (including specification of systems or equipment). (source: CDM Regulations - modified)

Term	Meaning
Design authority	Network Rail or such other organization as is contracted by Network Rail to undertake specified design work on a system or on the infrastructure.
Design details (Signalling)	Any plans, control tables, engineering details and data, which are required to sufficiently define Signalling systems and equipment for production or record purposes.
Design records	Design details defining the current state of the infrastructure.
Destructive test	A test which may alter the electrical, mechanical or physical state of the equipment.
Difference list	A computer / data processor generated print out (produced by a validated software program) which details the data differences between two versions of a software program or data.
Disarrangement of interlocking	The interlocking can no longer be relied on to operate safely because of the removal or disturbance of component parts.
Disconnection box	An apparatus housing for unprotected outdoor use, which is intended to contain mainly terminations and is commonly smaller than an apparatus case.
Dog chart comparison test	A test to ensure that the mechanical locking agrees with the site drawings.
Double-cut (circuit)	The inclusion of controls in both feed and return legs in order to mitigate the risk associated with a false feed or earth fault.
Drop away (DA) voltage (relay)	The maximum voltage applied to an operated relay coil at which the last front contact breaks.
Drop shunt	The maximum value of non-inductive resistance which, when placed across the rails, causes the track relay to fully open its front contact.
Drop-away time (track circuit)	The time between the application of a shunt to the rails and the front contacts of track relay (TR) fully opening. The converse is pick-up time.
Earth fault	Unintentional contact between a circuit conductor and a conductive part at earth potential, by which an earth fault current may flow.
Earth fault detector	A permanent device, wired to the busbars, that will detect an earth fault on the power supply and give an alarm that will alert the maintainer. Also known as earth leakage detector.
Earth fault loop impedance	The impedance of the earth fault current loop starting and ending at the point of earth fault. (source: BS 7671 extract)
Earth leakage detector	See earth fault detector.
Earth test	A test to ensure that leakage current to earth is below specified limits.
Emergency situation	A current unforeseen or unplanned event which has life threatening or extreme loss implications and requires immediate attention (e.g. a fire).
Energised	See operated.
Engineering details (Signalling)	Design details from which a Signalling system is constructed.
Engineers Line Reference (ELR)	A unique alphanumeric code used by Network Rail to define each route segment of the network.
Equipotential bonding	Electrical connection maintaining various exposed-conductive-parts and extraneous-conductive-parts at substantially the same potential. It need not include a direct connection to earth. (source: BS 7671 augmented)

Term	Meaning
External (circuit or power supply)	Failing to wholly meet the internal criteria.
Extraneous lighting	An external light source affecting a signal aspect, e.g. from an open signal head door or nearby streetlamps.
Fail-safe	A concept which is incorporated into the design of a product such that in the event of failure, it enters or remains in a safe state. (source: BS EN 50129)
Final functional test	A test carried out immediately prior to "signing-in" for operational use to ensure all equipment is fully connected and operates correctly.
FREDDY	Flange Reading Electronic Detector Designed at York. FREDDY treadles are not approved for use on Network Rail Infrastructure and will be removed in due course.
Free-wired interlocking	A relay interlocking that comprises individually wired relays rather than pre-wired sets of relays.
Frequency division multiplex (FDM)	A data transmission system that uses unique frequencies to separate channels over a single pair of conductors. See NR/SMS/SB00
Front (F) contact	A contact which is made when the relay is operated and broken when it is released.
Functional earthing	The connection to earth necessary for the proper functioning of electrical equipment, i.e. an earth return. This may be used for telecommunications purposes but is no longer permitted for new Signalling circuits. Conductors for functional earthing are identified by the colour cream. (source: BS 7671 augmented)
Global Positioning System (GPS)	A non-railway system used to determine geographical vicinity.
Graceful degradation	A means by which a more complex control sub-system has the facility to switch into some other (more restricted) mode of operation if a particular input fails, or if availability is otherwise reduced by some means.
Guaranteed power supply	See secure power supply.
Independent checking	Independent checking means that one person undertakes the work and another person checks it. In some cases, testing may be started before the work is completed. In other cases, the work may allow two staff to work on two tasks and then change over to test each other's work (as long as both are Maintenance Testers). Maintenance Testing may often be quite interactive within the guidelines of independence.
Inspection	A visual check to ensure that the specified equipment has been installed securely, undamaged and in accordance with the design details.
Installation (infrastructure)	That part of the Signalling system associated with the infrastructure at a particular place.
Insulated rail joint (IRJ)	A method of joining rail ends together whilst maintaining electrical insulation between them. An alternative non-preferred term is insulated block joint (IBJ).
Insulation test	A test to ensure that a cable, wire, spare core or other equipment meets the required insulation criteria.
Interlocking (building)	The (generally dedicated) building housing the interlocking system, where separate from the signal box (or other control point).

Term	Meaning
Interlocking (equipment)	The equipment that performs the role required of the interlocking system.
Interlocking (system)	The safety-critical locking provided between Signalling functions in accordance with control tables.
Interlocking area	The area of railway controlled by a particular interlocking, extended up to a boundary with each other adjacent interlocking controlled by the same or another signal box.
Internal (circuit)	A circuit that does not leave the apparatus housing in which it originates, and which is fed from a busbar which feeds only internal circuits. This includes the feed to an isolated transformer supplying an external circuit. Circuits that extend between adjacent apparatus housings may be considered to be internal if they are run in a protective non-conducting duct and are judged to be away from any environment that might be susceptible to earth faults.
Internal (power supply)	A power supply feeding only internal circuits. Also known as local power supply
Joint hopping	Where fast moving short vehicles pass from one track circuit to the next, the difference between the pick-up and drop-away times can cause the vehicle to momentarily be undetected.
Jumper	An interconnecting cable (commonly single core) between two termination points within an apparatus housing.
Jumper cable (track circuit / traction)	An interconnecting cable (commonly single core) between two pieces of rail that are not adjacent, for track circuit or traction purposes. This includes midpoint connections to impedance bonds.
Lamp proving relay	A neutral DC. relay designed to operate from the current supplied to signal lamps and to release when lamp or lamps burn out. Some relays incorporate a bridge rectifier to operate from a.c. lamp currents.
Left hand relay	The left-hand half of a twin relay as viewed from the front. In a 930 series twin relay this controls the contacts in banks C and D.
Like-for-like replacement	The removal and restoration of an item of equipment, including a cable, in a previously working and commissioned system where the work does not change the design. This may involve restoring the original item of equipment or replacing it with an operationally equivalent new item.
Line circuit	An external relay circuit, which is not a trackside circuit.
Local panel	A panel (sometimes simplified) provided at the interlocking and capable of being used to take over control from the main panel at the signal box. It may also be used as a maintainer's monitoring panel, when the operating function is not in use.
Local power supply	See internal power supply.
Main cable	A twin or multicore lineside cable carrying Signalling functions or power supplies between apparatus housings.
Main earthing terminal (MET)	The terminal or bar provided for the connection of protective conductors, including equipotential bonding conductors, and conductors for functional earthing if any, to the means of earthing. (source: BS 7671)
Maintainer's monitoring panel	An indication panel situated at the interlocking that repeats the indications sent to the Signaller and allows the maintainer to observe the state of the interlocking. It also indicates various fault conditions. This may be combined with a test panel.

Term	**Meaning**
Maintainer's terminal	This consists of a VDU, keyboard and printer connected to a solid state interlocking, or an IECC system monitor sub-system. It is used to obtain essential fault diagnostic information and also acts as an interface with the system to enable restrictive controls on the equipment to be set. Also known as a Technician's Terminal.
Maintenance	The combination of all technical and administrative actions, including supervision actions, intended to retain a product in, or restore it to, a state in which it can perform a required function. (source: BS EN 50126)
Maintenance records	Design records kept on site for maintenance purposes.
Maintenance tester	A person certificated as competent in the application of Maintenance Testing.
Master record	The certified Signalling design record from which duplicates are obtained for issue. See also source record.
Mechanical locking function test	A test to ensure that each mechanical lever is locked in its correct position.
Mentor	A person appointed as guide and council to a Trainee in a specific competence. The Mentor retains responsibility for the Trainee's actions in the Mentored Competence, but the Trainee is able to gain the necessary experience under field conditions. The Mentor ensures the safety and integrity of the Signalling system.
Meshed circuit	Complex circuitry feeding more than one relay, where the same could be achieved by independent circuits, thereby requiring duplication of contacts. Not all paths in a meshed circuit are applicable to all relays.
Method statement	A comprehensive step-by-step plan of how the work is to be safely carried out in order to ensure that all hazards are considered and risks minimised.
Missing equipment	Equipment which was previously working, and which is physically missing or separated from its normal position.
Mod state	See modification status.
Modification status	The detail that defines the particular version of the design or specification, appropriate to the functional and physical characteristics of an item of equipment or system, and is recorded under configuration control procedures. Colloquially known as mod state.
Modifications	Changes to the design details which are required to be carried out after they have been officially issued, usually as a result of installation, testing and commissioning activities.
Monitored (level crossing)	Checked by the observation of indications which provide the Signaller with the status of equipment.
Non-conceptual work	Work which is based directly on an applicable existing proven design and does not introduce new design features to a system. This includes work items that facilitate maintenance, or performance improvements, whilst maintaining similar functionality. Testing of this shall be undertaken to NR/L2/SIG/30014/G110
Non-destructive test	A test which may involve: visually examining Signalling equipment, taking measurements or readings without disconnecting the equipment or disturbing the electrical characteristics of the system.

Term	Meaning
Non-safety- contact	A relay contact that is not a safety contact. This includes metal to metal contacts for medium duty use, where both elements are made of silver, silver cadmium oxide, or 60/40 silver palladium.
Non-safety- related	A Signalling function or sub-system where operational safety and the integrity of the interlocking are not directly affected. Manual intervention, where a failure would be noticed, may be part of the process. Formerly known also as non-vital.
Non-vital	See non-safety-related.
Normal (function)	Position of a lever when it is fully back in the lever frame (away from the operator). The non-operated or quiescent state of a two-state system. The converse is reverse.
Note (failure investigation records)	Clearly record the facts when they are reported or discovered. Notes shall be readable and retained for future reference.
Operate time (relay)	The time interval between the energisation of the relay coil and the first front contact making. The converse is release time.
Operate voltage (relay)	The minimum voltage applied to a released relay coil at which the last front contact makes. Also known as pick-up (pu) voltage.
Operated (relay)	The state of a relay when the armature is energised, picked up (PU), or latched, all front contacts are made, and all back contacts are broken. Also known as energised, and colloquially as ‘picked’ or ‘up’. The converse is Released.
Operationally equivalent	The replacement item of equipment is functionally identical to the item it replaces.
Out of use	Non-operational equipment that is still connected to the infrastructure. See also spare.
Output	This includes all relevant indications, displays, communications links, power drives, etc.
Pick-up (PU) shunt	The minimum value of resistance between the two running rails at which the track relay just closes its front contacts.
Pick-up (PU) voltage (relay)	See operate voltage.
Pick-up time (track circuit)	The time between the removal of a shunt to the rails and the first front contact of the track relay (TR) making. The converse is drop-away time.
Pin-code	See registration pin-code.
Plugboard	The permanent mounting block and termination for external wiring, for use with plug-in equipment.
Plug-in	The attribute of an item of electrical equipment which can be replaced without disconnecting any wiring.
Point detection & correspondence test	A test to ensure the required correspondence between points and their controls and indications is achieved and ensure detection contacts are effective.
Polarised circuit	A circuit where the resulting operation is dependent on the polarity or phase angle of the feed.
Primary function relay	The relay by which the logic required to control a Signalling function is brought together. It is the first relay in a chain that directly controls all safety critical Signalling functions. it is the only function relay which has back contacts valid for use in safety-critical functions.

Term	Meaning
Principles test	A test to ensure that the Signalling system provided conforms to Railway Group Standards and Statutory Requirements and is fit for purpose. This test applies to Signalling works testing.
Product acceptance	Authorisation for the use of a product type. undertaken by the product acceptance team
Public emergency telephone system (PETS)	A special telephone system for use at level crossings, which includes provision for proving that handset connections are intact and also for the transmission of level crossing status indications. The speech path has priority over other facilities.
Pulse code modulation (PCM)	A serial data transmission system by which many channels of information are passed over a data link, by use of a multiplexer.
Random hardware failure	Failures occurring at random times, which result from a variety of degraded mechanism in the hardware. Note 1) There are many degradation mechanisms occurring at different rates in different components and since manufacturing tolerances cause components to fail due to these mechanisms after different times in operation, failures of a total equipment comprising many components occur at predictable rates but at unpredictable (i.e. random) times. Note 2) A major distinguishing feature between random hardware failures and systematic failures is that system failure rates (or other appropriate measure), arising from random hardware failures, can be predicted with reasonable accuracy but systematic failures, by their very nature cannot be accurately predicted. That is, system failure rates arising from random hardware failures can be quantified with reasonable accuracy but those arising from systematic failures cannot be accurately quantified. (source: BS EN 61508)
Record	Information bearing media, irrespective of date or physical format, created or received in the course of carrying out the duties and functions of an undertaking, and subsequently retained by the undertaking or its successors as evidence, as a reference source, or to meet legal or regulatory obligations.
Records custodian	See custodian (of records).
Registration pin-code	A series of locating pins assembled in a unique pattern to prevent equipment being incorrectly used. The unique pattern also acts as a means of identification for a specific style and variant of a relay. The term registration pin-code is commonly abbreviated to pin-code.
Release time (relay)	The time interval between the removal of the supply (at rated voltage) to the relay coil and the last front contact breaking. The converse is operate time.
Released (relay)	The state of a relay when the armature is de-energised, dropped away (DA), or unlatched, all back contacts are made and all front contacts are broken. Also known as de-energised and colloquially as ‘dropped’ or ‘down’. The converse is operated.
Relocatable equipment building (REB)	Apparatus housing to specification BR 1615 or equivalent. Also known as PER (portable equipment room)

Term	Meaning
Reset	Placing a system into a state which corresponds with the actual state of the railway prior to restoration into service, fault finding or testing. For an axle counter, this is the action of setting the number of axles registered in a track section to zero.
Residual voltage	The voltage remaining across the rails or relay of a track circuit after the feed has been disconnected. It may be caused by mutual interference between adjacent single rail track circuits, the battery effect of the track formation, cathodic protection measures, or d.c. traction return or other stray currents.
Restoration	Accepting reset systems back into service by the Signaller after maintenance, failure or (for axle counters) miscount.
Reverse (function)	Position of a lever when it is fully out of the lever frame (towards the operator). The operated state of a two-state system. The converse is normal.
Right hand relay	The right-hand half of a twin relay as viewed from the front. In a 930 series twin relay this controls the contacts in banks A and B.
Risk Based maintenance	A maintenance system developed failure mode studies, deterioration analysis, and consequence assessments, to allow differing maintenance intervals depending on the risk classification of the asset. This maintenance system shall **not** now be used on Network Rail
Reliability Centered Maintenance	Also known as RoSE (Reliability Centered Maintenance on Signalling Equipment). A maintenance system using an analysis of the equipment location, use, and failure modes to provide a full maintenance regime Shall only be used when authorized
Safe state	Any one of the following: the state of the last valid request at the interlocking; or correspondence with the state of the trackside equipment; or the most restrictive state.
Safety contact	A relay contact that is specified for safety purposes in the 930 series specifications. These are non-weld contacts, generally silver to carbon for ordinary use. For medium duty use, the contact elements may be of silver impregnated graphite (SIG) and silver.
Safety-critical	Carries direct responsibility for safety. (source: BS EN 50129)
Safety-related	Carries responsibility for safety (direct or indirect). (source: BS EN 50129)
Secure power supply	A power supply system that can be relied upon to keep certain safety- critical Signalling functions operating for a predetermined minimum time, in the event of a total failure of the main incoming supply. Also known as guaranteed power supply.
Signal aspect test	A test to ensure that only the correct aspects and indications as specified in the approved control tables and signal aspect sequence charts are displayed to the driver.
Signal sighting form	A form that depicts the profile, location and other details of each signal as agreed by the signal sighting committee.

Term	Meaning
Signalling function	Final discrete component of a Signalling system listed on control tables with a unique identity (such as signals, points, train detection devices, releases and level crossing barriers) and the circuitry or logic by which it is controlled an/or proved. Signalling functions are allocated (as defined by the control tables) to a specific interlocking controlled by a particular signal box (or other control point) and are given a unique identity within a particular Signaller's area.
Signalling system	Equipment, circuitry and software associated with: Lineside signals; Point operation; Level crossings; Train detection; Trainborne equipment conveying information about the state of the line; operational telecommunications (excluding electrification control systems and electrification telephones); and fixed trackside safety systems.
Single cut (circuit)	The inclusion of controls in either the feed or return leg, but not both. (See double cut.)
Slow acting relay	A relay in which both operation and release are intentionally delayed.
Slow to operate relay	A relay in which the operation is intentionally delayed and the operate time is significantly longer than the release time.
Slow to release relay	A relay in which the release is intentionally delayed, and the release time is significantly longer than the operate time.
Software controlled system (SCS)	Any item of electronic equipment which is controlled by software to enable it to perform the required activities. Examples include general purpose microprocessor systems (e.g. proprietary Personal Computers), dedicated systems using microprocessors or Digital Signal Processors. Note that a SCS may be composed of separate items, which are referred to in this document as "the parts of the SCS". Note: Application Specific Integrated Circuits (ASICs) have similar characteristics to software; for example, they are not readily visible to the tester, they may be created by software-controlled machines, and they may themselves require configuration by data. Therefore, the term SCS shall be taken to include ASICs, and consideration shall be given to applying these requirements to machines which contain no software but do contain ASICs.
SPAD	Signal Passed at Danger. The term used to describe an incident when a train has passed a stop signal at danger without authority. SPADs are categorised are detailed in GO/RT3119
Spare	Equipment not connected to any part of the infrastructure. See also out of use.
Specialist investigation	Examination or monitoring by a competent, independent Signalling and telecommunications specialist capable of undertaking comprehensive technical investigation of equipment and systems, where necessary using complex instrumentation.
Stagger (electrical)	The phase or polarity difference between one track circuit and the next, or between the rails on either side of an IRJ within one track circuit.
Stagger (physical)	Occurs where two IRJs in a pair of rails are not exactly opposite each other, thus creating a dead section between track circuits or within a track circuit.

Term	Meaning
State (of a function)	Position or action of the equipment. Examples of complementary states are: operated / released, normal / reverse, on / off, raised / lowered, locked / free, enabled / inhibited, energised / de-energised. In data driven systems this is stored as variable data.
State (of the infrastructure)	Configuration of an installation defined by the current design records.
State (of the railway)	The functional position of trackside equipment which should correspond to the state of the controlling device and the signal box indication.
Strap and function test	A circuit function test where the presence and operation of each individual contact is verified by the application of a test strap. This test applies to Signalling works testing.
Stub Ends	A parallel spur in track circuit configuration.
Supervised (level crossing)	Checked by visual observation, either directly or by use of CCTV.
Supervisory (circuit)	Control or indication circuit, particularly in respect of electric traction power supplies.
Systematic failures	Failures due to errors (including mistakes or acts of omission) in any safety life-cycle activity which cause it to fail under some particular combination of inputs or under some particular environmental condition. Systematic failures could arise in any safety life-cycle phase. Examples of systematic failure include: Systematic failures due to errors in the safety requirements specification; Systematic failures due to errors in the design, manufacture, installation, operation of the hardware; Systematic failures due to errors in the design, implementation etc. of the software. (source: BS EN 61508)
Tail cable	A cable between trackside or on-track Signalling equipment and other such equipment or a lineside apparatus housing. For track circuits, see also track cable.
Technician's Terminal	See maintainer's terminal.
Temporary diversion of circuits	The short-term reallocation of cores/contacts or emergency repositioning of an item of equipment which has been operating correctly.
Temporary work	Alterations which remain in use for a limited period of time.
Terminated	A wire that is finally connected in its allotted position. See also top-nutting.
Test	See NR/SMS/Part/A03
Test panel	A control panel provided at the interlocking for testing or maintenance purposes. It may be provided temporarily for a commissioning or the function may be performed by the local panel.
Through circuit	An external circuit drawn in entirety from supply to destination.
Through test	A test to ensure that each individual circuit between the supply source and the final control function operates and is installed throughout as shown in the approved design details. This test applies to Signalling works testing.

Term	Meaning
Tilt Activation and Speed Supervision System (TASS)	The TASS trackside sub system uses a Eurobalise Balise to store infrastructure data that describes the route ahead and transmit this data to a passing TASS capable train. This data is in turn used by the trainborne equipment to supervise the speed and give authority to the trains tilt system to allow tilting where permitted.
Time division multiplex (TDM)	A non-safety-critical serial data transmission system that addresses each channel in turn and converts it into a unique digital code. It is generally used to transmit operating controls and indications between a signal box and interlocking's. See NR/SMS/SB00
Top-nutting	Top-nutting is the connection of temporary or stage work cables or wires to the top of one side of a terminal strip with the links between the terminal columns removed, so as to interlink with existing circuitry beneath.
Train operations processing system (TOPS)	The national computer data system for management of train operations. This is a real-time network that tracks train movements and formations, vehicle identities and goods commodities. It provides input to the national train running system operating on TOPS (TRUST). Also known as total operating and processing system.
Track cable	A track circuit tail cable which connects directly to the rails.
Track jumping	Occurs when a fast moving vehicle passes over a very short track circuit (or a short arm of a longer track circuit) and fails to de-energise the track relay.
Trackside circuit	An external circuit. Run to, or via, an item of trackside or on-track Signalling equipment in a tail cable.
Trackside Apparatus Case	A single or group of apparatus housings at a particular site and the equipment contained therein. (This excludes apparatus housings that perform a main interlocking function, although some interlocking local to ground frames or level crossings may be included.) Alternatively known as lineside locations or colloquial as 'locs'.
Type approval	Approval granted to an individual product.
Uninterruptible power supply (UPS)	A power supply with a secondary source which is capable of providing an uninterrupted changeover in the event of a failure of the incoming supply. It generally consists of low maintenance cells, a charger, voltage regulator, and monitoring, changeover and bypass devices.
Verification	Confirmation by examination and provision of objective evidence that the specified requirements have been fulfilled. (source: BS EN 61508)
Wire count	A visual examination to ensure that the specified number of conductors is securely connected to each terminating point as shown on the wiring diagram and contact analysis, and that the conductors are correctly labelled.
Wrong side failure	A failure which reduces the protection normally provided by the Signalling system and increases the risk of an incident. Also known as safety-critical failure.

END

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END

Includes:	Powered Point Operating Equipment
Excludes:	Rail Clamp Point Lock (RCPL), In-Bearer Clamp Lock (IBCL), HPSS, T72 and Mechanical points

GENERAL

Before the Facing Point Lock (FPL) test is carried out, a safe system of work shall be established so that a Signaller cannot set a route over, or control the points being tested (See NR/SMS/PartA/A04 (Method Statement Summary).

Record Keeping, FPL records shall be kept on the Points System Record Card.

1. Test

NOTE: *This test requires the 3.5mm/5mm point checking gauge and a 1.5mm gauge.*

1.1 For each closed switch position, place the 3.5mm end of the FPL gauge between the switch and stock rail at a point in line with the bolt securing the stock rail to the first slide chair.

1.2 Manually operate the points and check that the lock does not enter the notch in the lock slide.

a) If the lock fails to enter the lock notch, then this is a pass and you shall proceed to step 1.3. This result shall be recorded.

b) If the lock enters the lock notch, then this is a failure and shall be recorded, reported to ICC and investigated.

c) The 3.5mm test shall then be repeated using the 5mm gauge.

d) If the lock fails to enter the lock notch, then this shall be recorded. The gauge of the points shall now be adjusted to bring them back to a position where they fail the 3.5mm test.

e) If the lock enters the lock notch, the test (5mm) is a failure and shall be recorded, reported to ICC and investigated.

f) Additional gauges shall be added until the lock fails to enter the lock notch, this shall be recorded, reported to ICC and the level three on-call engineer advised.

NOTE: *If the lock blades or lock dogs are worn the level three on-call engineer can defer the renewal for a maximum of 48 hours, only if the points can be adjusted to fail when the 5mm gauge when it is inserted as described in 1.1.*

NOTE: *The recording of the extent of the gauge failure is required to allow hazard rating to be calculated.*

g) After 48 hours the facing point route shall be signed out of use (unless it is mechanically secured) until the renewal has been completed.

1.3 Place the 1.5mm FPL gauge between the switch and stock rail at a point in line with the bolt securing the stock rail to the first slide chair.

1.4 Manually operate the points and check that the lock enters the notch in the lock slide.

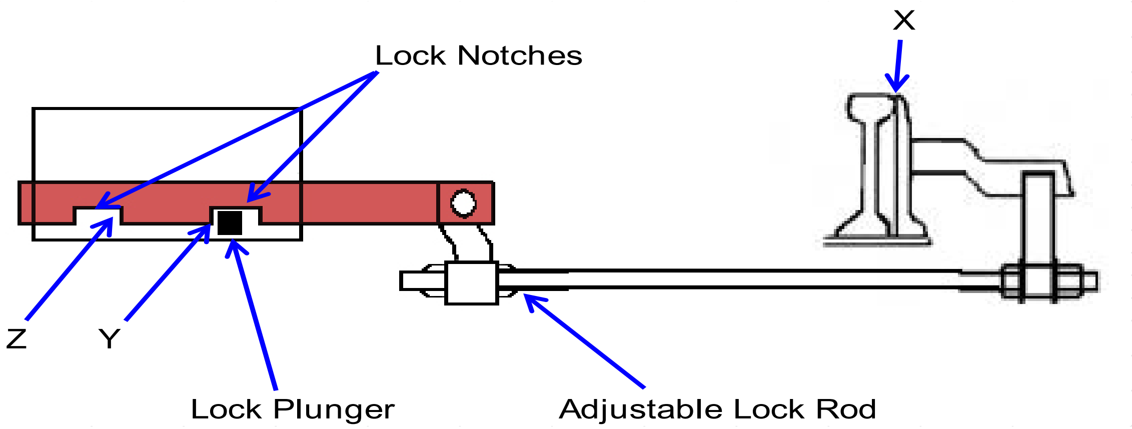


Figure 1 – FPL Blade Connections

1.5 With point switch fully closed (X), confirm there is a 1.5mm clearance on each lock face (Y & Z) see Figure 1.

1.6 Adjust and retest as necessary.

1.7 Record the results and details of any adjustments made on the record card.

1.8 Restore the points.

1.9 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

END

Includes:	All Mechanical Point
Excludes:	All other points

GENERAL

Before the Facing Point Lock (FPL) test is carried out, a safe system of work shall be established so that a Signaller cannot set a route over or control the points being tested, see NR/SMS/PartA/A04 (Method Statement summary).

1. Test

NOTE: *This test requires the 3.5mm/5mm point checking gauge and a 1.5mm gauge.*

1.1 Check that the travel of the lock plunger is approximately 215mm (8.5 inches).

1.2 Check that, in the unlocked position, the clearance between the lock stretcher and the end of the lock plunger is 19mm ±6.5mm (0.75 inches ±0.25 inches) adjust as necessary.

1.3 For each closed switch position, place the 3.5mm end of the FPL gauge between the switch and stock rail, at a point in line with the bolt securing the stock rail to the first slide chair.

1.4 Manually operate the points and check that the lock does not enter the notch in the lock slide.

a) If the lock plunger fails to enter the lock notch, then this is a pass and you shall proceed to step 1.5. This result shall be recorded.

b) If the lock plunger enters the lock notch, then this is a failure and shall be recorded, reported to ICC and investigated.

c) The 3.5mm test shall then be repeated using the 5mm gauge.

d) If the lock plunger fails to enter the lock notch, then this shall be recorded. The gauge of the points shall now be adjusted the points to bring them back to a position where the they fail the 3.5mm test.

e) If the lock plunger enters the lock notch, the test (5mm) is a failure and shall be recorded, reported to ICC and investigated.

f) Additional gauges shall be added until the lock plunger fails to enter the lock notch, this shall be recorded, reported to ICC and the level three on-call engineer advised.

NOTE: *If the lock plunger or lock notch is worn, the level three on-call engineer can defer the renewal for a maximum of 48 hours, only if the points can be adjusted to fail when the 5mm gauge when it is inserted as described in 1.3.*

NOTE: *The recording of the extent of the gauge failure is required to allow hazard rating to be calculated.*

g) After 48 hours the facing point route shall be signed out of use (unless it is mechanically secured) until the renewal has been completed.

1.5 Place the 1.5mm FPL gauge between the switch and stock rail at a point in line with the bolt securing the stock rail to the first slide chair.

1.6 Manually operate the points and check that the lock plunger enters the notch in the lock slide.

1.7 Adjust and retest as necessary.

1.8 Record the results and any adjustments made on the record card.

1.9 Request the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

END

Includes:	Rail Clamp Point Lock (RCPL), In-Bearer Clamp Lock (IBCL)
Excludes:	All Powered Point Machines and Mechanical points

GENERAL

Before the FPL test is carried out, a safe system of work shall be established so that a Signaller cannot set a route over or control the points being tested. See NR/SMS/PartA/A04 (Method Statement Summary).

Do not put any part of your hand between the stock and switch rail.

Record Keeping, FPL records shall be kept on the Points System Record Card.

All adjustments shall be classed as corrective maintenance.

Check detection by either connecting a meter to the outgoing KR circuit or in liaison with the Signaller.

1. FPL Safety Test

These steps shall be undertaken for both normal and reverse positions of the points.

This test requires the 3.5mm/5mm point checking gauge and a 1.5mm gauge.

1.1 Place the points on manual.

1.2 Check the correct voltage is present on the outgoing KR circuit for the mechanism being tested.

For each Lock Body mechanism:

RCPL Only

1.3 Place the 3.5mm end of the FPL gauge between the switch and stock rail at a point in line with the bolt securing the stock to the first slide chair.

1.4 Manually operate the points and check that the lock slide does not complete its travel, and the lock arm does not rise up and engage behind the locking piece.

a) Check that detection is broken.

b) If the lock slide fails to complete its travel, then this is a pass, proceed to step 1.5. This result shall be recorded.

c) If the lock slide completes its travel, then this is a failure and shall be recorded, reported to ICC and investigated.

d) The 3.5mm test shall then be repeated using the 5mm gauge.

e) If the lock slide fails complete its travel, this shall be recorded.

The packing of the points shall now be adjusted to bring them back to a position where they fail the 3.5mm test (See Appendix A).

When the points are returned to gauge you can proceed to step 1.5.

f) If the lock slide completes it travel, the test (5mm) is a failure and shall be recorded, reported to ICC and investigated.

g) Additional gauges or packing shall be added until the lock slide fails to complete its travel, this shall be recorded, reported to ICC and the level three on-call engineer advised.

If the fixed or adjustable cams are worn the level three on-call engineer can defer the renewal for a maximum of 48 hours, only if the points can be adjusted to fail when the 5mm gauge when it is inserted as described in 1.3.

The recording of the extent of the gauge failure is required to allow hazard rating to be calculated.

h) After 48 hours the facing point route shall be signed out of use (unless it is mechanically secured) until the renewal has been completed.

1.5 Place the 1.5mm gauge between the switch and stock rail in line with the lock arm.

a) Manually operate the points and check that the lock arm fully engages, and the drive lock slide fully completes its stroke.

b) Check that detection is made.

<u>IBCL Only</u>

1.6 Place the 3.5mm end of the FPL gauge between the switch and stock rail at a point in line with the lock arm.

1.7 Manually operate the points and check that the lock slide does not complete its travel, and the lock arm does not rise up and engage behind the locking piece (See Table 1 for dimensions).

Condition	**Mk 2**	**Mk 3**
Locked	> 25mm protrusion beyond lock body	> 71mm protrusion beyond lock body

Table 1 – Drive Lock Slide Protrusions when locked

1.8 Check that detection is broken.

a) Check that detection is broken.

b) If the lock slide fails to complete its travel, then this is a pass, proceed to step 1.9. This result shall be recorded.

c) If the lock slide completes its travel, then this is a failure and shall be recorded and investigated.

d) The 3.5mm test shall then be repeated using the 5mm gauge.

e) If the lock slide fails complete its travel, then this shall be recorded, reported to ICC and investigated.

The packing of the points shall now be adjusted to bring them back to a position where they fail the 3.5mm test (See Appendix A).

When the points are returned to gauge you can proceed to step 1.9.

f) If the lock arm completes it travel, the test (5mm) is a failure and shall be recorded, reported to ICC and investigated.

g) Additional gauges or packing shall be added until the lock slide fails to complete its travel, this shall be recorded, reported to ICC and the level three on-call engineer advised.

If the fixed or adjustable cams are worn the level three on-call engineer can defer the renewal for a maximum of 48 hours, only if the points can be adjusted to fail when the 5mm gauge when it is inserted as described in 1.6.

The recording of the extent of the gauge failure is required to allow hazard rating to be calculated.

h) After 48 hours the facing point route shall be signed out of use (unless it is mechanically secured) until the renewal has been completed.

1.9 Place the 1.5mm gauge between the switch and stock rail in line with the lock arm.

a) Manually operate the points and check that the lock arm fully engages, and the drive lock slide fully completes its stroke. Refer to Table 1 for dimensions.

b) Check that detection is made.

1.10 Restore the points to power.

1.11 Record the results of the FPL test on the record card.

1.12 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse (twice if possible). Observe correct operation.

APPENDIX A - Adjustment (Packing)

If either lock fails the FPL test, the lock shall be adjusted as follows:

If more than a 0.6mm shim is required, check for signs of a run-through by examining the switch rail and stretcher bars for damage.

Check for wear / damage on the locking piece, locating studs (**Mk1 only**), lock arm and inner edges of the switch and stock rails.

2. Fine Adjustment

2.1 Inset shim plates (0.3mm, 0.6mm & 1.6mm) behind the locking piece of the lock body mechanism in the smallest possible incremental steps as listed within the table, up to a maximum total of 4mm to a point at which the lock fails during the 3.5mm gauge test. For details see Table 2.

2.2 Renew tab washers.

2.3 Repeat NR/SMS/PartB/003 (Facing Point Lock Tests (Clamp Lock)).

Incremental Thickness	Packing Arrangement	Incremental Thickness	Packing Arrangement
0.3mm	**(1 x 0.3)**	2.8mm	(1 x 1.6 & 1 x 0.6 & 2 x 0.3)
0.6mm	(1 x 0.6)	**3.0mm**	**(5 x 0.6)**
0.9mm	**(1 x 0.6 & 1 x 0.3)**	3.1mm	1 x 1.6 & 2 x 0.6 & 1 x 0.3)
1.2mm	(2 x 0.6)	**3.2mm**	**(2 x 1.6)**
1.5mm	**(2 x 0.6 & 1 x 0.3)**	3.3mm	(5 x 0.6 & 1 x 0.3)
1.6mm	(1 x 1.6)	**3.4mm**	**(1 x 1.6 & 3 x 0.6)**
1.8mm	**(3 x 0.6)**	3.5mm	(2 x 1.6 & 1 x 0.3)
1.9mm	(1 x 1.6 & 1 x 0.3)	**3.6mm**	**(6 x 0.6)**
2.1mm	**(3 x 0.6 & 1 x 0.3)**	3.7mm	(1 x 1.6 & 3 x 0.6 & 1 x 0.3)
2.2mm	(1 x 1.6 & 1 x 0.6)	**3.8mm**	**(2 x 1.6 & 1 x 0.6)**
2.4mm	**(4 x 0.6)**	3.9mm	(6 x 0.6 & 1 x 0.3)
2.5mm	(1 x 1.6 & 1 x 0.6 & 1 x 0.3)	**4.0mm**	**(1 x 1.6 & 4 x 0.6)**
2.7mm	**(4 x 0.6 &1 x 0.3)**		

Table 2 – Fine Adjustment

3. Coarse Adjustment

3.1 If greater than 4mm of fine packing is required, insert packing plates (3mm &1.6mm) between the switch rail bracket and the switch rail web.

3.2 Adjust / renew stretcher bar and tie bar.

3.3 Reset actuator packing to maintain the 3mm clearance between the lock arm and the drive lock slide.

3.4 Repeat NR/SMS/PartB/003 (Facing Point Lock Tests (Clamp Lock)).

3.5 Carry out NR/SMS/PartB/014 (Lock and Detector Full Test (Clamp Lock)).

END

Includes:	HPSS
Excludes:	All other Powered Point Machines and Mechanical points

GENERAL

Ask the Signaller to operate the points to identify the correct points are being tested.

Before the Facing Point Lock (FPL) test is carried out, a safe system of work shall be established so that a Signaller cannot set a route over or control the points being tested, See NR/SMS/PartA/A04 (Method Statement Summary).

This FPL test is carried out with the machine under power, controlled by the Signaller.

To avoid injury whilst placing and removing gauges, it is recommended that you use the Hands-Free gauges (ask your SM(S) or hold the gauges with a pair of pliers or mole-grips.

Detection is confirmed by referring to the meter connected to the KR circuit at the location/disconnection box.

The HPSA Handset shall not be used to confirm detection as it is powered from a port on the ECU separate to the outgoing detection circuitry.

It is essential to confirm that detection is made and broken by referring to the meter only.

The secondary (supplementary) detection tests confirm the Rail Position Sensors shall not give detection when an obstruction is placed between the stock and switch rail, even though the rail bends around the obstruction.

This test requires:

a) Voltmeter, HPSA Handset (and passwords for old variants of Psion Handset).

b) Two 3.5mm point checking gauges. (Hands-free FPL Gauge recommended).

c) Two 8 mm (CEN 54) or two 10mm (NR60 / RT60).

Before carrying out the test, connect the HPSA Handset and check that each closed switch position is showing 0mm.

If the value is outside the limits -0.1mm to +0.5mm (primary / toe sensors) and/or –1mm to +2mm (secondary / supplementary sensors), this could indicate that the system is not securely fixed and it could impact performance.

Before and after values shall be recorded onto the record card so that any movement between maintenance visits is recorded.

If any excess movement is recorded, it shall be investigated and be reported.

1. Test

1.1 Connect the meter to the outgoing KR circuit at the location/disconnection box.

1.2 Perform a Datum Reset as detailed in NR/SMS/PartC/PC51 (High Performance Switch System (HPSS)) - Appendix A.

1.3 Check that the correct voltage is present on the outgoing KR circuit for the points being tested.

1.4 Place the 3.5mm gauge between the open switch and stock rails at a point in line with the centreline of the switch rail drive bracket. Hands-Free FPL Gauge recommended.

The gauge shall be inserted to prevent the switch rail from bending under the gauge and making detection.

1.5 Ask the Signaller to operate the points and ask what detection, if any, is given.

1.6 Check that no voltage is present on the outgoing KR circuit, by referring to the meter.

1.7 Place another 3.5mm gauge between the open switch and stock rails at a point in line with the centreline of the switch rail drive bracket. Hands-Free FPL Gauge recommended.

1.8 Ask the Signaller to operate the points and ask what detection, if any, is given.

1.9 Check that no voltage is present on the outgoing KR circuit, by referring to the meter.

1.10 Remove both gauges (operation of points is required).

1.11 Operate points under power and using the HPSA Handset, check that each supplementary position shows 0+/- 0.5mm at the closed position.

Check that any residual switch opening at the closed side is less than 2mm at the supplementary detection positions.

1.12 At the rear most pair of supplementary detection sensors place an 8 mm (CEN 54) or 10mm (NR60 / RT60) gauge between the open switch and stock rail at a point in line with the centre line of the switch rail drive bracket, power operate the points to close the open switch rail.

NOTE: *The purpose of this test is to confirm that the correct number of supplementary sensors have been selected during the datum reset procedure. Therefore, the testing of the supplementary detection sensor is only required to be completed with the points in either the normal or reverse position.*

1.13 Check that no voltage is present on the outgoing KR circuit, by referring to the meter. If voltage is present on the outgoing KR circuit:

a) Check that any residual switch opening at the closed side is less than 2mm at the supplementary detection positions.

b) Check on the HPSA Handset that the correct number of supplementary sensors have been commissioned during the datum reset procedure.

1.14 Remove all gauges (requires operation of Points).

1.15 Observe correct operation of the points to the normal and reverse position. The time taken is normally 4 seconds. If the time taken is greater than 5 seconds, make arrangements to carry out further investigation.

1.16 Record all sensor readings (open and closed positions) from the HPSA Handset, and any adjustments that have been carried out, on the record card.

END

Includes:	T72 Point machine
Excludes:	All other Powered Point Machines and Mechanical points

GENERAL

Before the Facing Point Lock (FPL) test is carried out, a safe system of work shall be established to prevent a Signaller setting a route over or operating the points being tested, see NR/SMS/PartA/A04 (Method Statement Summary).

Isolate the T72 point machine by moving the selector lever to the 'Hand' position.

When performing this test, check that when the clutch slips, the switch rail is tight against the inserted gauge.

1. Facing Point Lock Test

1.1 Disconnect the detection at the junction box by removing links T1 number 1 and T1 number 3.

1.2 Remove the VCC cover and the internal detector cover.

1.3 Connect a meter, set to the ohms range, to the terminals on the left hand VCC unit according to lie of points.

a) If the left-hand switch is closed and locked, use terminals 1 and 5.

b) If the right-hand switch is closed and locked, use terminals 4 and 8.

1.4 Measure the resistance (approximately 33k ohms).

1.5 Gently break each contact in turn and confirm that the reading is lost.

<u>If left hand switch is closed and locked:</u>

The contacts are the lock proving contacts on the left hand VCC and the open switch proving contacts on the right hand VCC.

<u>If right hand switch is closed and locked:</u>

The contacts are the open switch proving contacts on the left hand VCC and the lock proving contacts on the right hand VCC.

1.6 Place a 3.5 mm thick gauge between the switch blade and stock rail at a point in line with the hollow bolt securing the VCC body to the stock rail.

1.7 Manually operate the points, check that the cranked ‘C’ head does not engage the locking piece and observe that the detection is broken.

1.8 Replace the 3.5 mm gauge with the 1.5 mm gauge.

1.9 Manually operate the points. Check that the cranked ‘C’ head fully engages the locking piece and observe that detection is made.

1.10 Remove the gauge. If the lock has failed the test, perform steps 1.11 and 1.12. If the lock passes the test, continue from 1.13.

1.11 Adjust the shims under the ‘C’ heel and repeat clauses 1.6 to 1.10.

1.12 Carry out NR/SMS/PartB/Test/007 (Detection Test (VCC Detector)).

1.13 Remove the meter and replace the internal detector cover and replace and secure the VCC cover.

1.14 Repeat 1.2 to 1.13 for the other lock.

1.15 Replace links T1 number 1 and T1 number 3.

1.16 Record the results and details of any adjustments on the record card.

1.17 Restore the points to service operation.

1.18 Ask the Signaller to operate the points to Normal and Reverse positions (twice if possible). Observe correct operation.

END

Before the detection test is carried out, a safe system of work shall be established so that a signaller cannot set a route over, or control the wheelstop being tested (See NR/SMS/ Part/A04).

The detection test shall only be carried out using Manual operation only.

Standard gauges are required, but are used in non-standard ways.

DETECTION TEST

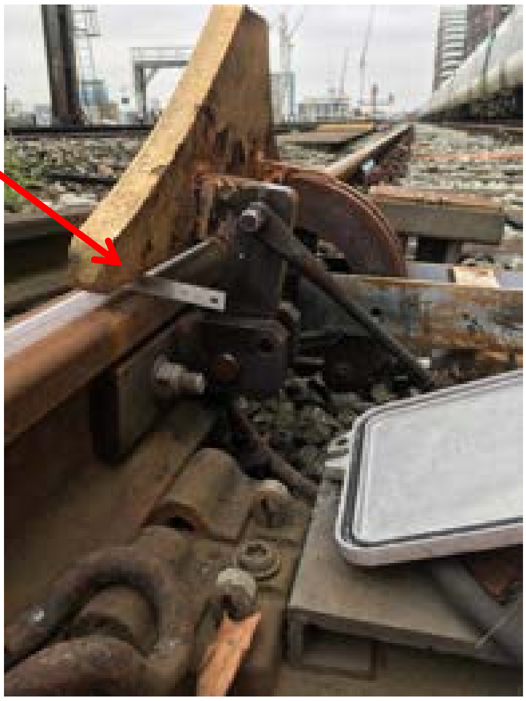
1. Detection Test – Normal Position

This test requires a meter and a 1.5mm or 2mm point checking gauge.

1.5mm or 2mm gauges are 15mm wide, as shown in diagram 1 below

Diagram 1 – 15mm gauge

1.1 With the 15mm point checking gauge place between the top of the rail head and wheel stop whilst slowly operating the wheel stop to the normal position.



1.2 Electrically prove that, with the gauge in place, normal detection is not achieved.

1.3 If normal detection is achieved the wheel stop circuit controller shall be adjusted/reset and the test restarted from clause 1.1

2. Detection Test – Reverse Position

- This test requires a meter and a 3.5mm/5mm point checking gauge.
- 3.5mm - 5mm gauges are 80mm tall, as shown in diagram 2.

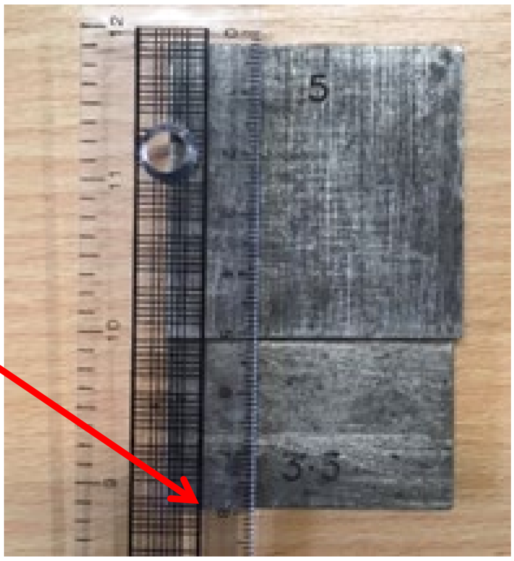


Diagram 2 – 80mm Gauge

2.1 With the 80mm length of the 3.5mm/5mm gauge placed between the top edge of the wheel stop casting and the wheel stop in line with the first horizontal plate. Slowly operate the wheel stop to the reverse position

2.2 Electrically prove that, with the gauge in place, reverse detection is not achieved.

2.3 If reverse detection is achieved the wheel stop circuit controller shall be adjusted/reset and the test restarted from clause 2.1

3. Final Check

3.1 Ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

END

GENERAL

Isolate the supply to the point machine and operate the points manually. Disconnect the point control links in the junction box or apply an alternative safe system of work, See NR/SMS/PartA/A04 (Method Statement Summary).

More information on performing this test can be found in NR/SMS/Appendix/02 (General Information on Ansaldo Signalling Equipment).

1. Detection Test

This test requires the 6 mm 'U' shaped gauge, 13/26 mm gauge, rule, small inside callipers (for measuring tappet screw / locknut assembly), and a meter.

1.1 Check that the closed switch rail is fully up against the stock rail and is locked and also that there are no obstructions between the open switch rail and stock rail.

1.2 Disconnect the detection at the junction box by removing links T1 number 1 and T1 number 3.

1.3 Remove the VCC cover and the internal detector cover.

1.4 Connect a meter, set to the ohms range, to the terminals on the left hand VCC unit according to lie of points.

If the left-hand switch rail is closed and locked: use terminals 1 and 5.

If the right-hand switch rail is closed and locked: use terminals 4 and 8.

1.5 Measure the resistance (approximately 33 k ohms).

1.6 Manually operate the switch blade to the opposite lie of points.

1.7 While manually closing the switch rail, gauge the amount the crank head engages the locking piece, when the lock contacts are just made.

Check that the side of the gauge is fully against the face of the crank head, as detailed in NR/SMS/Appendix/02 (General Information on Ansaldo Signalling Equipment).

Switch Closed and Locked

1.8 Manually operate the points and check that the switch rail is closed and locked on the side to be tested.

1.9 Check that the crank head fully engages the locking piece, see NR/SMS/Appendix/02 (General Information on Ansaldo Signalling Equipment).

1.10 Gauge the stroke of the detector cam shaft.

Insert the 6 mm 'U' shaped gauge between the hexagonal nut and the rear of the detector frame at approximately 45° to straddle one of the hexagonal fixing screws.

The gauge shall be a sliding fit (6 mm + 1 mm). If the gap is incorrect adjust the stroke, see NR/SMS/Appendix/02 (General Information on Ansaldo Signalling Equipment).

1.11 Check that the open switch detection contacts are broken and that the closed switch and lock proving contacts are made (i.e. not in contact with the cam plastic cover).

1.12 Remove the gauge and open the switch blade.

1.13 Measure the overall length of the tappet screw and lock nut assembly (maximum 17mm).

Details and action to take if over 17mm are in NR/SMS/Appendix/02 (General Information on Ansaldo Signalling Equipment).

If any adjustment has been made, the test shall be repeated

1.14 Remove the meter, replace the internal detector cover, and replace and secure the VCC cover.

1.15 Repeat tests 1.4. to 1.14 on the right hand VCC.

1.16 Replace links T1 number 1 and T1 number 3.

1.17 Ask the Signaller to operate the points to Normal and Reverse positions (twice if possible). Observe correct operation.

END

GENERAL

Ask the Signaller to operate the points to identify that the correct points are being tested.

Before the test is carried out, a safe system of work shall be established so that a Signaller cannot set a route over, or control, the points being tested (See NR/SMS/Part/A04).

These tests shall be carried out under powered operation in liaison with the Signaller.

To avoid injury whilst placing and removing gauges, it is recommended that you use the Hands-Free gauges (ask your SM(S)) or hold the gauges with a pair of pliers or mole-grips.

Due to the possibility of a small gap between the closed switch and stock rails, the Handset reading is unlikely to show the exact value (thickness) of the test gauge. If a residual gap was present without the gauge inserted, then the Handset values can be expected to under- read by an amount equivalent to the residual gap.

1. Brake Torque Test

1.1 Disconnect the brake power cable, ECU connector J3.

1.2 Ask the Signaller to operate the points to the opposite position and carry out the following during the movement:

a) Manually release both brakes by compressing both brake handles to allow the points to drive.

b) Once the points have started to move, apply one of the brakes by releasing one of the brake handles and confirm the points cease to move.

c) Manually release by compressing both brake handles together and confirm the points complete their movement to the opposite position under powered operation within 6 seconds.

d) Repeat 1.2 for the other brake handle.

1.3 Reconnect the brake power cable (J3) and ask the Signaller to operate the points to confirm satisfactory operation.

2. Toe Sensor Integrity Test

2.1 Using the HPSA Handset, carry out the ECU Datum Reset procedure as detailed in NR/SMS/PartC/PC51 (High Performance Switch System (HPSS)) Appendix A.

2.2 Place a 3.5mm gauge between the open switch and stock rails at a point in line with the centre line of the switch rail drive bracket. Power-operate the points to the normal position. Hands-Free FPL Gauge recommended.

2.3 Using the HPSA Handset, check that the measured position at the closed switch rail is 3.5mm +/- 0.5mm. Check that the open rail position has also decreased by 3.5mm +/- 0.5mm.

2.4 Place a 3.5mm gauge between the open switch and stock rails at a point in line with the centre line of the switch rail drive bracket. Power-operate the points to the reverse position. Hands-Free FPL Gauge recommended.

2.5 Using the HPSA Handset, check that the measured position at the closed switch rail is 3.5mm +/- 0.5mm. Check that the open rail position has also decreased by 3.5mm +/- 0.5mm.

2.6 Remove both gauges (operation of points is required).

NOTE: *This test confirms the integrity of the Toe Sensor LVDTs and is not an alternative to the FPL test.*

3. Supplementary Sensor Integrity and Detection Test

3.1 Connect the meter to the outgoing KR lines at the location/disconnection box.

3.2 Operate points under power and using the HPSA Handset, check that each supplementary position shows 0+/- 0.5mm at the closed position, and that any residual switch opening at the closed side is less than 2mm at the supplementary detection positions.

3.3 Carry out the same tests as described in Section 2 at each supplementary detection position, using 8mm (CEN54) or 10mm (NR60/RT60) gauges.

It is strongly recommended that the Hands-Free Detection Gauge (PADS No. 086/035401) is used (placed on the stock rail), to avoid injury.

3.4 Using the HPSA handset, check that the relevant sensor shows the measured position at the closed switch rail is equal to the thickness of the gauge, minus the residual switch opening (thickness of the gauge +/- 0.5mm).

Check that the open rail position has also decreased by the same amount (thickness of the gauge +/- 0.5mm).

3.5 Check that no voltage is present on the outgoing KR circuit.

3.6 Repeat 3.1 to 3.4 for all other Supplementary Sensors.

3.7 Remove all gauges (requires operation of points).

END

GENERAL

Isolate the mechanism by turning to the "Manual" position on the hydraulic pack. Disconnect the point detection from the KR lines or apply an alternative safe system of work, see NR/SMS/PartA/A04 (Method Statement Summary).

Gauges: 2mm and 4mm detection gauge.

1. Switch Closed and Locked

1.1 Check the correct voltage is present on the outgoing KR circuit in the associated disconnection box for the SO Supplementary Drive Unit being tested.

1.2 Insert the 4mm gauge between the switch and stock rail at a point in line with the drive rod.

1.3 Manually operate the points and test that detection is broken.

1.4 Where adjustment is required, remove the horizontal drive pin, loosen the gauge adjusting lug locking screws, and wind the gauge adjusting lug out (away from the SO unit) to adjust.

Replace the horizontal drive pin. Repeat from 1.2 as necessary.

Check that the drive shuttle does not drop out of the gauge adjusting lug during adjustment.

Check that the gauge adjusting lug locking screws are re-secured once adjustments are complete.

1.5 Repeat using the 2mm gauge and test that detection is made, and the correct voltage is present on the KR circuit.

1.6 Where adjustment is required, remove the horizontal drive pin, loosen the gauge adjusting lug locking screws, and wind the gauge adjusting lug in (towards the SO unit) to adjust.

Replace the horizontal drive pin. Repeat from 1.2 as necessary.

Check that the drive shuttle does not drop out of the gauge adjusting lug during adjustment.

Check that the gauge adjusting lug locking screws are re-secured once adjustments are complete.

1.7 Repeat tests 1.1 to 1.6 for each drive.

1.8 Restore the points to power.

1.9 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

END

Excludes:	Detectors are excluded from this test if one of the following conditions is met: • The detector is part of a detection circuit wired directly to a SSI points module without any intermediate relays • The detector forms part of a circuit which feeds polar or phase sensitive detection relays (e.g., BR 961, VL1) over a two-wire circuit indicating both normal and reverse detection • There is another detector, clamp lock or point machine in the circuit between the BR998 detector and the detection relay(s) • The detector is part of a detection circuit wired directly to a Westrace Mk2 SOM24 without any intermediate relays

GENERAL

If applicable, isolate the supply to the point machine and operate points manually.

Disconnect the point detection from the KR lines or apply an alternative safe system of work, see NR/SMS/PartA/A04 (Method Statement Summary).

When taking measurements with respect to the chassis, check a good electrical connection to the chassis is obtained, otherwise false readings might be obtained.

1. Electrical Test

1.1 Using the maintenance diagrams identify the terminals which carry the outgoing feed to the detection relay(s) for each lie of the points.

For points with electrical detection made for one position only (e.g., train operated) arrange for the points to be in the detection made position.

<u>Tasks 1.2 to 1.10 Apply to DC Detection Circuits Only</u>

1.2 With the detection made, measure using a DVM with a 150kΩ shunt the outgoing detection voltage for the current position of the points.

Check that this voltage is correct to diagram and note this.

1.3 Transfer the DVM to the terminals for the outgoing detection for the opposite detection and measure the voltage. If a voltage greater than 5% of the voltage measured in 1.2 is obtained, your SM(S) shall be informed immediately.

1.4 Leave the DVM connected and have the points moved to the opposite position.

1.5 Measure the voltage. Check this voltage is the same as obtained in 1.2.

NOTE: *This might not apply where electrical detection is proved for one position of the points only.*

1.6 Transfer the DVM to the terminals used in 1.2 and measure the voltage. If a voltage greater than 5% of the voltage measured in 1.5 is obtained, your SM(S) shall be informed immediately.

1.7 Have the points moved to their original position and move the DVM to terminals 2 and 5 of the detector. Measure the voltage and check it is the same as measured in 1.2 (ignore the polarity).

1.8 Connect the DVM between terminal 2 and the metal detection chassis. Measure the voltage and note it as V1.

1.9 Connect the DVM between terminal 5 and the metal detection chassis. Measure the voltage and note it as V2.

1.10 Report immediately to your SM(S) if:

a) V1 or V2 is more than 60% of that measured in 1.2.

b) V1 + V2 is more than 80% of that measured in 1.2.

<u>Tasks 1.11 to 1.19 Apply to AC Detection Circuits Only</u>

1.11 Using a DVM (with a input impedance of least 1Mohm) set the range to DC volts and connect the red and one of the black terminals of an AC busbar earth test adaptor.

Connect the green and other black terminal of the adaptor together and check that the obtained reading is at least +8V.

Note this voltage as Vb.

If the voltage is <+8V, change the battery in the adaptor and carry out step 1.11 again.

1.12 Disconnect the green and black terminals of the adaptor from each other and connect them to the outgoing terminals of the detector corresponding to the current position of the points. Measure the voltage and note this voltage.

1.13 Transfer the green and black terminals of the adaptor to the outgoing terminals for the Normal BX and Reverse BX detection lines. Measure any voltage present. If a voltage greater than 5% of that recorded in 1.12 is found, inform your SM(S) immediately.

1.14 Transfer the green and black terminals of the adaptor to the outgoing terminals for the Normal NX and Reverse NX detection lines. Measure any voltage present. If a voltage greater than 5% of that recorded in 1.12 is found, inform your SM(S) immediately.

1.15 Arrange to have the points moved to the opposite position and repeat steps 1.12 to 1.14.

1.16 Arrange to have the points moved to their original position and transfer the green and black terminals of the adaptor to terminals 2 and 5 of the detector. Measure the voltage and check it is the same as measured in 1.12 (ignore the polarity).

1.17 Connect the black terminal of the adaptor to terminal 2 of the detector and the green terminal of the adaptor to the metal chassis of the detector. Measure the voltage and note it as V1.

1.18 Connect the black terminal of the adaptor to terminal 5 of the detector and the green terminal of the adaptor to the metal chassis of the detector. Measure the voltage and note it as V2.

1.19 Report immediately to your SM(S) if:

a) V1 + V2 is more than 90% of Vb.

b) V1 - V2 is more than 11% of Vb.

2. Microswitch Tests

2.1 With point switch fully closed, insert a 2mm gauge between limit switch tappet screw and plunger button. Observe that detection is lost.

2.2 Repeat using a 1.5mm gauge. Observe that detection remains made.

2.3 Repeat 2.1 and 2.2 for the opposite lie of the points.

3. Train Operated and Yard Points fitted with August 2000 Wiring Modifications Tests

The modified circuit is designed to make sure that the detection fuse will blow through the reverse limit switch contact if a normal contact welds up. This test makes sure that the reverse contact on each limit switch is not high resistance.

3.1 Manually operate the points to the reverse position.

3.2 Disconnect ONE end of ONE short-circuit strap.

3.3 Measure the loop resistance of the micro-switch circuit. Use a multi-meter set to ohms. Place the prods across the end of the disconnected short circuit strap and its associated terminal. The resistance shall be less than 2Ω. If the resistance is more than 2Ω, investigate the cause and take corrective action.

3.4 Remove the meter and reconnect the short-circuit strap.

3.5 Manually operate the points to the normal position.

3.6 Reconnect the detection links.

3.7 Observe that the point indicator only lights up when the points are detected fully in the normal position.

3.8 Observe that the point indicator does not light up after the points have been moved from the normal position until the restoration process is fully complete.

END

Includes:	Point machine internal detectors and external detectors used for main point detection
Excludes:	Supplementary detectors (see NR/SMS/PartB/Test/016) Clamp lock point detectors (see NR/SMS/PartB/Test/013)

GENERAL

Isolate the supply to the point machine and operate points manually.

Disconnect the point detection from the KR lines or apply an alternative safe system of work, see NR/SMS/PartA/A04 (Method Statement Summary).

On WRSL Style 63 Point machines, only section 3 shall be undertaken for the detection test.

Gauges : This test requires the 3.5mm/5mm point checking gauge (slotted gauges).

1. Adjusting Nuts Adjacent to Detection Mechanism

1.1 Check that the points are fully over, locked and in correspondence.

1.2 Check the short detector rod is connected to the closed switch (Figure 1).

1.3 Check the correct voltage is present on the outgoing KR circuit.

1.4 Slacken the red nut to allow a 5mm gauge to be placed between the detector blade and blue nut. DO NOT move the blue nut.

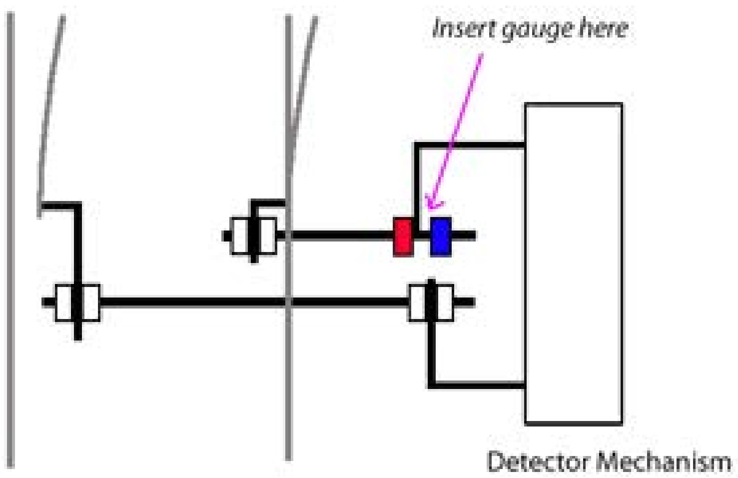


Figure 1 – Detector Mechanism (1)

1.5 Insert the 5mm gauge between the detector blade and the blue nut, re-tighten the red nut.

1.6 Check the detection voltage is lost.

1.7 Replace the 5mm gauge with a 3.5mm gauge and check the detection voltage is present.

1.8 Remove the gauge and re-tighten the red nut, check that the blue has not moved.

1.9 Check the correct voltage is present on the KR circuit.

1.10 Operate the points to the opposite position, lock and check they are in correspondence.

1.11 Check the long detector rod is attached to the closed switch (Figure 2).

1.12 Check the correct voltage is present on the outgoing KR circuit.

1.13 Slacken the pink nut enough to allow a 5mm gauge to be placed between the detector blade and green nut. DO NOT move the green nut.

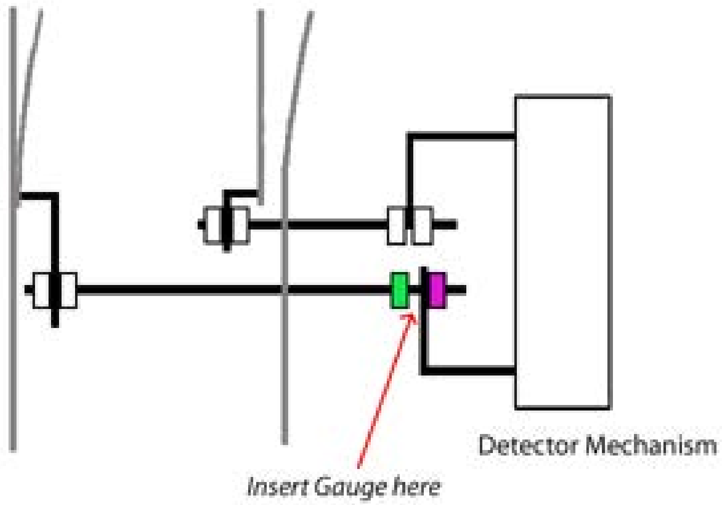


Figure 2 – Detector Mechanism (2)

1.14 Insert the 5mm gauge between the detector blade and the green nut and re-tighten the pink nut.

1.15 Check the detection voltage is lost.

1.16 Replace the 5mm gauge with a 3.5mm gauge and check the detection voltage is present.

1.17 Remove the gauge and re-tighten the pink nut, check that the green nut has not moved.

Any adjustments shall be verified by repeating the test.

1.18 Check the correct voltage is present on the KR circuit.

1.19 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

2. Adjusting Nuts Fitted on the Switch Rail Extension Ends in the Four Foot

2.1 Check that the points are fully over, locked and in correspondence.

2.2 Check the short detector rod is connected to the closed switch (Figure 3).

2.3 Check the correct voltage is present on the outgoing KR circuit.

2.4 Slacken the red nut to allow a 5mm gauge to be placed between the detector blade and blue nut. Do not move the blue nut.

2.5 Insert the 5mm gauge between the extension piece and the blue nut and re-tighten the red nut.

2.6 Check the detection voltage is lost.

2.7 Replace the 5mm gauge with a 3.5mm gauge and check the detection voltage is present.

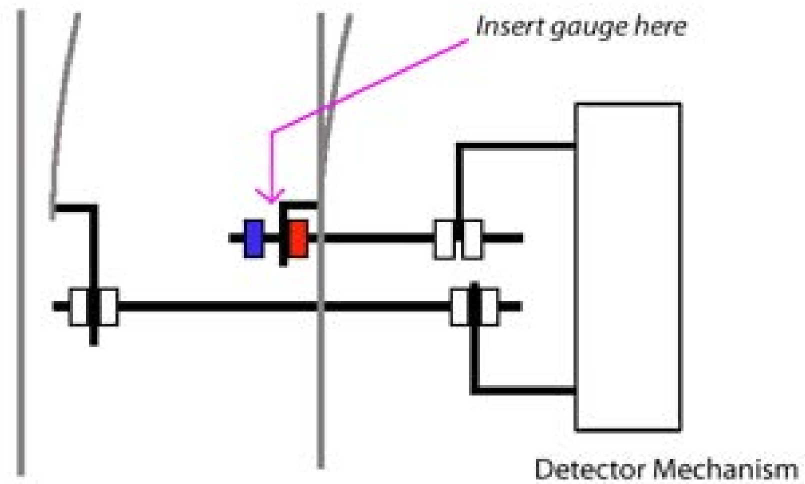


Figure 3 – Detector Mechanism (3)

2.8 Remove the gauge and re-tighten the red nut, check that the blue nut has not moved.

2.9 Check the correct voltage is present on the KR circuit.

2.10 Operate the points to the opposite position, lock and check they are in correspondence.

2.11 Check the long detector rod is attached to the closed switch (Fig 4).

2.12 Check the correct voltage is present on the outgoing KR circuit.

2.13 Slacken the pink nut enough to allow a 5mm gauge to be placed between the extension piece and green nut. Check the green nut does not move.

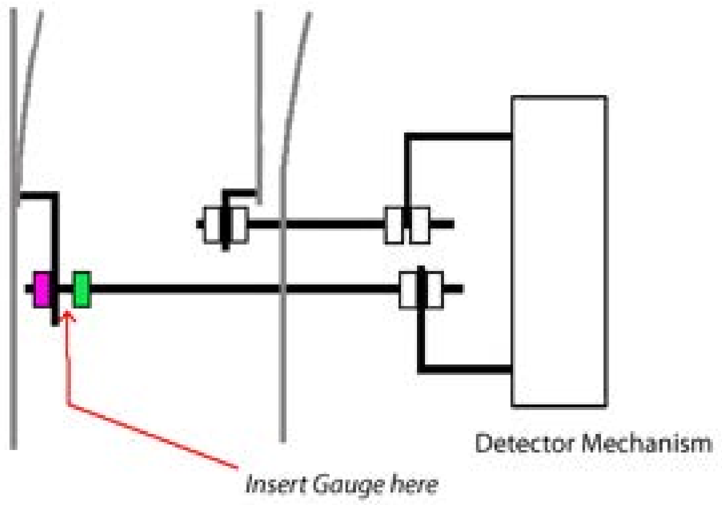


Figure 4 – Detector Mechanism (4)

2.14 Insert the 5mm gauge between the extension piece and the green nut and re-tighten the pink nut.

2.15 Check the detection voltage is lost.

2.16 Replace the 5mm gauge with a 3.5mm gauge and check the detection voltage is present.

2.17 Remove the gauge and re-tighten the pink nut, check that the green nut has not moved.

Any adjustments shall be verified by repeating the test.

2.18 Check the correct voltage is present on the KR circuit.

2.19 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

2.20 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

3. WRSL Style 63 Point Machine

Unless this detection test is being done in conjunction with NR/SMS/PartC/PC41 (Point Machine WRSL Style 63) the machine shall be isolated by removal of the motor and detection fuses, or apply an alternative safe system of work (See NR/SMS/Part/A04).

Contact Setting

3.1 Close and lock the points reverse.

3.2 Unlock the points without opening the switch rails.

3.3 Gauge the 2mm gap of both reverse detection contacts (insert and remove 2mm insulated gauge). If the gap is less than 2mm, the points shall be booked out of use.

3.4 Repeat 3.2 and 3.3 for the point's normal position.

Normal Detection

3.5 Lock the points normal.

3.6 Examine the normal detection roller.

NOTE: *It should be free from wear, rotate freely, and drop correctly into the detector blade notch.*

3.7 Check detection is made by connecting a meter across the normal detection terminals on the ohms range.

3.8 Using the 2mm gauge (Position 1 – in Figure 5), check that detection is broken by reference to the meter.

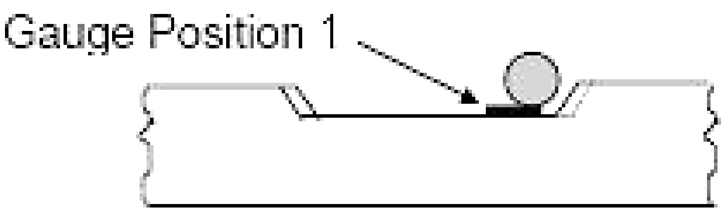


Figure 5 – Gauge Position 1

Any adjustment shall be followed by a repeat of steps 3.7 and 3.8.

3.9 Using the 2mm gauge (Position 2 – Figure 6), check that detection remains made by reference to the meter.

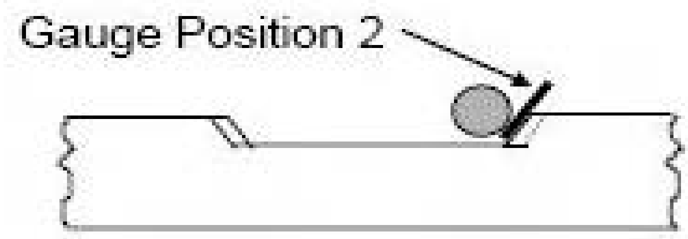


Figure 6 - Gauge Position 2

3.10 Using the 3.5mm gauge (Position 2), check detection is broken.

3.11 Using the 5mm gauge (Position 2), check the normal detection contact gap using the 2mm insulated gauge.

If the gap is less than 2mm, the points shall be booked out of use.

<u>Reverse Detection</u>

3.12 Repeat steps 3.5 - 3.11 for the points in the reverse position (Figure 7).

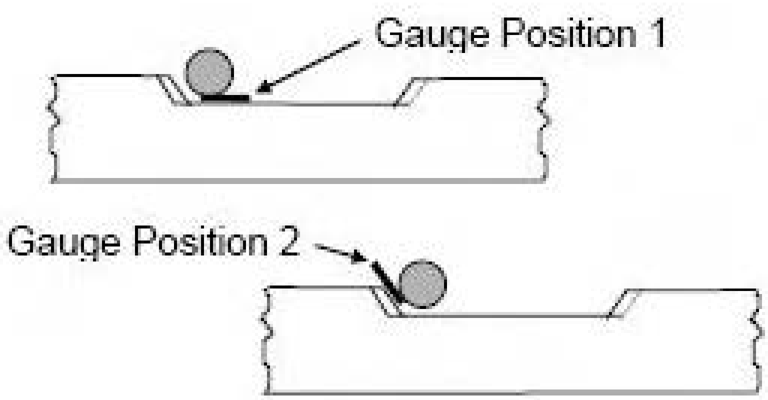


Figure 7 - Gauge Position – Reverse Position

3.13 When work is complete, reset the isolating contacts and restore the motor and detection fuses.

3.14 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

END

GENERAL

Before this test is carried out, a safe system of work shall be established so that a Signaller cannot clear a protecting signal, or move the points being tested (NR/SMS/Part/A04).

Gauges : This test requires the 3.5mm/5mm point checking gauge and a 2mm gauge.

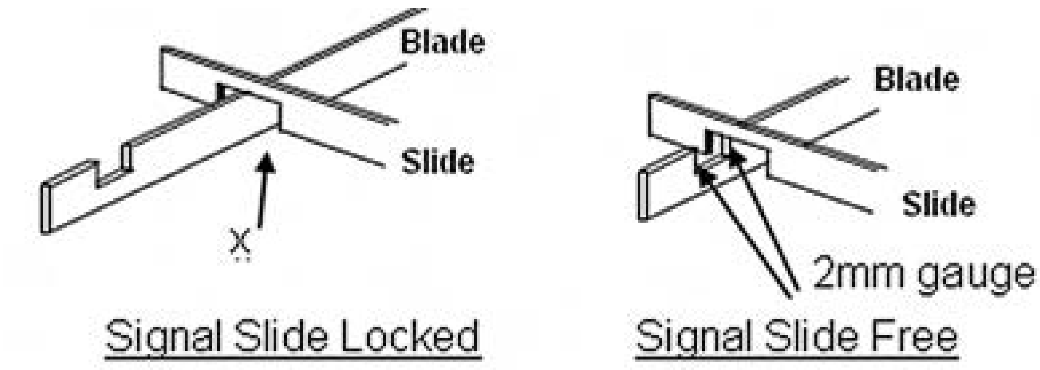


Figure 1 – Signal Slides

1. Detection Test

FOR NORMAL AND REVERSE POSITIONS:

1.1 Each detector blade should have a 2mm clearance to each notch face on each side of the signal slides. Fouling blades can cause a signal to stick off.

1.2 Check clearance ‘x’ between each signal slide notch face and the nearest blade.

Maximum 0.5 inch (13mm) for signals within 25yds (23m) of the signal, this dimension may be increased for distances over 25yds (23m) to cater for the effect of temperature changes.

Where two or more detectors control the same signal, the detector nearest the signal should have the normal clearance. Other detectors should have a progressively increased clearance up to a maximum of 2 inches (51mm) at the last detector if it is more than 200yds (183m) from the signal.

The increase of signal slide clearance should not exceed 1 inch per 100 yds (or 10mm per 36m) of wire run.

1.3 Insert a 5mm gauge between the point switch and stock rail at a position in line with the bolt securing the stock rail to the first slide chair.

1.4 Observe that the signal slides are held by the detector blade. Adjust as necessary and then retest.

1.5 Ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

END

Includes:	Rail Clamp Point lock (RCPL) & In-Bearer Clamp Lock (IBCL)
Excludes:	All other types of POE

GENERAL

Isolate the mechanism by turning to the 'Manual' position on the hydraulic pack. Disconnect the point detection from the KR lines or apply an alternative safe system of work, see NR/SMS/PartA/A04 (Method Statement Summary).

If any of the following tests fail, carry out NR/SMS/PartB/014 (Lock and Detector full Test (Clamp Lock).

Gauges

a) 2.5mm & 4mm detection gauge (RCPL).

b) 3.5mm & 5mm detection gauge (IBCL).

c) 1.5mm & 2mm micro-switch gauges.

1. Switch Open

1.1 Check the correct voltage is present on the outgoing KR circuit for the mechanism being tested.

1.2 Check the right-hand micro-switch plunger is clear of its cam follower tappet screw.

1.3 Operate the right-hand micro-switch and observe that detection is broken.

2. Switch Closed and Locked

2.1 Check the correct voltage is present on the outgoing KR circuit for the mechanism being tested.

2.2 RCPL Only

Insert the 4mm gauge between the point detector blade lug and the shoulder of the connecting eye; tighten nut and observe that the detection is broken.

IBCL Only

Insert the 5mm gauge between the point detector blade lug and the shoulder of the connecting eye; tighten nut and observe that the detection is broken.

2.3 RCPL Only

Repeat using the 2.5mm gauge and observe the detection is made and the correct voltage is present on the KR circuit.

IBCL Only

Repeat using the 3.5mm gauge and observe the detection is made and the correct voltage is present on the KR circuit.

2.4 Remove the gauge, tighten the nut and check that detection is made.

2.5 Insert the 1.5mm gauge between the left-hand micro-switch plunger and the cam follower tappet screw. Observe the detection is made and the correct voltage is present on the KR circuit.

2.6 Repeat 2.5 using the 2mm gauge and observe that detection is broken.

2.7 Repeat tests 1.1 to 1.3 for the other mechanism.

2.8 Repeat tests 2.1 to 2.6 for the other mechanism.

2.9 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

END

Clamp Includes:	Rail Clamp Point lock (RCPL) & In-Bearer Clamp Lock (IBCL)
Excludes:	

Isolate the mechanism by turning to the 'Manual' position on the hydraulic pack. Disconnect the point detection from the KR lines or apply an alternative safe system of work (See NR/SMS/Part/A04).

Detection shall always be checked by reference to a meter connected to the outgoing KR circuit.

Gauges: 2.5mm & 4mm detection gauge (RCPL) 3.5mm & 5mm detection gauge (IBCL) 1.5mm & 2mm micro-switch gauges.

1. Lock & Detection Setting

1.1 Close & lock the switch rail.

1.2 **Mk 2 Only:** Slacken the detector locking nut by 1/16th turn and turn the adjusting screw clockwise until the adjustable cam has reached the head of the adjusting screw.

1.3 **Mk 3 Only:** Slacken the detector locking nut by 1/16th turn. There is an additional inner lock nut on the adjusting screw (plain half nut). The inner nut (plain half-nut) shall be slackened sufficiently to allow the adjuster screw to move. Turn the adjusting screw clockwise until the adjuster screw head meets the detector blade lug.

Figure 1 - RCPL and IBCL (with Mk 2 clamp lock) Adjusting Screw field side

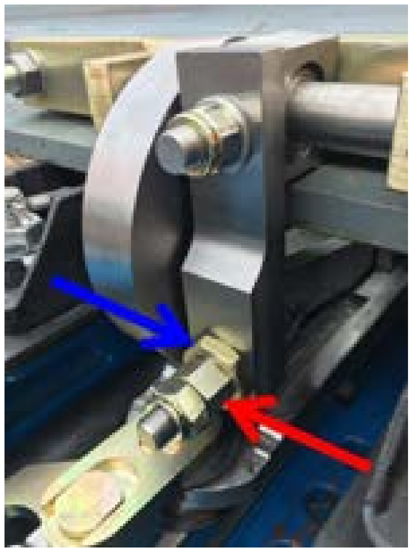


Figure 2 - IBCL Mk 3 Adjusting Screw (red). Inner lock-nut (blue). Adjustment made from 4' side

NOTE: *RCPL and IBCL (with Mk2 Clamp Lock) adjusting screws are found on the field side of the lock body. IBCL Mk3 adjusting screws are found on the 4ft side of the lock body. See Figure 1 and Figure 2 for details.*

1.4 Check the correct voltage is present on the outgoing KR circuit for the mechanism being tested.

1.5 Insert the 2mm gauge between the micro-switch plunger and the cam follower tappet screw.

1.6 Adjust the left-hand tappet screw until detection is broken; tighten the lock nut.

1.7 Retest the detection using the 1.5mm gauge. If necessary, adjust the left-hand tappet screw until detection is made. Tighten the lock nut.

Where adjustments are made to the left-hand tappet screw, repeat 1.1 to 1.7.

RCPL Only

1.8 Insert the 4mm gauge between the point detector blade lug and the shoulder of the connecting eye. Whilst observing the meter, turn the adjusting screw anticlockwise until the detection is just broken.

1.9 Tighten the nut and observe that the detection is broken. If detection is made, return to step 1.1.

Repeat using the 2.5mm gauge and observe the detection is made and the correct voltage is present on the KR circuit. If the detection is broken, remove the gauge and return to step 1.1.

IBCL Only

1.10 Insert the 5mm gauge between the point detector blade lug and the shoulder of the connecting eye.

NOTE: *On IBCL Mk 3, pull the bottom of the detector blade lug toward the 4' to open a gap for the 5mm gauge. When loosening or tightening the connecting eye nut retain the connecting eye with a spanner to prevent rotation of the spherical bearing.*

1.11 Whilst observing the meter, turn the adjusting screw anticlockwise until the detection is just broken.

1.12 Tighten nut and observe that the detection is broken. If detection is made, return to step 1.1.

1.13 Repeat using the 3.5mm gauge and observe the detection is made and the correct voltage is present on the KR circuit. If the detection is broken, remove the gauge and return to step 1.1.

1.14 Remove the gauge, tighten the nut and check that detection is made.

All Types

1.15 Insert the 1.5mm gauge between the left hand micro-switch plunger and the cam follower tappet screw. Observe the detection is made and the correct voltage is present on the KR circuit.

1.16 Repeat using the 2mm gauge and observe that detection is broken.

1.17 Remove gauge and open the closed switch rail to approximately 25mm (1”).

1.18 Observe that the right-hand tappet screw is level with the left-hand tappet screw. Adjust the right-hand tappet screw as necessary and tighten the lock nut.

1.19 Check, with the switch rail fully open, that there is a gap between the right-hand micro-switch plunger and its tappet screw.

1.20 Once adjustments have been correctly set, tighten lock nuts to specification.

NOTE: *On IBCL Mk 3 are two lock nuts to tighten, one on the end of the adjuster screw and another against the detector blade lug.*

1.21 Repeat steps 1.1 to 1.20 for the opposite switch position.

1.22 Carry out Facing Point Lock Test (Clamp Lock) – NR/SMS/PARTB/003

1.23 Request the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

END

Includes:	Rail Clamp Point lock (RCPL) & In-Bearer Clamp Lock (IBCL)
Excludes:	All other "Tests for Air" in Hydraulic Systems

1. Check a System for Air

1.1 Check the following:

a) The hydraulic fluid level in the reservoir.

b) The power pack is reasonably level.

c) The hose run does not have any major humps that can trap air.

NOTE: *Ideally, the hoses should rise slightly towards the power pack.*

1.2 Switch the Power Pack to 'Manual'.

1.3 Observe the lie of the points and move the direction control lever to the opposite lie.

1.4 Using the hand pump, gently pump until the drive mechanism just starts to move.

(In POCV fitted packs, a sudden release of pressure may be noticed).

1.5 Allow the direction control lever to return to the central position.

1.6 Using a crow bar:

RCPL & IBCL Mk 2:	Against the tie bar lugs, attempt to bar the points open.
IBCL Mk 3:	Against the open rail barring lug, attempt to bar the drive lock slide closed. It should not be possible to move the mechanism any measurable distance. Do not bar the switch rail itself.

1.7 The actuator piston should not move. If movement does occur, note how much and whether it springs back once released and refer to Table 1 regarding the action to be taken.

Movement	Likely Cause	Action
No measurable movement	Points free from trapped air.	No action required.
Some movement, spongy, mechanism springs back when released:	Some trapped air. (Expansion of long non-conductive hoses may result in some movement.)	Bleed the system and retest.
Movement with little resistance, mechanism does not spring back:	Internal leakage likely, possibly an over length POCV piston or piston head seal failure	Arrange to replace the power pack or ram as necessary. (This is not mandatory at a supplementary drive driven by a four-port power pack).

Table 1 – Results

1.8 Hand pump the points to the opposite position and repeat 1.6.

1.9 For installations fitted with traditional hydraulic supplementary drives (back drives) fed by four port packs, the tests shall be repeated at each drive point. Barring should be carried out at the closed switch rail.

1.10 When testing is completed, restore power operation.

2. Bleeding the System

2.1 Starting at the actuator, for each joint in turn, loosen the joint and hand pump fluid into the joint. When fluid flows without frothing, tighten that joint. Fit the locking wires.

2.2 Hand pump the points over and back again.

2.3 Operate the points, on power, normal and reverse for at least 6 complete cycles.

2.4 Test the system for air.

3. Installing a New Actuator

3.1 Refer to the relevant sections in the Clamp Lock Installation Manual suite for instructions, See table 2.

Clamp Lock Variant	S&C Design	Switch Opening	Supplementary Drive	Document Number
RCPL	CEN56 Full-Depth / UIC54 Shallow Depth	110	Mechanical	SRB0201ra
IBCL Mk 2	NR60 Mk 1	110	Mechanical / Hy-Drive	SRA0101ra
	NR56v	110	Mechanical / Hy-Drive	SRC0301ra
IBCL Mk 3	NR60 Mk 2	130	Mechanical	E05-01RA-1
		110	Hy-Drive	F06-01RA-1
	NR56v	110	Hy-Drive	G06-01RA-1
		110	Mechanical	H06-1RA-1

Table 2 – Document References

END

Isolate the supply to the point machine and operate points manually. Disconnect the point detection from the KR lines or apply an alternative safe system of work See NR/SMS/PartA/A04 (Method Statement Summary).

The positions and number of supplementary detectors can vary on switches of the same type from different manufacturers; in addition, the length of the turn out and the rail profile will affect the pass/fail criteria of the detector.

This means that with the position of the detector(s) and rail profile on certain combinations of switch layout, they will not always gauge to that stated in the test. An obstruction fail gauge lower than that stated is on the safe side.

In all circumstances, the obstruction pass/fail gauge shall NOT exceed the limits stated. If in doubt, ask your SM(S).

Tools and Gauges

- Detection Gauges (various depending on layout).
- Digital Volt Meter (DVM).
- Tape measure or rule.

1. Gauge Test (All detectors except those fitted to T72 style point machines)

1.1 Check that the points are locked REVERSE.

1.2 Disconnect the point detection from the KR lines or apply an alternative safe system of work. On Invensys Rail Westrace modular plug coupled points, the point detection shall be disconnected by uncoupling the 4c detection cable in the OC(P).

1.3 Check using the DVM that the correct voltage is present on the outgoing detection circuit (reverse detection).

On Invensys Rail Westrace modular plug coupled points, the correct voltage is a pulsing pseudo random voltage. This shall be checked for its presence at the first set of incoming terminals on which the detection supply cable is connected. Refer to site installation drawings.

1.4 Insert an 8mm gauge between the switch rail and stock rail at a point in line with the stretcher at the supplementary detector.

1.5 Manually operate and lock the points NORMAL.

1.6 Check normal detection is broken.

1.7 Repeat 1.3 to 1.6 using an 6mm gauge and Check that detection remains made.

1.8 Repeat 1.3 to 1.7 for the opposite lie of the points (reverse detection).

If any adjustments are made, the test shall be repeated.

1.9 Hand operate and lock the points REVERSE. Check reverse detection is made.

1.10 Repeat 1.1 to 1.9 for any other supplementary detectors in the layout.

1.11 Reconnect the points and Observe correct operation from the controlling point.

2. Gauge Test (Detectors fitted to T72 style point machines only)

2.1 Disconnect the detection at the junction box by removing links T1 number 1 and T1 number 3.

2.2 Remove the lineside detection disconnection box cover.

2.3 Connect a suitable meter, set to the ohms range, to the appropriate detection circuit terminals.

- If the left-hand switch blade is closed and locked: use T3 Link number 1 'B' side (LHS) and test point on T2 Link 4.
- If the right-hand switch blade is closed and locked: use T1 Link number 1 'B' side (LHS) and test point on T2 Link 4.

2.4 Measure the resistance (approximately 33kΩ).

2.5 Manually operate the switch blade to enable a 6mm gauge to be inserted between the switch rail and stock rail at a point in line with the stretcher at the supplementary detector.

2.6 Manually operate the switch blade onto the gauge.

2.7 Measure the resistance (approximately 33kΩ).

2.8 Manually operate the switch blade to enable an 8mm gauge to be inserted between the switch rail and stock rail at a point in line with the stretcher at the supplementary detector.

2.9 Manually operate the switch blade onto the gauge and Measure the resistance. This should be infinity.

2.10 Move the points to the opposite lie and repeat steps 2.3 to 2.10.

2.11 When the test has been completed for the lie of the point's normal and reverse, replace the lineside detection disconnection box cover.

2.12 Replace links T1 number 1 and T1 number 3 and Observe correct operation from the controlling point.

END

Includes:	Mk.1 Rail Clamp Point Locks
Excludes:	All other types of Clamplock

Where gas type point heaters are fitted, the gas supply shall be turned off.

Allow heated points to cool before the test is carried out.

1. Dye Penetrate Test

1.1 Clean the lock body and allow to dry.

1.2 Spray the “dye penetrate” in an even film over the area to be tested from a distance of 300mm.

1.3 Wait for 10 minutes to enable complete penetration of any cracks.

1.4 Wipe all excess dye from the surface using paper tissue moistened with cleaner until all red coloration has been removed from the surface.

1.5 Spray the developer in an even film over the area to be tested.

1.6 Wait 10 minutes for the developer to react with any remaining dye.

1.7 Report any signs of cracking (red lines) to your SM(S) immediately.

2. Eddy Current Test

2.1 Use the eddy current detector meter in accordance with the instruction manual.

2.2 Report any signs of cracking to your SM(S) immediately.

End

Gauges: 3.5mm/5mm point checking gauge
1.5mm gauge.

1. Detection Test

For each position of the points:

1.1 Place a 3.5mm point checking gauge between the switch and stock rails at a point in line with first slide chair bolt. Observe that the detection is broken.

1.2 Repeat the test using a 1.5mm gauge. Observe that detection is made.

1.3 Record the results on the test record card.

End

Voltage Test (Excluding Reed, SSI and Invensys Rail Westrace SOM24 fed points)

With 4 ends of points and supplementary detection, you should expect a volt drop under 2.0V. If you find a volt drop greater than expected, you should isolate the cause with the resistance test.

1.1 Check all point ends are in correspondence.

1.2 Compare the voltage at the detection circuit fuse with the voltage at the incoming detection circuit links or at the relay coil.

1.3 Repeat the test for the opposite lie.

1.4 Record the results on the record card.

2. Resistance Test

50/0.25mm cable has a typical al resistance of approximately 8 Ω/km, therefore a typical 200m tail cable circuit (out & back) should give a resistance of approximately 1.6Ω. This should be added to the resistance of circuit components and judgment applied.

Investigate the cause of any high resistance and action as a corrective maintenance item (e.g. high resistance contacts, poor termination, and cable core resistance).

Any value above 10Ω indicates a potential failure.

2.1 Check all point ends are in correspondence.

2.2 Disconnect the detection circuit at the links adjacent to the detection relay.

On Invensys Rail Westrace modular plug coupled points, the point detection shall be disconnected by uncoupling the 4c detection cable in the OC(P)

2.3 Connect a multi-meter and Measure the resistance through each leg of the point detection circuit from the fuse/ terminal to the relay link. Tap the micro-switches and look for any light contacts.

2.4 Repeat the test for the opposite lie of points.

2.5 Reconnect the detection circuit and Observe correct operation of the points.

End

Includes:	Hydraulic Derailers (Type BRB 817) powered by SPX Hydraulic Pumps and Actuators.
Excludes:	All other types of Derailer.

The equipment shall not be operated on power until the unit has been proven to work correctly by hand pump operation.

Hydraulic Derailers use a standard Clamplock pump unit and a pair of Clamplock rams to drive a Derailer mechanism. Detection is accomplished using a standard circuit Controller or a 998 unit

Tests

1. Mechanical Set-up and Test

1.1 With the Derailer in its normal position (on rail) Check that the sleeper to sleeper dimension (Inside edge to inside edge) is 575mm

1.2 Check that the Derailer Rail Unit flange cut out aligns with the running edge of the rail.

1.3 Check that the Derailer Rail Unit is in contact with the rail when in the ‘Normal’ position.

1.4 Check that the Derailer Rail Unit is in contact with the Derailer stop when in the ‘Reverse’ position. In accordance with Drawing SE-SK-0415

1.5 Check the torque settings of the nuts for the bolts holding the Derailer mechanism to the rail at 80Nm.

1.6 Check the Derailer Drive Rod Alignment to the Driving Crank is parallel and in line to adjacent sleepers leading to the de-railer connection pin.

1.7 Check that when operated that the driving crank between the Hydraulic Pump Unit connecting rod, operates smoothly and that the driving angle does not become chocked or interferes with the Detector Box, and that the crank is greased and is fitted with respective grease nipples in the crank stud and joint pins.

2. Test Normal Detection

2.1 With the points on manual and with a meter connected to the detection lines check, that normal detection is made when the Derailer is in the 'Normal' position (in contact with the rail).

2.2 Move Derailer to off-rail position and check that 'Normal' detection is broken when the Derailer Rail Unit has moved by no greater than 2mm from the 'Normal' position i.e. no greater than 2mm between the rail surface and bottom of Derailer Rail Unit.

2.3 Move Derailer towards on-rail position and Check detection does not make until the Derailer is 2mm from the 'Normal' position i.e. no greater than 2mm between the rail surface and bottom of Derailer Rail Unit.

3. Motor Cut Out Test

3.1 Disconnect detection lines; Select 'Power' and ask the signaller to operate the Derailer. Check the overload cut-out operates (6-9 seconds) Reconnect detection after successful test.

4. Local Correspondence Test

4.1 Check that the KR Lines are disconnected before carrying out this test and that the signaller has been informed that indications for the De-railer will be lost.

4.2 Remove the pump unit cover and turn to "Power" before carrying out the following tests.

4.3 TEST the correspondence of all detection positions by the breaking of the Normal / Reverse detection contacts and observing the correct indication relays are operated. 50V shall be present on the NKR and 0V on the RKR for 'Normal' position. 50V shall be present on the RKR and 0V on the NKR for 'Reverse' position.

4.4 TEST the correspondence of all detection positions by the breaking of the Normal / Reverse detection contacts and observing that the correct detection at the signal box is lost.

5. Signal Box Correspondence Test

5.1 TEST that the signal box point switch, and any indication corresponds with the Derailer position for both 'Normal' and 'Reverse' positions.

5.2 TEST that a correct out of correspondence indication is present at the controlling signal box; with the Derailer in the 'Normal' position, key the points reverse and observe no movement of the Derailer. Confirm the out of correspondence indication with the signal box.

5.3 Using pump handle pump the Derailer into the 'Reverse' position and confirm correct indication in signal box.

5.4 TEST with the Derailer in the 'Reverse' position key the points 'Normal' and observe no movement of the Derailer. Confirm the out of correspondence indication with the signal box.

5.5 Using pump handle pump the Derailer into the 'Normal' position and confirm correct indication in signal box.

5.6 The final check before completion of the work is to ask the signaller to operate the Derailer to 'Normal' and 'Reverse' positions (3 times each way), while observing the movement of the Derailer is correct.

Specific Definitions

Term	Definition
Derailer Stop	Metal plate that protects rodding when Derailer Rail Unit is in reverse position.
Derailer Rail Unit	Derailing block that sits on top of rail.
BR817 Power Pack	Electro Hydraulic Power Pack that provided power to actuator.

End

General

Lamp voltage and current ranges are listed in NR/SMS/Part/Z01

A voltage below the specified range can result in insufficient light output conversely too high a voltage may affect the life of the lamp.

The notes following the types of lamp give more details. Where practicable every aspect should be tested once per year.

Lamps fed directly from 110V bus bars in most cases will not be able to be adjusted. Inform your SM(S) if a lamp fed directly in this way is out of the stated limits.

Quartz Halogen Lamps

Signals using these have separate lamps for the main and auxiliary.

Check these lamps are set to run as close as possible to their rated voltage. If this is not possible, report it to your SM(S) immediately.

Running a Quartz Halogen lamp at a voltage lower than its rated voltage will cause the glass envelope to blacken and consequently the light output will be reduced.

These lamps become very hot "do not" touch the glass with your bare hands.

If this occurs the glass should be cleaned with methylated spirits.

Automatic Signals

Aspects are tested using one of the following methods:

- Disconnection of the circuits to the controlling relay
- Following passage of a train.

Ansaldo SD321 Signals

The lamp / lamp holder metal components can be very hot.

Before refitting the lamp / lamp holder assembly, the red notches on the lamp holder and optical unit shall be aligned to confirm polarisation.

Because of the configuration of these signals, the lamp voltage and lamp proving tests are combined in this test. This does not apply to Position Light Junction Indicator (PLJI) and Ground Position Light (GPL) lamp proving which are contained in NR/SMS/Test/022.

The signal lamp voltage and proving tests requires the use of the Ansaldo Maintenance Terminal and shall only be performed with the agreement of the signaller.

These tests shall not be performed if a train is approaching as this may cause the signal to display a red aspect.

Every aspect shall be tested once per year as a minimum. Each lamp shall be illuminated and tested in turn.

Signal lamp voltages are recorded at the maintenance desk and on the signal head record card kept in the signal head.

If the voltage cannot be maintained within the voltage range detailed in NR/SMS/Part/Z01, report the problem to your SM(S) immediately.

If the voltage on an unlit lamp is found to be ≥0.8V, the actions detailed in NR/SMS/Appendix/02 shall be followed and your SM(S) informed immediately.

1. Voltage Test (Not Quartz Halogen Lamps)

1.1 Measure the main filament voltage for each signal aspect and Check (where provided) for 0V on the auxiliary filament. Voltages are listed in NR/SMS/Part/Z01

A standing voltage on the auxiliary filament terminals indicates a problem with the filament proving circuitry.

On SIMIS-W schemes, measure the main filament voltage for each signal aspect across the appropriate Wago terminals.

1.2 Disconnect the main filament and Measure the auxiliary filament voltage (where provided) for each aspect.

On SIMIS-W schemes, disconnection of the main filament is achieved at the Wago terminals for the appropriate aspect under test.

After the test, check that the Wago terminal is fully inserted in to its original position.

1.3 Record the results on the signal lamp record card. Where illumination of a lamp is refused by the signaller, endorse the record card ‘REFUSED’.

2. Voltage Test (Quartz Halogen Lamps Only)

Some banner repeater signals have two main lamps illuminated simultaneously; therefore the tests applicable to auxiliary lamps do not apply. If you are in doubt, ask your SM(S).

2.1 Measure the main lamp voltage and Check for 0V on the auxiliary lamp.

A standing voltage on the auxiliary lamp terminals indicates a problem with the filament proving circuitry.

2.2 Disconnect the main lamp and Measure the voltage on the auxiliary lamp.

2.3 Record the results on the signal lamp record card. Where illumination of a lamp is refused by the signaller, endorse the record card 'REFUSED'

3. Current Test (SIMIS-W Interlocking Areas Only)

3.1 Measure, using a suitable current clamp meter, the current on the primary side of the transformer. Currents are listed in NR/SMS/Part/Z01

4. Voltage Test & Proving Test (Ansaldo SD321 Signal)

For the lower optical unit:

4.1 Arrange for a red aspect to be displayed.

This should be displayed in the lower aperture.

4.2 Measure the voltage of the illuminated lamp.

4.3 Measure the voltage of the unlit lamps. See the notes in the general section

4.4 Remove the illuminated lamp/lamp holder assembly and Check that the filament failure alarm has operated. Use the Ansaldo Maintenance Terminal.

4.5 Check that the corresponding auxiliary aspect lamp illuminates in the upper optical unit.

4.6 Measure the voltage of the unlit lamps in the upper optical unit.

See the notes in the general section

4.7 Replace the lamp/lamp holder assembly.

4.8 Re-instate the lamp as the operative lamp. This is a Signaller action.

4.9 Check that the operative lamp is illuminated and that the corresponding auxiliary aspect lamp is extinguished.

4.10 Repeat 4.2 to 4.9 for the yellow aspect.

For the upper optical unit:

4.11 Arrange for a green aspect to be displayed.

This should be displayed in the upper aperture.

4.12 Measure the voltage of the illuminated lamp.

4.13 Measure the voltage of the unlit lamps. See the notes in the general section.

4.14 Remove the illuminated lamp/lamp holder assembly and Check the filament failure alarm has operated. Use the Ansaldo Maintenance Terminal.

4.15 Check that the corresponding auxiliary aspect lamp illuminates in the lower optical unit.

4.16 Measure the voltage of the unlit lamps in the lower optical unit.

4.17 Replace the lamp/lamp holder assembly.

4.18 Re-instate the lamp as the operative lamp (this is a Signaller action).

4.19 Check that the lamp is illuminated and that the auxiliary lamp is extinguished.

4.20 Repeat 4.12 to 4.19 for the yellow aspect.

End

GENERAL

There are no record cards for these tests, however where a route cannot be set to prove an aspect, junction indication or route indication, report this on your work order.

Computer Based Interlocking (CBI) Areas

In CBI areas the lamp proving function can be checked by use of the data link interrogator, the Technician's terminal or by asking the Signaller to observe their panel indications.

SIMIS-W Areas

In SIMIS-W areas, the S&D terminal is used to check the operation of the failure alarm. The S&D terminal and the Vicos terminals are used to check that the operation of the lamp proving function.

1. Multi Aspect Signals on CBI Areas (Filament Lamps)

1.1 Remove the lamp from lamp holder.

1.2 Check the lamp proving function has operated.

1.3 Replace the lamp.

1.4 Disable the main filament.

1.5 Check that the main filament is extinguished and the auxiliary filament illuminates.

1.6 Check the filament failure alarm has operated.

1.7 Reconnect the main filament.

1.8 Check that the auxiliary filament extinguishes and the main filament illuminates.

2. FOCL Signals on CBI Areas

2.1 Remove the flying leads of the main and auxiliary QH lamps.

2.2 Check that an alarm has been raised.

2.3 Connect the flying leads of the main and auxiliary QH lamps and check the main QH lamp is illuminated only.

2.4 Remove the flying lead to the main QH lamp and check the auxiliary QH lamp illuminates.

2.5 Check that an alarm has been raised.

2.6 Connect the flying lead to the main QH lamp and check that the main QH lamp illuminates and the auxiliary lamp extinguishes.

3. Multi Aspect Signals on Non-CBI Areas (Filament Lamps)

3.1 Remove the lamp from lamp holder.

3.2 Check the lamp-proving relay de-energises.

3.3 Replace the lamp.

3.4 Check the lamp-proving relay re-energises.

3.5 Disable the main filament.

3.6 Check that the main filament is extinguished and the auxiliary filament illuminates.

3.7 Check the filament failure alarm has operated.

3.8 Reconnect the main filament.

3.9 Check that the auxiliary filament extinguishes and the main filament illuminates.

4. Multi Aspect Signals on SIMS-W Areas (Filament Lamps)

4.1 Using the disconnection links in the signal head disable the main filament.

4.2 Check that the main filament is extinguished and the auxiliary filament illuminates.

4.3 Check the filament failure alarm has operated.

4.4 Using the disconnection links in the signal head disable the auxiliary filament.

4.5 Check the lamp proving function has operated.

4.6 Reconnect the auxiliary filament.

4.7 Check that the main filament is extinguished and the auxiliary filament illuminates.

4.8 Check the lamp proving function has operated.

4.9 Reconnect the main filament.

4.10 Check that the auxiliary filament extinguishes and the main filament illuminates.

4.11 Check the filament failure alarm shows rectified.

5. FOCL Signals on SIMIS-W Areas

5.1 Carry out these steps for each lamp in turn:

a) Using the disconnection links in the signal head disconnect the QH lamp.

b) Check that an alarm has been raised.

c) Reconnect the QH lamp.

d) Check the lamp failure alarm shows rectified.

6. LED Multi Aspect, Position Light, and Route Indicators (Dorman Light Modules Only)

NOTE: *Excluding areas fed by the Invensys Rail Westrace SOM24. See Section 15.*

6.1 Check drawings as some LED PLS are not lamp proved.

6.2 Disconnect the link to the light module under test. Liaise with the Signaller to obtain the required aspect/indication.

6.3 Check that the lamp-proving relay de-energises. On CBI areas check that an alarm is raised.

6.4 Reconnect the link to the module and check that the lamp-proving relay re-energises.

6.5 Check that the correct aspect/indication is displayed.

7. Fibre Optic Position Light Signals

7.1 Disconnect the link feeding the main QH lamp.

7.2 Check that the auxiliary QH lamp illuminates.

7.3 If lamp-proving indication is provided in the controlling signal box, check that the correct indications are given.

7.4 Reconnect the link feeding the main QH lamp. Check it illuminates and the auxiliary QH lamp extinguishes.

8. Mechanical Signals using a Paraffin Lamp and Pyrometer

8.1 Open the outer lamp case and allow the pyrometer to cool.

8.2 Check the Signaller receives a “lamp out” warning/indication. Check when the audible is cancelled the indication remains.

8.3 Close the cover and check that once the pyrometer has heated up, the audible sounds. Check when cancelled, the audible ceases and the indication restores.

9. Mechanical Signals using Electric Lamps

9.1 Disconnect the link feeding the lamp.

9.2 Check the lamp-proving relay de-energises and the correct indication is given in the controlling signal box.

9.3 Reconnect the link feed the lamp. Check it illuminates and the lamp-proving relay re-energises.

10. Junction Indicators with Five Lamps (Filament Lamps, not SIMIS-W Interlockings)

10.1 Arrange with the Signaller to display an agreed route indication. Check the indication is displayed and the main signal shows a proceed aspect.

10.2 Remove lamps until only two are illuminated.

10.3 Check the lamp-proving relay de-energises and the main signal shows a red aspect. On CBI areas check that an alarm has been raised.

If these checks fail, with only two lamps remaining fitted, have the Junction Indicator extinguished and re-illuminated. Repeat the checks.

10.4 Replace one lamp.

10.5 Check the lamp-proving relay re-energises and the main signal shows a proceed aspect.

10.6 It might be necessary to extinguish and re-illuminate the indicator.

10.7 Replace the remaining lamps.

10.8 Check that all lamps are illuminated.

10.9 Repeat steps 10.1 to 10.7 for each available route indication at the signal.

11. Junction Indicators with Five Lamps (Filament Lamps, SIMIS-W Interlockings Only)

11.1 Arrange with the Signaller to display an agreed route indication. Check the indication is displayed and the main signal shows a proceed aspect.

11.2 Remove each lamp in turn.

11.3 Check the relevant alarm message has been received on the diagnostic terminal.

11.4 Replace the lamp.

11.5 Repeat 11.2 to 11.4 for all remaining lamps.

11.6 Check all lamps are illuminating.

11.7 Repeat 11.2 to 11.4 for each route indication at the signal.

12. Junction Indicators fitted with Five Dorman LED Light Modules

NOTE: *This task might not be possible in Plug and Plug Area.*

12.1 Arrange with the Signaller to display an agreed route indication. Check the indication is displayed and the main signal shows a proceed aspect.

12.2 Disconnect the links to the modules until only two are illuminated.

12.3 Check the lamp-proving relay de-energises and the main signal shows a red aspect.

On CBI areas check that an alarm is raised.

12.4 Reconnect the link to one module.

12.5 Check the lamp-proving relay re-energises and the main signal shows a proceed aspect.

12.6 Reconnect the remaining links.

12.7 Check that all the light modules are illuminated.

12.8 Repeat items 12.1 to 12.7 for each available route indication at the signal.

13. Ansaldo Five Lamp Position Light Junction Indicators

> ***NOTE:*** *The lamps are paired: 3 and 5, 2 and 4 and each pair is driven by a single POT. The pivot lamp (lamp 1) has its own POT, see NR/SMS/Appendix/02 (General Information on Ansaldo Signalling Equipment).*

13.1 Liaise with the Signaller before carrying out these tasks.

13.2 Arrange with the Signaller to display a proceed aspect with an agreed route indication.

13.3 Remove the pivot lamp and check that the signal is still showing a proceed aspect .

13.4 Remove one other lamp and check that the corresponding lamp in the pair extinguishes. The associated POT has shut down.

13.5 Check that the signal has reverted to RED.

13.6 Replace the lamps and request the Signaller to reset the signal and display the previously agreed proceed aspect with an agreed route indication.

13.7 Check that all the lamps are illuminated. The associated POTs have powered-up.

13.8 Remove one non-pivot lamp and check that the corresponding lamp in the pair extinguishes. The associated POT has shut down.

13.9 Remove one lamp from the other pair and check that the corresponding lamp extinguishes. The associated POT has shut down leaving only the pivot illuminated.

13.10 Check that the signal has reverted to a RED aspect.

13.11 Replace the lamps and request the Signaller to reset the signal and display the previously agreed precede aspect with an agreed route indication.

13.12 Check that all the lamps are illuminated, and the associated POTs have powered-up.

13.13 Repeat items 13.1 to 13.11 for each available route indication at the signal.

14. Ansaldo Ground Position Light Signal

14.1 Arrange with the Signaller to display an ON indication.

14.2 Check that the Main ON lamp is illuminated.

14.3 Remove the Main ON lamp and check that the Auxiliary ON lamp illuminates.

14.4 Replace the Main ON lamp and request the Signaller to re-set the signal.

14.5 Check that the Main ON lamp illuminates and that the Auxiliary ON lamp extinguishes.

14.6 Arrange with the Signaller to display an OFF indication.

14.7 Remove the OFF lamp and check that the signal is ‘black’, no aspect is displayed.

14.8 Check that the alarm is activated.

14.9 Replace the OFF lamp and request the Signaller to re-set the signal.

14.10 Check that the OFF lamp illuminates and that the alarm is silenced.

15. LED Multi Aspect, Position Light, and Route Indicators Invensys Rail Westrace SOM24 fed.

15.1 Check drawings as some LED PLS are not lamp proved.

15.2 Check that the relevant input LED on the SOM24 is illuminated indicating voltage free contact proving.

15.3 Disconnect the plug coupler in the OC or MEH to the signal or route indicator under test.

15.4 Liaise with the Signaller to obtain the required aspect/indication.

15.5 Check that the relevant input LED on the SOM24 extinguishes indicating no voltage free contact proving.

15.6 Reconnect the plug coupler in the OC or MEH to the signal or route indicator under test and check that the relevant input LED on the SOM24 illuminates indicating voltage free contact proving.

15.7 Check that the correct aspect/indication is displayed.

15.8 Check that the plug coupler is securely fitted, and its retaining clip is engaged fully.

END

1. Signal Post Replacement Switch (SPRS) Test

1.1 Check that the signal is displaying a proceed aspect.

1.2 Request permission from the Signaller to operate the signal post replacement switch.

1.3 Check, with the switch turned to ‘RED’, the signal returns to a red aspect.

1.4 Check, with the switch turned to ‘AUTO’, the signal displays a proceed aspect.

2. Signal Box ERS Test (Automatic Signals)

2.1 Check that the signal is displaying a proceed aspect.

2.2 Request the Signaller to operate the emergency replacement switch.

2.3 Check the signal returns to a red aspect.

2.4 Confirm the ‘signal at red’ indication is illuminated at the signal box.

2.5 Request the Signaller to restore the switch to the ‘AUTO’ position.

2.6 Check the signal displays a proceed aspect.

2.7 Confirm the ‘signal at red’ indication is extinguished at the signal box.

3. SPAD Indicator Test

3.1 Test the SPAD function by slipping the test link.

a) Observe the SPAD indicator illuminates.

b) Observe the Technicians test lamp is lit.

3.2 Check the following:

a) The flasher is operating.

b) The treadle is operating correctly.

c) The over-ride plunger has not stuck up.

d) The timer (SPAD GR) is correctly set.

3.3 Check that an alarm entry with a RED symbol is displayed in the relevant trackside object alarm window.

3.4 Acknowledge or remove the alarm condition and check that the audible alarm is silenced and that the symbol changes to YELLOW.

3.5 Check that the alarm and symbol display is cleared when the alarm has been resolved (when the track circuit in advance of the signal has cleared).

3.6 Return the signal (SPAD alarm) to service operation.

4. SPAD Alarm on Ansaldo Signals (Test 2)

4.1 Agree with the Signaller, the particular signal (SPAD alarm) to be tested and simulate a SPAD situation.

NOTE: *This can be achieved by operating the relevant track circuits on the maintainers' desk.*

4.2 Check the associated audible alarm activates immediately and an alarm entry with a RED symbol is displayed in the relevant trackside object alarm window.

4.3 Resolve the alarm (without acknowledgement). Clear the track circuit in advance of the signal.

4.4 Check the alarm has self-restored and that the symbol has changed to GREEN.

4.5 Return the signal (SPAD alarm) to service operation.

5. SPAD Alarm on Ansaldo Signals (Test 3)

5.1 Agree with the Signaller, the particular signal (SPAD alarm) to be tested and simulate a multiple SPAD situation.

NOTE: *This can be achieved by operating the relevant track circuits on the maintainers' desk.*

5.2 Check that the associated audible alarms activate immediately and that the volume and/or tone of the audible alarm is distinctive, dissimilar, and acceptable to the Signaller. Arrange adjustment with your SM(S).

5.3 Check an alarm entry with a RED symbol is displayed in each relevant trackside object alarm window.

5.4 Check that acknowledgement silences all the audible alarms and that each symbol only changes to YELLOW when its associated alarm entry is acknowledged.

5.5 Check that each alarm and symbol display is only cleared when its associated alarm has been resolved (when the track circuit in advance of the particular signal has cleared).

5.6 Return the signals (SPAD alarms) to service operation.

6. Flasher Unit Test (Flashing Aspects)

6.1 To avoid interference with signal aspect sequences and relay stick circuits, the TEST and RESET buttons shall only be operated under the following conditions:

a) Check the four flasher unit indication lamps are extinguished.

b) Check the flasher unit proving relay (FECR) is de- energised.

SIGNALS CAPABLE OF DISPLAYING A FLASHING DOUBLE YELLOW ASPECT:

6.2 With the signal at danger and the first track circuit ahead of the signal occupied:

a) Press the TEST button, check the four indication lamps are lit and the FECR is de-energised.

b) Press the RESET button, check the four indication lamps extinguish and the FECR re-energises.

SIGNALS CAPABLE OF DISPLAYING A FLASHING SINGLE YELLOW ASPECT:

6.3 With the signal not displaying a flashing aspect:

a) Press the TEST button, check the four indication lamps are lit and the FECR is de-energised.

b) Press the RESET button, check the four indication lamps extinguish and the FECR re-energises.

END

General

Standard strength inductors are coloured yellow and can operate at 12VDC, 24VDC and 110VAC.

On lines employing third or fourth rail DC traction, extra strength inductors are used, which are coloured green these can also operate at 12VDC, 24VDC, 60VDC, 100/110VDC or 110VAC.

Corresponding yellow and green S&P meters are available for testing each type.

When testing yellow magnets, the yellow S&P meter shall be placed upright in the centre of the top surface of the magnet. When testing green magnets, the green S&P meter shall be stood on a 46mm wooden plinth upright in the centre of the top surface of the magnet. This applies to both permanent magnets and electro-magnets.

Some AWS Inductors can be wired for parallel or series operation check the local diagrams for details.

Inductors can be fitted with plug couplers and if they are provided, voltage and current measurements shall be taken at the inductor by the use of an approved “breakout” connector.

If a Vortok Electro-Magnet or Suppressor Magnet is being tested, there is not a controlling relay to check, depending on the type of interlocking/trackside equipment in use. Contact the Signaller and arrange for the routes to be set to energise/de-energise the magnets during the tests.

NOTE: *The Vortok AWS magnets are designed with spark quench diodes as part of the internal circuitry and there is no requirement to perform this test.*

1. Permanent Magnet

1.1 Test permanent magnet flux strength using the S&P meter.

The pointer should move to the green position, with the letter ‘P’ displayed.

If the pointer only moves to the yellow position with a letter ‘P’, the magnet shall be replaced as soon as possible.

If the pointer remains in the red position, the magnet shall be reported as a failure to the Signaller as this can lead to a wrong side failure.

2. Electro-Magnet

2.1 Test electro-inductor flux strength using the S&P meter for caution and proceed signal aspects or positions.

Check that the inductor remains de-energised for R, Y & YY signal aspects (and distant arm ON). The pointer should remain in the red position.

For a green aspect (or distant arm OFF), the pointer should move to the green position, with the letter ‘E’ displayed.

If the pointer only moves to the yellow position with a letter ‘E’, the magnet shall be replaced as soon as possible.

If the pointer remains in the red position, the magnet shall be reported as a failure to the Signaller and as a corrective maintenance item.

2.2 At the electro-inductor terminals Measure the electro-inductor voltage for both caution and proceed signal aspects. A “breakout box” shall be used if required.

Check that 0v is present for R, Y & YY aspects (or distant arm ON). Check that the energised voltage is within 10% of nominal voltage. Voltages are detailed in NR/SMS/Part/Z08 (Train Protection - Reference Values).

2.3 Measure the electro-inductor current for green aspects (and distant arm OFF). A “breakout box” shall be used if required.

3. Suppressor Magnet

3.1 At the inductor terminals measure the suppressor inductor voltage. A “breakout box” shall be used if required.

Voltages are detailed in NR/SMS/Part/Z08 (Train Protection - Reference Values).

A suppressed inductor can be energised by requesting the Signaller to set a route over the inductor in the opposite direction to that for which the de-energised inductor is used. It might be necessary to drop the track circuit over the inductor, as power saving controls are sometimes used.

3.2 Test suppressor flux strength using the S&P meter.

a) Check the controlling relay is energised, or if no relay present, check the controlling equipment is driving the suppressor magnet. The permanent magnet should be suppressed.

b) Test suppressor flux strength using the S&P meter.

The pointer should remain in the red position.

c) Check the controlling relay is de-energised, or if no relay present, check the controlling equipment is not driving the suppressor magnet. The permanent magnet should not be suppressed.

d) Test suppressor flux strength using the S&P meter.

The pointer should move to the green position, with the letter ‘P’ displayed.

The permanent magnet field should be present (see Section 1).

3.3 Measure the current flow through the inductor.

a) Check the controlling relay is energised, or if no relay present, check the controlling equipment is driving the suppressor magnet. The permanent magnet should be suppressed.

b) Test the current flow through the suppressor.

The suppressor magnet should be energised, and the permanent magnet should be suppressed. The meter should measure current flowing.

c) Check the controlling relay is de-energised, or if no relay present, check the controlling equipment is not driving the suppressor magnet. The permanent magnet should not be suppressed.

d) Test the current flow through the suppressor.

The permanent magnet field should be present and there should be no current flowing.

4. Records

4.1 Record all the results on the record card.

5. Spark Quench

Where an external spark quench diode is present and during a fault investigation carrying out this test might assist with the fault diagnosis.

a) Disconnect one leg and test the diode or resistor spark quench.

On electronic meters the diode test function should be used to test the spark quench diode (audible beep one way, nothing on the other).

If you are using an analogue meter, the resistance range should be used (low, typically 100Ω one way and high, typically several thousand the other).

The spark quench resistor should be tested using the resistance range on both types of meter. Resistor values should correspond with the diagrams.

b) Reconnect the disconnected leg.

END

Includes:	Vehicle Identification System used in the Sheffield Tram-Train Project Network Rail mainline infrastructure, between the Sheffield Supertram network and Parkgate Tram Stop.
Excludes:	Vehicle Identification System used on the Sheffield Supertram Network

GENERAL

The following process should be used when a particular loop requires replacement or reactive maintenance.

The process explains how to tune the loop to the 147 kHz frequency providing the maximum signal strength at the loop, by adjustment of the Tuner Unit links.

1. Loop Tuning Setup

1.1 Check the loop and feeder cables are connected and no links LK1 – LK10 are fitted.

1.2 Connect a test ribbon cable with the 10-way dip switch in test connector.

1.3 Check that the 10-way switch is switched OFF in reset condition.

1.4 Now connect the oscilloscope, loop test meter box or multi meter (capable of reading a high frequency) to the loop feeder cable in loop tuner unit.

1.5 The aim is to set the maximum reading by changing the switch position starting from switch 10 towards switch 1.

1.6 Switches 1-5 select a low capacitance, and these have very little effect, whereas switches 6-10 select higher values of capacitance and thus have a greater effect on the tuning.

1.7 Initially note down the loop voltage reading in the start condition.

1.8 Now turn ON switch 10 and make sure the corresponding reading is increased from the start condition. If it is increased, then switch 10 is kept set to the ON position.

1.9 If the reading is decreased from the start value, then turn switch 10 to the OFF position.

1.10 Now turn on switch 9. If it increases the output from the previous value then keep switch 9 on and now turn off switch 10 and check if the reading increases, if yes then turn off switch 10 and turn on switch 9 alone. If it decreases, then both switch 9 and 10 are kept on.

1.11 Repeat step 1.7. to 1.10 for all the switches positions from 8 to 1.

1.12 Note down the switch position that are ON and make sure the corresponding link headers in the Tuner Unit are fitted in the corresponding positions.

1.13 Remove the test ribbon cable and re-fit the Tuner Unit cover.

1.14 Any unused left-over link headers are stored for future use.

1.15 After completion of the tuning adjust the related Loop card potentiometer VR2 clockwise or anticlockwise to set the loop voltage to the level as per Table 1.

Rack Voltage			**Loop Tuner Feeder**			**Loop Tuner Loop**		
Fluke	**Meter Box**	**Oscilloscope**	**Fluke**	**Meter Box**	**Oscilloscope**	**Fluke**	**Meter Box**	**Oscilloscope**
3.7V	70	10V	3.6V	70	10V	7.5V	FSD	22.4V
3.7V	70	10V	3.7V	70	10V	8.1V	FSD	24V

Table 1 – Loop Voltages

1.16 Finally phase the loop and simulate trams using the tram simulator to make sure the loop is fully functional.

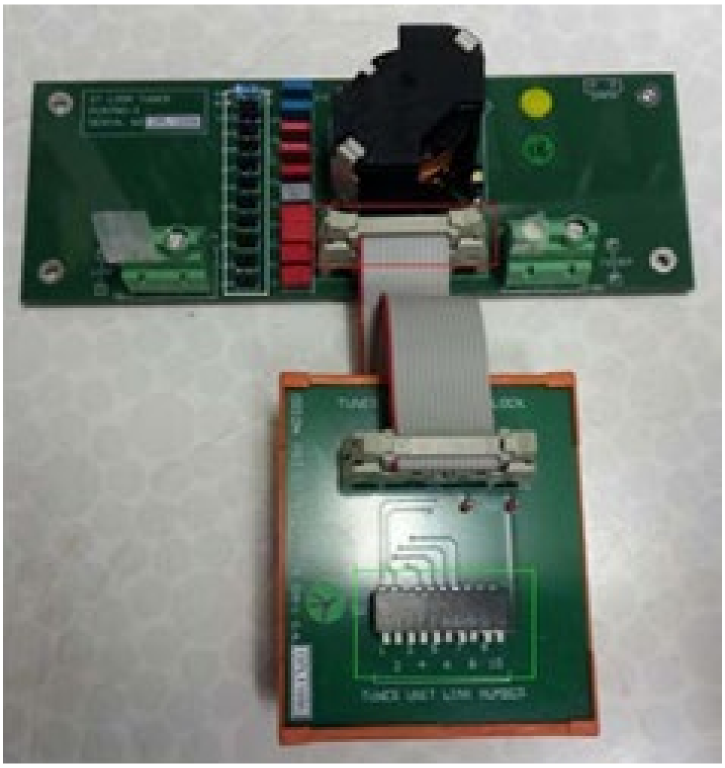


Figure 1 - Loop Tuner with 10-way DIP switch

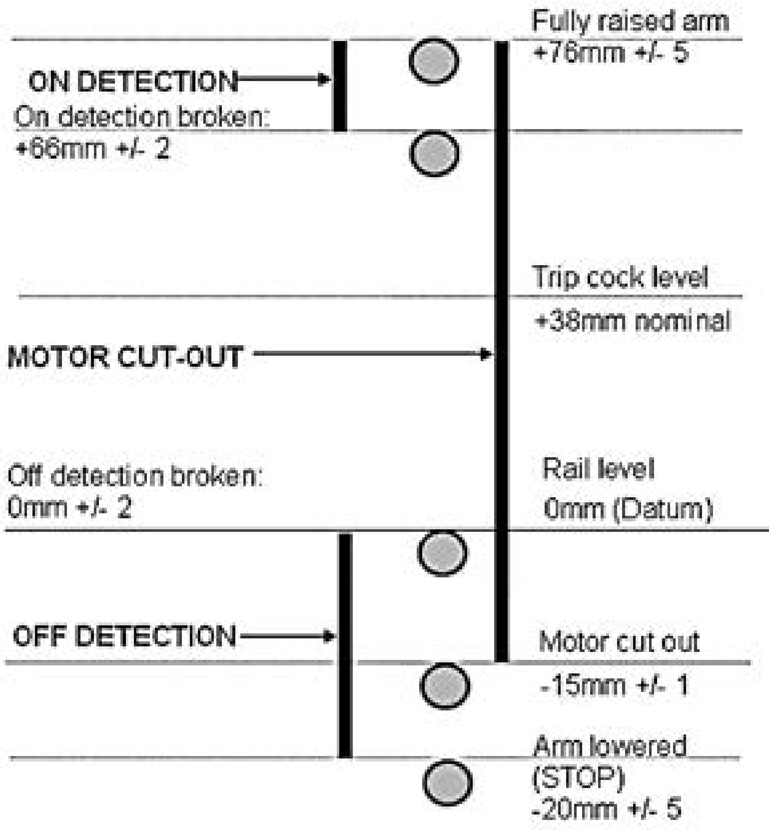
END

Includes:	Electro-hydraulic Trainstops
Excludes:	All other Trainstops

1. Test

1.1 Manually operate the trainstop and Check the following:

- With stop arm fully raised: 'ON' detection is made.
- 'ON' detection is lost when stop arm is depressed by 10mm (± 2mm).
- When stop arm is fully lowered, 'OFF' detection is made.
- 'OFF' detection is maintained from the fully lowered position until the stop arm is raised to rail level (± 2mm).
- Check that motor cut out contacts are set to break when stop arm is 5mm (± 1) above the fully lowered position.



End

Includes:	Siemens JE Trainstop.
Excludes:	All other types and styles of Trainstop .

Trainstops contain moving parts which can cause severe personal injury.

1. Trainstop Test

1.1 Check the tail cables, Earth Bond and power supply is reconnected.

1.2 Confirm with the signaller that the signal associated with the train stop is at danger and confirm what indication he/she has for the Trainstop.

1.3 Request the Signaller to clear the signal associated with the Trainstop to a proceed aspect.

1.4 Observe the trainstop moves completely to the lowered position.

1.5 Check that the motor cuts out prior to the Trip Arm hitting the lower stop.

1.6 Ask the Signaller to confirm the indication.

1.7 Request the Signaller to place the signal associated with the Trainstop back to danger.

1.8 Observe the trainstop moves completely to the raised position.

1.9 Ask the Signaller to confirm the indication.

End

JE Style Trainstop – Positioning Check

Issue No: 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Siemens Style JE Trainstop.
Excludes:	All other types and styles of Trainstop .

Trainstops contain moving parts which can cause severe personal injury.

1 Positioning Check

1.1 Check the Trip Arm is the correct distance from the running rail.

The distance from the inside of the running rail to the centre of the Trip Arm must be 222 mm +/- 3mm, as shown in Figure 1. In areas with conductor rails a non-metallic rule shall be used.

If necessary slacken the Trainstop fixings and adjust the position of the Trainstop. If it is still not possible to set the correct distance:

- Suspect damage or distortion to the Trainstop.

Figure 1 – Distance from Rail

1.2 Using the Trip Arm Gauge, check the height of the top of the raised Trip Arm is 76 mm +/- 3 mm above a line joining the tops of the running rails (see Figure 2).

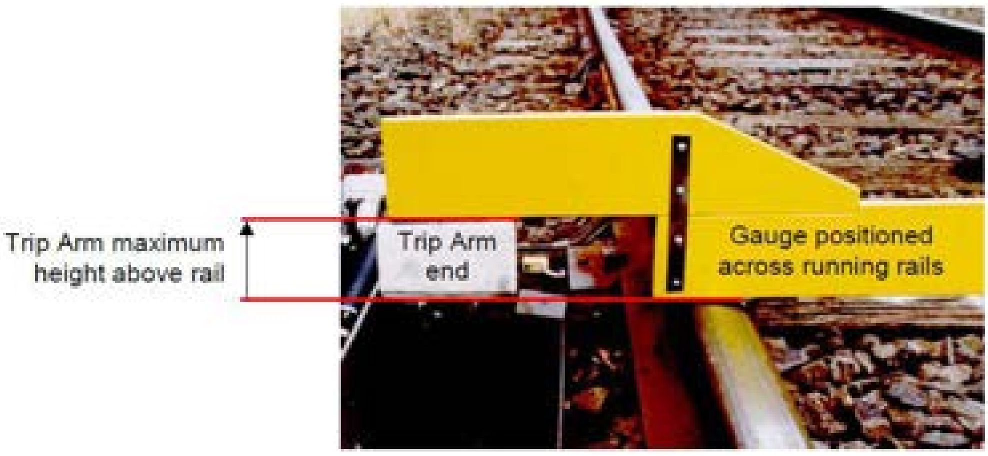


Figure 2 – Height of Trip Arm Checked with Gauge

1.3 If the height is out of tolerance, add or remove Packer Plates (Figure 3).

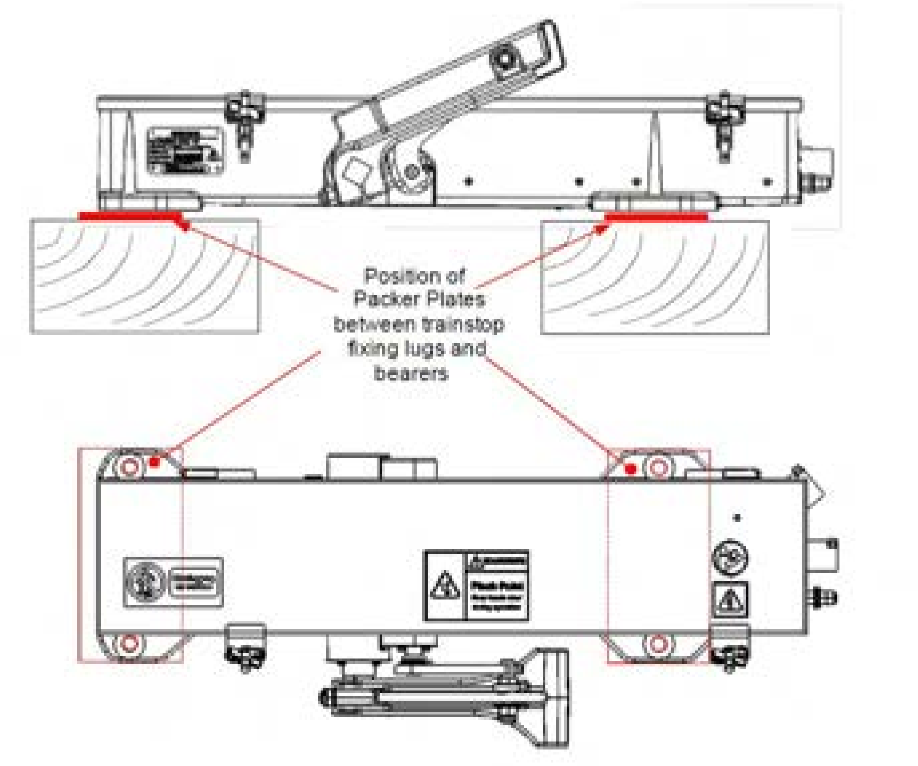


Figure 3 – Position of Packer Plates

If a Sole Plate (B54132/1) is used Packers will be fitted (if required) between the Sole Plate and the Casing Foot.

1.4 If any adjustments have been made carry out SMS Test 027 – JE Style Trainstop Detection Test

End

General

Anti-static precautions shall be taken.

Tools: The following equipment is required to carry out these tests:

- Modulator/Output board extender card. (See Figure 1).
- 1000:1 Current probe.
- Digital voltmeter (DVM).

Figure 1 - Modulator/Output board extender card

1. Loop Test

This test shall only be carried out if a card has been changed

1.1 Take off the cover of the LEU, remove the Modulator/Output board and replace it with an extender card. Plug the Modulator/Output board into the end of the extender card.

1.2 Clip a 1000:1 current probe around the loop cable and connect a DVM to read a current in the range 50-250μA. Verify that both switches on the extender card are in the up position.

1.3 Move switch one to the down position and leave switch two in the up position.

1.4 On the Modulator/Output board adjust the screw in potentiometer L1 to obtain the highest possible meter reading (minimum of 100 μA).

1.5 Leave switch one in the down position and move switch two to the up position.

1.6 On the Modulator/Output board adjust the screw in potentiometer L1 to obtain the highest possible meter reading (minimum of 100 µA).

1.7 Repeat 1.4 & 1.6 until the two reading are as close as possible and still exceed 100 µA.

1.8 Observe that the LED on the Modulator/Output board is illuminated and not flickering. If it is not illuminated or is flickering, repeat the test from 1.3.

1.9 Remove the extender card and replace the Modulator/Output board in the LEU.

1.10 Record the loop current on the ATP record card.

1.11 Remove the current probe and replace the cover.

END

Includes:	AzL Series Axle Counters
Excludes:	All other types of AzLM and AzLE

The system locations details show sites that use the detailed procedure; other unlisted sites may use the same procedure. If you are in ant doubt, ask your SM(S).

1. AzL Series, Procedure 01 - Wembley Control Centre

This axle counter installation has a co-operative reset facility. The circuit makes sure that the technician and the signaller follow the correct resetting procedure.

The reset circuit is fitted with an incremental counter at the evaluator.

Isolate the Axle Counter:

1.1 Contact the signaller and get permission to start. Fill in part A of the axle counter restoration form.

1.2 Write down the restoration counter reading in part A.

1.3 Remove the TPR isolation link. This disconnects the axle counter from the interlocking. Check the ‘INT OCC’ indication is lit (red).

Reset the Axle Counter:

1.4 Contact the signaller and confirm that no trains are in the section. Fill in part 1 of the axle counter restoration form.

1.5 Turn the key-switch to the ‘R’ reset position.

1.6 If the red LED is lit on the GRDFR card in the evaluator counter, you shall reset the card and Check that the LED goes out. If the LED is not lit, proceed to the next step

1.7 Press the ‘Reset’ button. The ‘AC CLEAR’ indication will light up (green).

Restore the Axle Counter:

1.8 Tell the signaller that you are ready to restore the axle counter. Fill in part 2 of the axle counter restoration form. (Stay on the phone and guide the signaller through the final stage).

The signaller is responsible for making sure that the section is clear before the axle counter is restored.

1.9 Turn the key switch back to the ‘N’ position and replace the TPR isolation link.

1.10 Press and hold the ‘Restore’ button. The ‘Restoration available’ indication will start to flash (red).

1.11 Check the signaller has now got a flashing red in the correct axle counter button on his panel. Ask the signaller to pull his button and hold.

1.12 Check the 'Restoration available' indication goes out and the 'Restoration taking place' indication is lit (red).

1.13 Check the signaller's button indication has also gone steady; continue to hold.

1.14 After 10 seconds, the restoration relays will reset.

1.15 The 'Restoration taking place' and 'INT OCC' indications will go out. The 'INT CLEAR' will light up (green).

1.16 The 'Restore' button can now be released.

1.17 Check the restoration counter has increased by one.

1.18 The axle counter has now reset. The indications should be as follows:

Indication	Colour	State
INT Clear	Green	Illuminated
AC Clear	Green	Illuminated
All Others		Extinguished

Fill in part 3 of the restoration form and write down the restoration counter number.

Where possible, watch the first train through the section.

2. AzL Series, Procedure 02 - Crewe Junction Signal Box

This axle counter installation has a co-operative reset facility. The circuit makes sure that the technician and the signaller follow the correct resetting procedure.

The reset circuit is fitted with an incremental counter at the evaluator.

Isolate the Axle Counter

2.1 Contact the signaller and get permission to start.

2.2 Write down the restoration counter reading.

2.3 Remove the TPR isolation link. This disconnects the axle counter from the interlocking. Check the 'AC OCC' indication is lit (red).

Reset the Axle Counter

2.4 Contact the signaller and confirm that no trains are in the section.

2.5 Turn the 'Reset' key-switch to the reset position and hold.

2.6 If the red LED is lit on the GRDFR card in the evaluator counter, you shall reset the card and Check that the LED goes out. If the LED is not lit, proceed to the next step

2.7 Press and release the 'Reset' button. The 'AC CLEAR' indication will light up (green).

Restore the Axle Counter

2.8 Turn the 'Reset' key-switch back to the 'N' position and remove the key. Check that the counter has reset.

2.9 Tell the signaller that you are ready to restore the axle counter. Fill in the axle counter restoration form parts 1 and 2, including the serial number given to you by the signaller. (Stay on the phone and guide the signaller through the final stage).

The signaller is responsible for making sure that the section is clear before the axle counter is restored.

2.10 When the signaller gives you permission, re-connect the TPR isolation link.

2.11 Check the signaller has now got a flashing red in the correct axle counter button on his panel. Ask the signaller to push his button and hold.

2.12 After 10 seconds, the restoration relays will reset and the 'AC CLEAR' will illuminate (green)

2.13 Check the restoration counter has increased by one.

2.14 The axle counter has now reset. Check with the signaller that the track indication is clear and the flashing indicator on the panel has gone out.

2.15 Complete the remainder of the axle counter restoration form and file it in the logbook.

2.16 If the reset is associated with a failure, tell ICC the axle counter reset number and also write it down on your fault report.

2.17 Where possible: Watch the first train through the section.

3. AzL Series, Procedure 03 - Bearley Junction Signal Box

This axle counter installation has a co-operative reset facility. The circuit makes sure that the technician and the signaller follow the correct resetting procedure.

The reset circuit is fitted with an incremental counter at the evaluator.

Isolate the Axle Counter

3.1 Contact the signaller and get permission to start.

3.2 Write down the restoration counter reading.

3.3 Remove the TPR isolation link.

3.4 This disconnects the axle counter from the interlocking. Check the 'AC OCC' and 'INT OCC' indications are illuminated (red).

Reset the Axle Counter

3.5 Contact the signaller and confirm that no trains are in the section.

3.6 Turn the 'Reset' key-switch to the reset position.

3.7 If the red LED is lit on the GRDFR card in the evaluator counter, you shall reset the card and Check that the LED goes out. If the LED is not lit, proceed to the next step

3.8 Press and release the 'Reset' button. The 'AC CLEAR' indication will illuminate (green).

Restore the Axle Counter

3.9 Turn the 'Reset' key-switch back to the 'N' position and remove the key. Check that the counter has reset.

3.10 Tell the signaller that you are ready to restore the axle counter. Fill in the axle counter restoration form parts 1 and 2, including the serial number given to you by the signaller. (Stay on the phone and guide the signaller through the final stage).

The signaller is responsible for making sure that the section is clear before the axle counter is restored.

3.11 When the signaller gives you permission, re-connect the TPR isolation link.

3.12 Press and hold the 'RESTORE' button.

3.13 The 'RESET RELEASE' left hand indication will flash red.

3.14 Check the signaller now has a flashing red in the correct axle counter button on his panel. Ask the signaller to push his button and hold.

3.15 After 10 seconds, the restoration relays will reset.

3.16 The 'RESET RELEASE' will illuminate (red) and the 'INT CLEAR' indication will illuminate (green).

3.17 The 'RESTORE' button can now be released.

3.18 Check the restoration counter has increased by one.

3.19 Check the only indications are as follows:

Indication	Colour	State
INT Clear	Green	Illuminated
AC Clear	Green	Illuminated
All Others		Extinguished

3.20 The axle counter has now reset. Check with the signaller that the track indication is clear and the flashing indicator on the panel has gone out. Complete the remainder of the axle counter restoration form and file it in the logbook.

3.21 If the reset is associated with a failure, tell ICC the axle counter reset number and also write it down on your fault report.

3.22 Where possible: Watch the first train through the section.

4. AzL Series, Procedure 04 - Heath Junction, Caerphilly, Severn Tunnel, and Cwmbran

This axle counter installation has a co-operative reset facility. The circuit makes sure that the technician and the signaller follow the correct resetting procedure.

The reset circuit is fitted with an incremental counter at the evaluator.

Isolate the Axle Counter

4.1 Contact the signaller and get permission to start.

4.2 Remove the TPR isolation link.

4.3 This disconnects the axle counter from the interlocking. Check the ‘Section OC’ indication is illuminated (red).

Reset the Axle Counter

4.4 Contact the signaller and confirm that no trains are in the section.

4.5 Turn the key-switch to the ‘Isolate’ position.

4.6 If the red LED is lit on the GRDFR card in the evaluator counter, you shall reset the card and Check that the LED goes out. If the LED is not illuminated, proceed to the next step

4.7 Press the ‘Reset’ button. The ‘Evaluator clear’ indication will illuminate (green).

Restore the Axle Counter

4.8 Tell the signaller that you are ready to restore the axle counter. The signaller should stamp his train register with the axle counter reset stamp. (Stay on the phone and guide the signaller through the final stage).

The signaller is responsible for making sure that the section is clear before the axle counter is restored.

4.9 Turn the key switch back to the ‘N’ position and replace the TPR isolation link.

4.10 Press and hold the ‘Restore’ button. The ‘Offered’ indication will start to flash (red).

4.11 Check the signaller now has a flashing red in the correct axle counter button on his panel. Ask the signaller to push his button and hold. Check the signaller's indication has gone steady; continue to hold.

4.12 After 10 seconds, the restoration relays will reset.

4.13 The 'Restoration in progress' and 'Section Occupied' indications will extinguish and the 'Section Clear' will illuminate (green).

4.14 The 'Restore button' may now be released.

4.15 Check with the signaller that the restoration counter has increased by one.

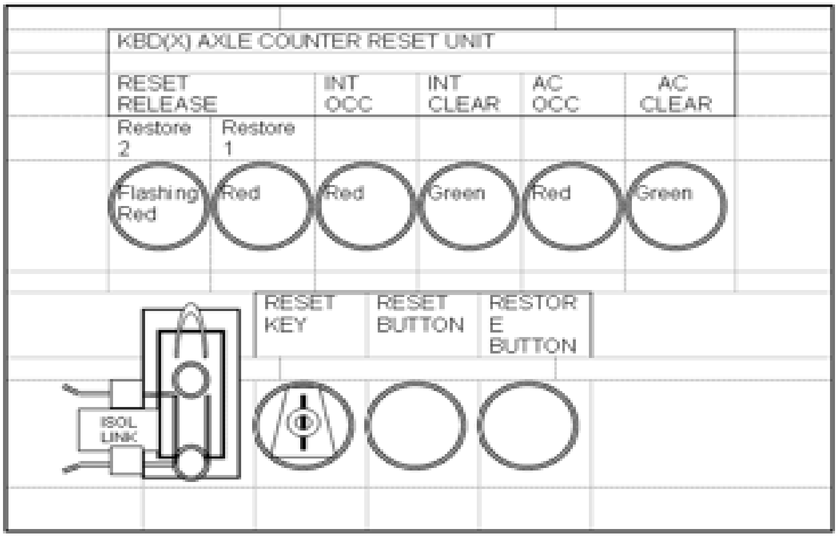
4.16 The axle counter has now reset. The indications should be:

Indication	Colour	State
Section Clear	Green	Illuminated
Evaluator Clear	Green	Illuminated
All Others		Extinguished

4.17 Where possible: Watch the first train through the section.

5. AzL Series, Procedure 05 - Swale

Reset Unit Diagram (not to scale)



Isolate the Axle Counter

5.1 Contact the signaller and get permission to start.

5.2 Write down the restoration counter reading.

5.3 Remove the TPR Isolation Link (this disconnects the axle counter from the interlocking).

5.4 Check the "INT OCC" indicator is lit (red).

Reset the Axle Counter

5.5 Contact the signaller again and confirm that no trains are in the section.

5.6 Complete Part 1 of the axle counter restoration form.

5.7 Turn the key-switch to the reset position. (The 3 0'Clock Position)

5.8 Press the "RESET BUTTON". The "AC CLEAR" indication will light up (green).

5.9 Restore the Axle Counter

5.10 Tell the signaller you are ready to restore the axle counter. Fill in part 2 of the axle counter restoration form. (Stay on the phone and guide the signaller through the final stage).

5.11 The signaller is responsible for making sure that the section is clear before the axle counter is restored.

5.12 When the signaller gives you permission, turn the key-switch back to the normal position (The 6 0'Clock Position) and replace the TPR Isolation Link.

5.13 Press and hold the "RESTORE BUTTON". The signallers axle counter restoration button indication will start to flash (red). The "RESET RELEASE" (Restore 1) steady light is lit (red) in the REB. The restore button SHALL be held in until Step 5.16 below.

5.14 Ask the signaller to press and release his button. The "RESET RELEASE" (Restore 2) indication starts to flash (red) in the REB.

5.15 Ask the signaller to press and release his button again at no less than 10-seconds and no greater than 20-seconds after his initial press in step 5.14 above. (The timing is critical to the restore process). The "INT CLEAR" indication will light up (green). Check the only indications are as follows:

Indication	Colour	State
INT CLEAR	Green	Illuminated
AC CLEAR	Green	Illuminated
All Others		Extinguished

5.16 The axle counter has now reset. The technician can now release the "RESTORE BUTTON". Check with the signaller that the track indication is clear and that the axle restoration counter has incremented by one. Complete part 2 of the axle counter restoration form.

Note: The route will set but the signal(s) will not clear for the first train through the section following an axle counter reset/restoration.

END

Includes:	All Types of Thales Axle Counters
Excludes:	All other types of Axle Counter

GENERAL

Functional tests using the dummy wheel shall require appropriate protection/possession arrangements and liaison with the Signaler.

Specialist Equipment

a) Laptop loaded with the Thales Diagnostic Software (If applicable).

b) Laptop Leads (If applicable).

This test should be carried out when directed (preferred option). In exceptional circumstances it is acceptable, and if a train is available (within 20 minutes), to use the passage of that train.

Refer to NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems) for more details on the system.

1. Functional Test with Dummy Wheel (All Types)

This test applies to all affected Detection Points and their associated sections.

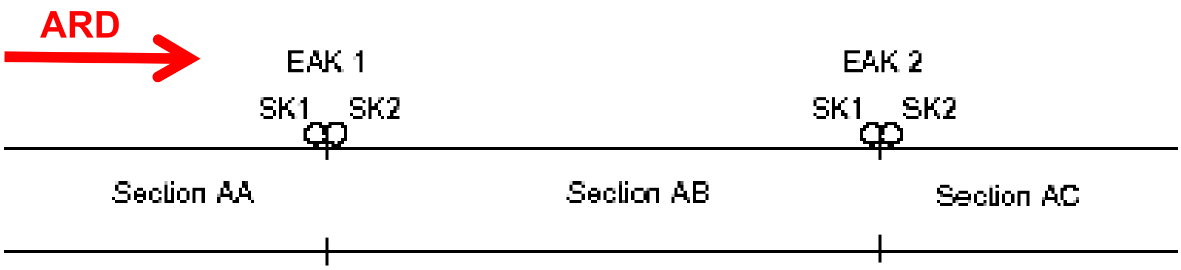


Figure 1 - Typical axle counter section (double rail contacts only)

1.1 Identify the Axle Counter Reference Direction (ARD).

All testing of the sections will be carried in sequence in the reference direction.

1.2 Confirm that the sections to be tested are showing clear.

This should be done using the indications on the ACE / Diagnostic software or by liaising with the Signaller.

1.3 Using the dummy wheel sweep three axles in the direction ARD (in this case of Figure 1 from section AA to section AB).

It should be noted that the sweeping in of the axles will leave section AA in a disturbed state (Shows occupied on the Signaller's panel) and this condition will need to be rectified after the testing is completed

1.4 Check that section AB is showing 'occupied'.

1.5 Confirm with the Signaller and/or indication on ACE or laptop.

1.6 Using the dummy wheel sweep three axles in the opposite direction to the ARD (in this case of Figure 1 from section AB to section AA).

1.7 Check that section AB is showing 'clear'.

1.8 Confirm with the Signaller and/or indication on ACE or laptop.

At boundaries additional factors should be taken into consideration when testing the ARD and other ACE's can be affected.

1.9 On completion of the testing check that all sections are Reset/Clear

END

GENERAL

There are several current variations of Frauscher FAdC in service with Network Rail. Select the Method below that is applicable to your system.

METHOD 1
This method should be used on all Axle counters that are NOT fitted with Counting Head Control (CHC) and/or Supervisor Track Sections (STS) OR those fitted with CHC where the application of EPR's inhibit CHC and/or STS.

METHOD 2
This method should be used on Axle counters that are fitted with Counting Head Control (CHC) where the application of an EPR does NOT inhibit CHC and STS is not configured.

METHOD B - EAST SUFFOLK LINES ONLY
This method is suitable where it is not practicable to observe a train traversing the section to complete the occupancy test.

<u>METHOD 1</u>

1. Before proceeding

1.1 Arrange an EPR with the Signaller.

This task will disturb one or both axle counter sections related to a single wheel sensor and completing this task will cause an error code to occur on one of the axle counter sections associated with the wheel sensor.

This error requires the Signaller's reset procedure to be completed to clear.

2. Sweep Test

2.1 Identify the AEB related to the axle counter sensor to be tested and confirm the section is indicating clear.

2.2 Place the PB200 testing plate on the railhead to the left of the axle counter wheel sensor in the start position (Figure 1).

NOTE: *The AEB card should have two green power LEDs lit. Sys 1 and Sys 2 should not be lit / flashing.*

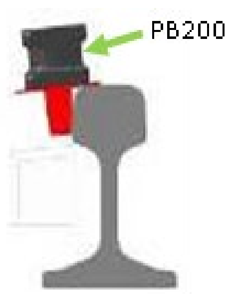


Figure 1 – PB200

2.3 Move (slide) the PB200 slowly in direction of arrow and stop over the first wheel sensor system (Figure 2).

Figure 2 – System 1

Figure 3 – AEB Card

2.4 Check the LED indications SYS1 on the AEB are illuminated (Figure 3).

2.5 Move (slide) the PB200 slowly in direction of the arrow and stop in between the two-wheel sensor systems (Figure 4).

2.6 Check the LED indications SYS1 and SYS2 on the AEB are illuminated (Figure 5).

Figure 4 – Between Systems

Figure 5 – AEB Card

2.7 Move (slide) the PB200 slowly in direction of arrow and stop over the second wheel sensor system (Figure 6).

2.8 Observe the indication SYS1 has extinguished and SYS2 remains illuminated (Figure 7).

Figure 6 – System 2

Figure 7 – AEB Card

2.9 Move (slide) the PB200 slowly away from the sensor to end the simulation. When the PB200 testing plate has passed beyond the sensor check the SYS2 LED has extinguished.

2.10 Check the correct axle counter section has become occupied.

NOTE: *This can be done by either by checking the ASD or by contacting the Signaller. LED A1 or A2 should be permanently lit on the AEB evaluating the section (A1 corresponds to Track Section (FMA1) on AEB and A2 corresponds to Track Section (FMA2)).*

2.11 The PB200 shall now be traversed over the axle counter sensors in the reverse direction to clear the section.

2.12 Confirm the correct axle counter section has cleared.

NOTE: *This can be done by either by checking the ASD or by contacting the Signaller.*

2.13 The Signaller shall now be requested to reset the adjacent axle counter section, if disturbed, and confirm that the section is showing clear.

3. When using the AEB with counting head outputs (e.g. treadle)

3.1 Observe that the system connected to the AEB, COM-XXX shows the following behaviour:

The counting head outputs are output by switching of the counting head outputs from the AEB optocouplers or the IO-EXB relays, or output as an element of the vital protocol of the COM-XXX.

END

METHOD 2

4. Before Proceeding

4.1 Arrange an EPR with the Signaller.

This task will disturb one or both axle counter sections related to a single wheel sensor and completing this task will cause an error code to occur on one of the axle counter sections associated with the wheel sensor.

This error requires the Signaller's reset procedure to be completed to clear.

5. Sweep Test

5.1 Identify the AEB related to the axle counter sensor to be tested and confirm the section is indicating clear.

5.2 Place the PB200 testing plate on the railhead to the left of the axle counter wheel sensor in the start position (Figure 8).

NOTE: *The AEB card should display two green power LEDs lit. LED's A1 and A2 will be flashing ON 50ms OFF 1000ms. AEB is desensitised (CHC active) and FMA Section is clear.*

Figure 8 – PB200

5.3 Move (slide) the PB200 slowly in direction of arrow and stop over the first wheel sensor system (Figure 9).

5.4 Check the LED indications SYS1 on the AEB are illuminated (Figure 10).

Figure 9 – System 1

Figure 10 – AEB Card

5.5 Move (slide) the PB200 slowly in direction of the arrow and stop in between the two wheel sensor systems (Figure 11).

5.6 Check the LED indications SYS1 and SYS2 on the AEB are illuminated (Figure 12).

Figure 11 – Mid Position

Figure 12 – AEB Card

5.7 Move (slide) the PB200 slowly in direction of arrow and stop over the second wheel sensor system (Figure 13).

5.8 Observe the indication SYS1 has extinguished and SYS2 remains illuminated (Figure 14).

Figure 11 – System 2

Figure 12 – AEB Card

5.9 Move (slide) the PB200 slowly away from the sensor to end the simulation. When the PB200 testing plate has passed beyond the sensor check the SYS2 LED has extinguished.

NOTE: *Each sweep must be carried out within 30 seconds to ensure CHC remains inactive.*

5.10 Repeat steps 5.2 to 5.9 to correspond with CHC value, (the CHC value is predetermined by the signalling scheme design of the head under test) LEDS A1 and A2 will stop flashing once the AEB is sensitised (CHC inactive).

5.11 Check the correct axle counter section has become occupied.

NOTE: *This can be done by either by checking the ASD or by contacting the Signaller. LED A1 or A2 should be permanently lit on the AEB evaluating the section (A1 corresponds to Track Section (FMA1) on AEB and A2 corresponds to Track Section (FMA2)).*

5.12 The PB200 shall now be traversed over the axle counter sensor systems in the reverse direction to clear the section.

5.13 Confirm the correct axle counter section has cleared.

NOTE: *This can be done by either by checking the ASD, or by contacting the Signaller.*

5.14 The Signaller shall now be requested to reset any axle counter sections that have been disturbed following the sweep test and confirm that the sections are showing clear.

NOTE: *LED's A1 and A2 will be flashing ON 50ms OFF 1000ms. AEB is desensitised (CHC active) and FMA Section is clear.*

END

METHOD B - EAST SUFFOLK LINES ONLY

This method is suitable where it is not practicable to observe a train traversing the section to complete the occupancy test.

6. Before Proceeding

6.1 Arrange an EPR with the Signaller.

This task will disturb one or both axle counter sections related to a single wheel sensor system and completing this task will cause an error code to occur on one of the axle counter sections associated with the wheel sensor system.

This error requires the Signaller's reset procedure to be completed to clear.

7. Sweep Test

7.1 Identify the adjacent wheel sensor system and AEB related to it and confirm the section is indicating clear.

NOTE: *This is the adjacent section to the one you are testing.*

7.2 Place a PB200 testing plate on the rail head over the centre of the wheel sensor system (Figure 18) and leave in situ to log a permanent occupancy status in the system.

NOTE: *The adjacent section being in a disturbed state supresses the CHC function on the adjacent wheel sensors enabling the occupancy detection capability test to be undertaken.*

7.3 Identify the AEB related to the axle counter sensor to be tested and confirm the section is indicating clear.

7.4 Place the PB200 testing plate on the railhead to the left of the axle counter wheel sensor system in the start position (Figure 15).

Figure 13 – PB200

NOTE: *The AEB card should have two green power LEDs lit. Sys 1 and Sys 2 should not be lit / flashing.*

7.5 Move (slide) the PB200 slowly in direction of arrow and stop over the first wheel sensor system (Figure 16).

7.6 Check the LED indications SYS1 on the AEB are illuminated (Figure 17).

Figure 14 – System 1

Figure 15 – AEB Card

7.7 Move (slide) the PB200 slowly in direction of the arrow and stop in between the two wheel sensor systems (Figure 18).

7.8 Check the LED indications SYS1 and SYS2 on the AEB are illuminated (Figure 19).

Figure 16 – Mid Position

Figure 17 – AEB Card

7.9 Move (slide) the PB200 slowly in direction of arrow and stop over the second wheel sensor system (Figure 20).

7.10 Observe the indication SYS1 has extinguished and SYS2 remains illuminated (Figure 21).

Figure 18 – System 2

Figure 19 – AEB Card

7.11 Move (slide) the PB200 slowly away from the sensor to end the simulation. When the PB200 testing plate has passed beyond the sensor check the SYS2 LED has extinguished.

7.12 Check the correct axle counter section has become occupied.

NOTE: *This can be done by either by checking the ASD or by contacting the Signaller. LED A1 or A2 should be permanently lit on the AEB evaluating the section (A1 corresponds to Track Section (FMA1) on AEB and A2 corresponds to Track Section (FMA2)).*

7.13 The PB200 shall now be traversed over the axle counter sensor systems in the reverse direction to clear the section.

7.14 Confirm the correct axle counter section has cleared.

NOTE: *This can be done by either by checking the ASD or by contacting the Signaller.*

7.15 The Signaller shall now be requested to reset the adjacent axle counter section, if disturbed, and confirm that the section is showing clear.

END

Includes:	ACM 100 (ACM module and WSD wheel detector)
Excludes:	AzS 350 U, AZM, ZP D 43 and ZP 43 V, WSR and WSS

This test requires a Fluke 771 Milliamp Process Clamp Meter. Other clamp meters shall not be used during this test as these can give inaccurate measurements. The clamp meter shall be reset to zero before use.

Keep switched on mobile phones 3m away from the counting heads whilst undertaking maintenance as they can cause false-counts/readings.

Keep metallic objects at least 20cm away from the counting heads. The movement of metallic objects including tools, steel toe-cap boots and jewellery across the upper surface of the counting heads may cause occupation of the track sections.

Do not step directly across the top of the wheel sensor during the calibration process.

If during installation the temperature of the wheel detector differs by more than 10°C from the temperature of the rail, it shall be allowed to equalise before calibration is performed. This could potentially be an issue when moving a WSD from Vehicle to Rail.

All wires of the connecting cable to the wheel detector can be subject to interference voltages. Do not touch live parts. This is particularly to be observed when working on the junction box (attaching wires, performing checks).

1. Calibration of the Wheel Sensor

1.1 Make suitable arrangements with the signaller for possession of the relevant axle counter sections.

One wheel detector can affect more than one section.

1.2 Connect the clamp meter around wire 1 of the wheel detector.

A current of approximately 5mA should be expected if the wheel sensor has been working in service. Other currents might be seen with uncalibrated wheel sensors.

1.3 Disconnect wire 1 of the wheel detector.
This can usually be achieved by opening a link in the trackside disconnection box.

Steps 1.4 to 1.6 are timed steps.

1.4 After at least 5 seconds of wire 1 being disconnected, reconnect wire 1 then wait approximately 30 seconds (minimum 15 seconds, maximum 45 seconds) and check that the current measured is now between 1.3mA and 7mA. If the reading is outside of this range, check the sensor is fitted correctly to the rail and no metallic objects are interfering with the measurement then return to step 1.1.

1.5 Place the adjustment gauge (1) on the top of the wheel detector as shown in figure 1.

a) The green metal strip **(2)** should be on the bottom of the adjustment gauge against the WSD.

b) The adjustment gauge should rest against the rail head.

c) The "Cal." **(3)** marking should coincide with the centre marking **(4)** on the wheel detector housing.

Do not move the position of the adjustment gauge after it has been placed on the sensor.

Check the clamp meter indicates a current consumption between 1.2 mA and 2.99 mA.

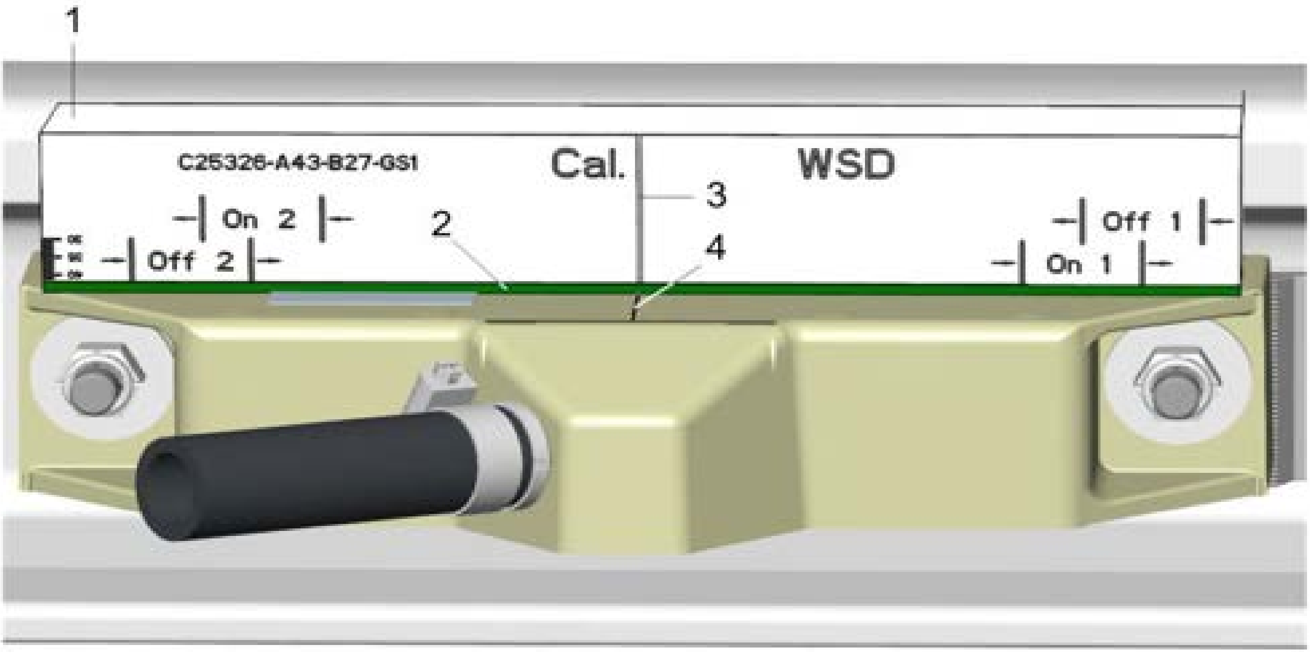


Figure 1 – Positioning of the adjustment gauge on the wheel detector

1.6 Leave the adjustment gauge on the wheel detector for approximately 30 seconds (minimum 15 seconds, maximum 40 seconds) before completely removing it from the wheel detector.

Approximately 25 seconds after removing the block the wheel detector adopts the calibrated value. Check the current reading now reads between 4.75 mA and 5.25 mA.

The calibration of subsystem 1 is now complete.

1.7 Move the clamp meter from wire 1 to wire 4

1.8 Disconnect wire 4 of the wheel detector.
This can normally be achieved by opening a link in the trackside disconnection box.

Steps 1.9 to 1.11 are timed steps

1.9 After at least 5 seconds of wire 4 being disconnected reconnect wire 4, wait approximately 30 seconds (minimum 15 seconds, maximum 45 seconds). Check that the current measured during this period is between 1.3mA and 7mA. If the reading is outside of this range check the sensor is fitted correctly to the rail and no metallic objects are interfering with the measurement then return to step 1.8.

1.10 Place the adjustment gauge (1) on the top of the wheel detector as shown in figure 1.

a) The green metal strip **(2)** should be on the bottom of the adjustment gauge.
b) The adjustment gauge should rest against the rail head.
c) The "Cal." **(3)** marking should coincide with the center marking **(4)** on the wheel detector housing.

Do not move the position of the adjustment gauge after it has been placed on the wheel sensor.

Check the clamp meter indicates a current consumption of the wheel detector between 1.2 mA and 2.99 mA.

1.11 Leave the adjustment gauge on the wheel detector for approximately 30 seconds (minimum 15 seconds, maximum 40 seconds) before completely removing it from the wheel detector.

Approximately 25 seconds after removing the block the wheel detector adopts the calibrated value. Check the current reading now reads between 4.75 mA and 5.25 mA.

1.12 Remove the clamp meter from wire 4.

The calibration of subsystem 2 is now complete.

1.13 Perform a functional test of the wheel sensor [NR/SMS/Test/039] before returning to service.

End

Includes:	ACM 100 (ACM module and WSD wheel detector)
Excludes:	AzS 350 U, AZM, ZP D 43, ZP 43 V, WSR and WSS

This test requires a Fluke 771 Milliamp Process Clamp Meter, Other clamp meters shall not be used during this test as these can give inaccurate measurements. The clamp meter shall be reset to zero before use.

Keep switched on mobile phones 3m away from the counting heads whilst undertaking maintenance as they can cause false-counts/readings.

Keep metallic objects at least 20cm away from the counting heads. The movement of metallic objects including tools, steel toe-cap boots and jewellery across the upper surface of the counting heads may cause occupation of the track sections.

Do not step directly across the top of the wheel sensor during the calibration process.

All wires of the connecting cable to the wheel detector can be subject to interference voltages. Do not touch live parts. This is particularly to be observed when working on the junction box (attaching wires, performing checks).

Test of the Wheel Sensor

This procedure describes the functional test of the WSD wheel detector. It shall be used immediately after a calibration has been carried out to prove the calibration was successful. It can also be used at other times to assess the performance of the wheel sensor.

Do not disconnect any wires or remove any links before or during functional testing.

1.1 Make suitable arrangements with the signaller for possession of the relevant axle counter sections.

One wheel detector can affect more than one section.

1.2 Connect the clamp meter to wire 1 of the wheel detector. The current clamp reading should indicate a current between 4.75 mA and 5.25 mA.

If a negative value is indicated, this is because of the physical orientation of the clamp meter on the wire and does not affect the accuracy of the measurement. If this occurs, readings can continue to be made and the negative sign ignored.

1.3 Place the adjustment gauge on the top (see figure 1) of the wheel detector as follows:

a) The adjustment gauge **(1)** should rest against the rail head.

b) The green sheet-metal strip **(2)** should be located on the side facing away from the rail head.

The clamp meter should now indicate a value between 1.3 mA and 2.99 mA. Record the value on the Wheel Detector Record Card.

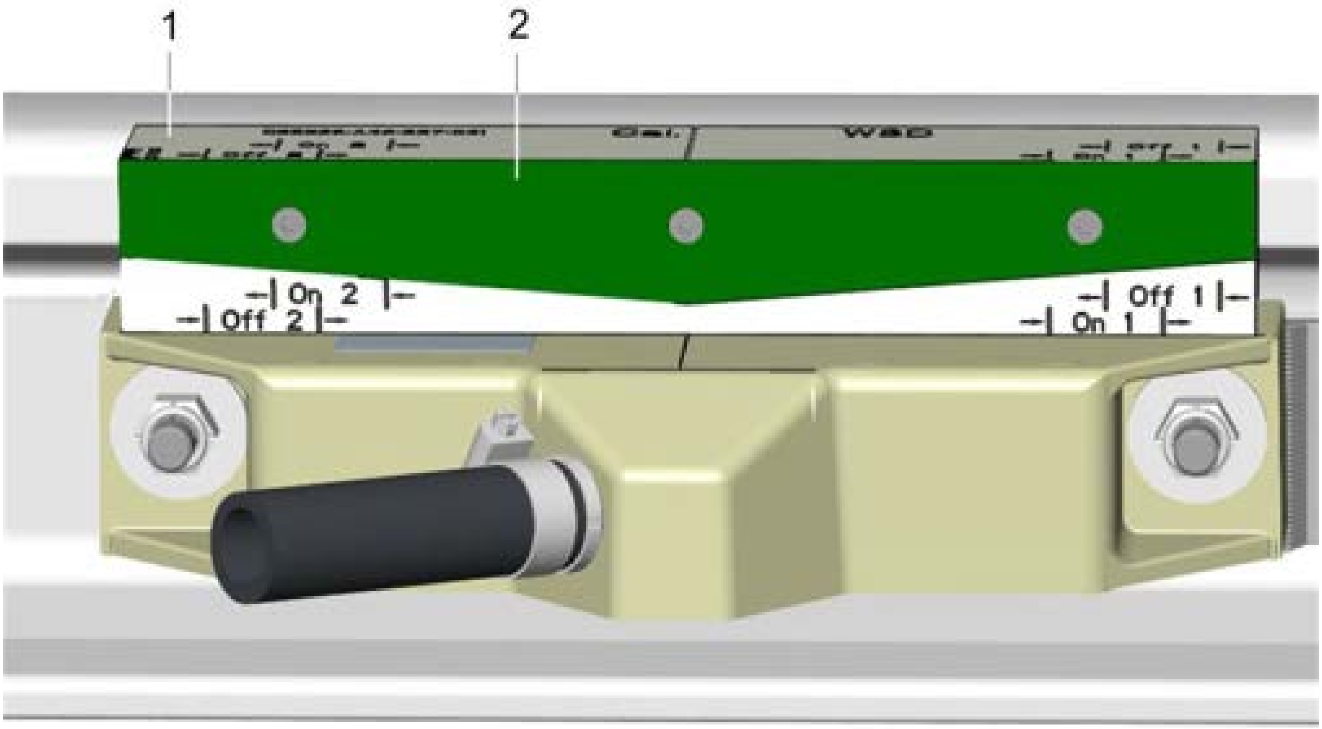


Figure 1 – Positioning of the adjustment gauge on the wheel detector

1.4 Move the adjustment gauge along the rail over the wheel detector in direction A (see figure 2). The adjustment gauge should be in contact with the wheel detector and rail when doing so.

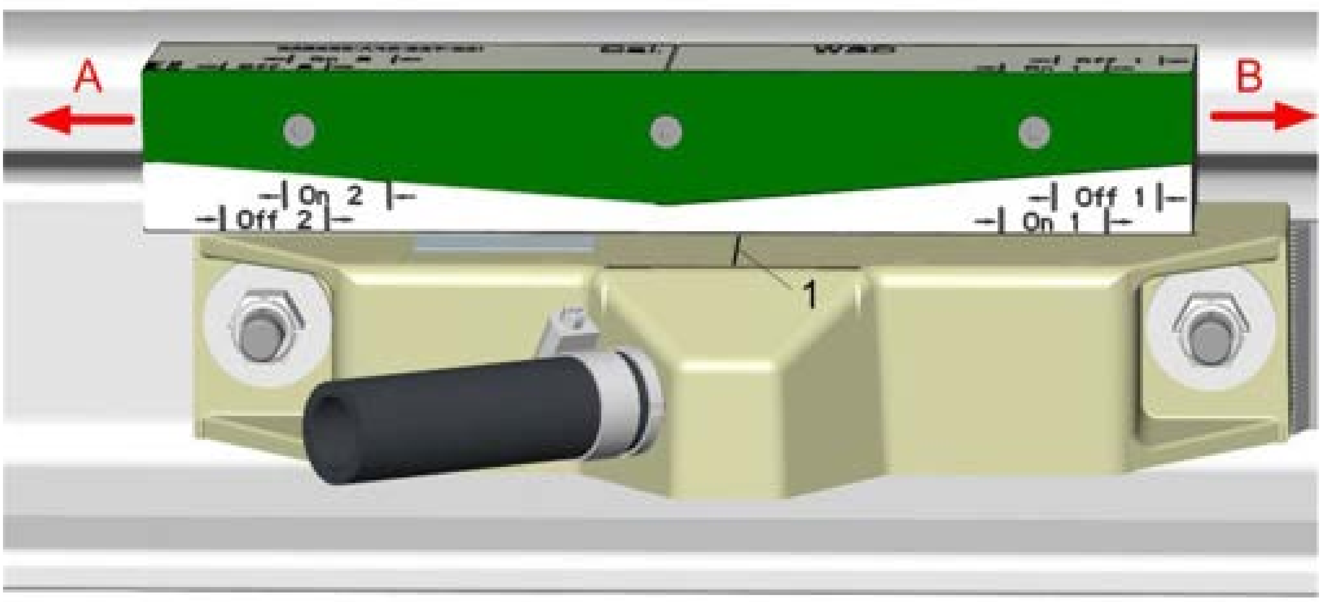


Figure 2 – Movement of the adjustment gauge towards A

1.5 Continue to move the adjustment gauge in direction A (see figure 3) until the measured current rises to a value between 4.75 mA and 5.25 mA. Then check whether the centre marking (1) on the wheel detector is between the "Off 1" markings on the adjustment gauge. A tolerance of 10 mm on both sides of the "Off 1" markings is permissible (see figure 3). Record the result of the test on the Wheel Detector Record Card.

> Do not leave the adjustment gauge in position continue and complete functional testing with step more than 1.6 within 40 seconds

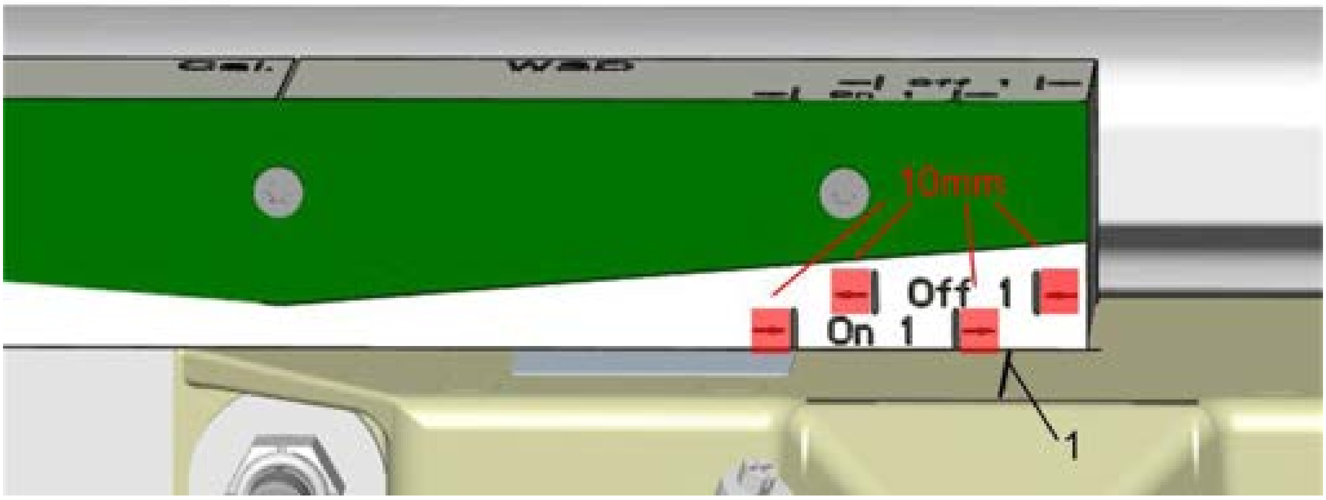


Figure 3 – Continued movement of the adjustment gauge towards A

1.6 Move the adjustment gauge back in direction B until the measured current has dropped again to a value between 1.3 mA and 2.99 mA. Then check whether the center marking (1) on the wheel detector is between the "On 1" markings on the adjustment gauge. A tolerance of 10 mm on both sides of the "On 1" markings is permissible.

Record the result of the test on the Wheel Detector Record Card

1.7 Return the adjustment gauge to its initial position (see figure 1 and Step 1.3).

1.8 Remove the clamp meter from wire 1.

1.9 Connect the clamp meter to wire 4. The clamp meter shall indicate a value between 1.3 mA and 2.99 mA.

Record the value on the Wheel Detector Record Card.

1.10 Move the adjustment gauge along the rail over the wheel detector in direction B. The adjustment gauge should be in contact with the wheel detector and rail when doing so

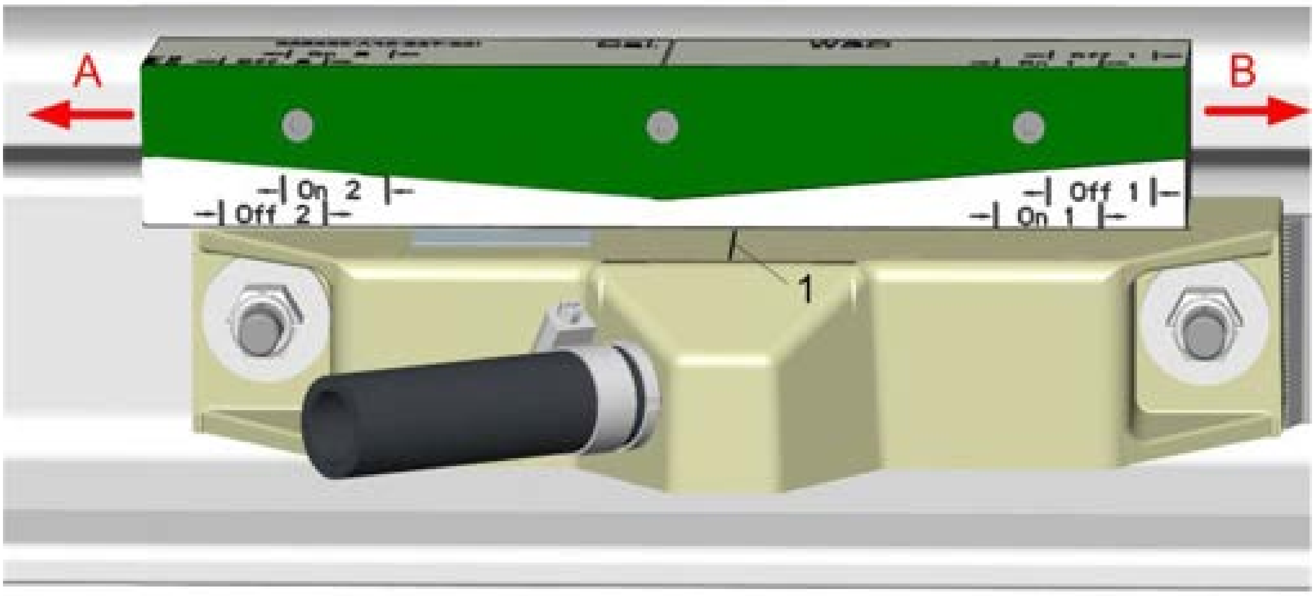


Figure 4 – Movment back towards A

Continue moving the adjustment gauge in direction B until the measured current rises to a value between 4.75 mA and 5.25 mA. Then check whether the center marking (1) on the wheel detector is between the "Off 2" markings on the adjustment gauge. A tolerance of 10 mm on both sides of the "Off 2" markings is permissible. Record the result of the test on the Wheel Detector Record Card.

Do not leave the adjustment gauge in position continue and complete functional testing with step more than 1.11 within 40 seconds

1.11 Move the adjustment gauge back in direction A (see figure 4)until the measured current has dropped to a value between 1.3 mA and 2.99 mA. Then check whether the center marking (1) on the wheel detector is between the "On 2" markings on the adjustment gauge. A tolerance of 10 mm on both sides of the "On 2" markings is permissible.

Record the result of the test on the Wheel Detector Record Card

1.12 Remove the adjustment gauge from the wheel detector and clamp meter from wire 4.

1.13 The wheel detector will function correctly if the gauge has been within the permitted range during tests for “On” and “Off” on both System 1 and System 2. If the gauge is outside the permitted range the wheel detector requires recalibration. If unsuccessful after recalibration replace the wheel detector as corrective maintenance.

1.14 Simulate two train wheels passing over the sensor. To pass a simulated wheel, start with the test block in position (1) shown in the diagram below, pass through position (2) to position (3) before removing the test block. Note that the test block must be orientated as shown in figure 5, with the green metal plate on the side away from the rail head.

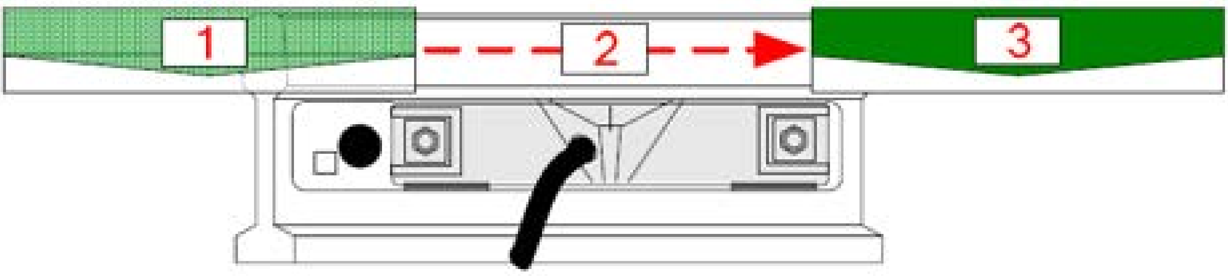


Figure 5 – Simulate Train

1.15 Check that the WSD LEDs on the ACM100 module for the affected sensor are showing solid green. If they are flashing green, repeat step 1.14. Only once the WSD LEDs are solid green, the signaller can be informed that work is complete and the section may be reset.

End

Includes:	RSR 123 Wheel sensors associated with Frauscher Advanced Evaluation Boards (AEB)
Excludes:	RSR123 Wheel sensors associated with IMC Boards

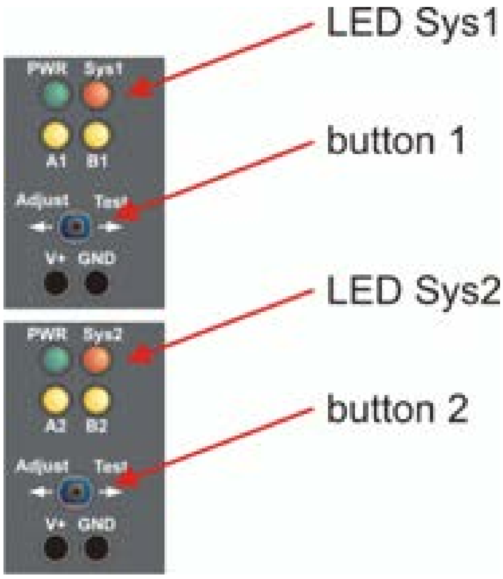
General

Before adjustment, check that wheel sensor RSR123 attached to the AEB is correctly mounted.

During adjustment, check that the wheel sensor RSR123 attached to the AEB is not occupied.

1. The button actuation sequence:

1.1 Push both buttons to the left (direction “Adjust”) within half a second.



1.2 Retain both buttons in this position for at least half a second.

1.3 Release both buttons within half a second.

1.4 Retain both buttons in the normal position for a maximum of 2 seconds.

1.5 Push both buttons to the right (direction “Test”) within half a second.

1.6 Retain both buttons in this position for at least half a second.

1.7 Release both buttons within half a second.

After the correct initiation of the adjustment sequence, Sys1 and Sys2 LEDs illuminate for between 20 to 80 seconds. Once adjustment has been carried out successfully, Sys1 and Sys2 LEDs go out.

If the adjustment is unsuccessful, the Sys1 and Sys2 LEDs flash rapidly (10 times per second), for 2 seconds.

To start a new adjustment, recommence the actuation sequence (points 1 to 7) from the start. The actuation sequence should prevent accidental actuation of one or both buttons starting an adjustment process.

1.8 The Signaller should now be requested to reset the axle counter section.

1.9 Carry out NR/SMS/PartB/Test/037 (Frauscher: RSR123 Wheel Sensor Occupancy Detection Capability Test).

END

GENERAL

The purpose of this test is to determine whether any fishplates or bolts of an insulated joint are in electrical contact with either rail.

When a track repair or insulated IBJ is changed a full test shall be carried out. Record details on the Record Card.

<u>**Select one of the following Tests:**</u>

1. IRJ Tester

1.1 Test insulated rail joints using IRJ tester.

Follow the user instructions provided with the equipment. Only use testers on authorised TC types.

1.2 List each rail joint that results in a red or yellow reading and forward the results to your SM(S).

2. 220Ω Shunt Resistance Test

This test can be carried out on all DC track circuits and the WR Quick Release Track Circuit (for which AC voltage should be measured).

2.1 For double rail track circuits, strap out the opposite IRJ.

2.2 Connect a 220Ω (+/- 10%) shunt across the meter.

2.3 Measure and record voltages V1, V2 & V3. The results and outcomes are as follows:

a) If V2 and V3 are less than or equal to 10% of V1, the IRJ is satisfactory.

b) If V2 or V3 are between 11% and 50% of V1 then the IRJ is degrading and shall be monitored.

c) If V2 or V3 are greater than 50% of V1 then the IRJ has failed and shall be reported as requiring replacement.

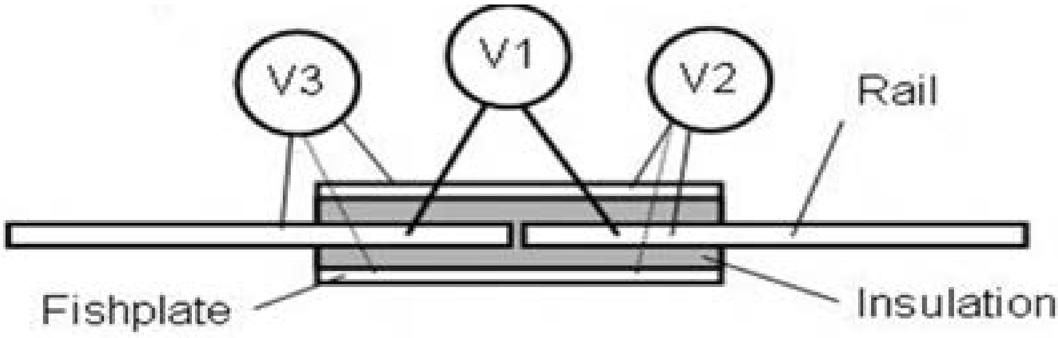


Figure 1 – Measurements V2 and V3 apply to both the inner and outer plates of the IRJ

3. Current Probe Test

3.1 Secure the probe connected to a digital meter around the rail adjacent to the IRJ and between the IRJ and any track connection.

3.2 Check the current value is less than 5mA.

3.3 If any readings are greater than 5mA or any other defects are noted, the joint is faulty and shall be reported. It is essential for the continued correct operation of the track circuit that the joint is repaired or replaced as soon as reasonably practicable.

4. Resistance checks

4.1 HVI tracks only: Power down prior to testing to prevent possible damage to meter.

4.2 Check test prods are sharp to improve electrical contact.

4.3 Remove any rail end burrs and visually inspect end post.

4.4 Remove any swarf or metallic debris.

4.5 Where possible use a shiny part of the wheel-rail contact area as a test point.

4.6 Where another surface is to be used, scrape contact surface and loop test with both prods to confirm good electrical contact before resistance testing is carried out.

4.7 Check that the resistance between each rail and the inner fishplate is at least 150ohms.

4.8 Check that the resistance between each fishplate bolt and the rail it bolts through is at least 150ohms.

4.9 Check that the resistance between each rail and the outer fishplate is at least 150ohms.

5. AC Track Circuits

This test is for use with IRJ's on 50Hz AC track circuits only.

Operational track circuits on the other side of the insulated rail joint can be AC, TI21, FS2600 or Reed type. HVI tracks should be powered down prior to testing to prevent possible damage to meter.

The test does not apply to insulated rail joints such as the Treble 6 or Permali that use split fishplates.

Use an AVO8 or similar low impedance moving coil type meter set to Ohms range. Electronic meters do not give good open circuit readings.

Test prods should be sharp to improve electrical contact.

5.1 Remove any rail end burrs and visually inspect end post. Remove any swarf or metallic debris.

5.2 Where possible use a shiny part of the wheel-rail contact area as a test point.

Where another surface is to be used, scrape contact surface and loop test with both prods to confirm good electrical contact before resistance testing is carried out.

5.3 Check that the resistance between each rail and the inner fishplate is at least 150Ω.

5.4 Check that the resistance between each inner fishplate bolt and the rail it bolts through is at least 150Ω.

5.5 Check that the resistance between each rail and the outer fishplate is at least 150Ω.

5.6 Check that the resistance between each outer fishplate bolt and the rail it bolts through is at least 150Ω.

5.7 If any readings are below 150Ω or any other defects are noted that part of the joint is faulty and shall be reported as a corrective maintenance item. It is essential for the continued correct operation of the track circuit that the joint is repaired or replaced as soon as reasonably practicable.

APPENDIX A - Photographic Examples of Insulated Block Joints

Figure 2 shows an IBJ in good condition (no lipping or contamination).

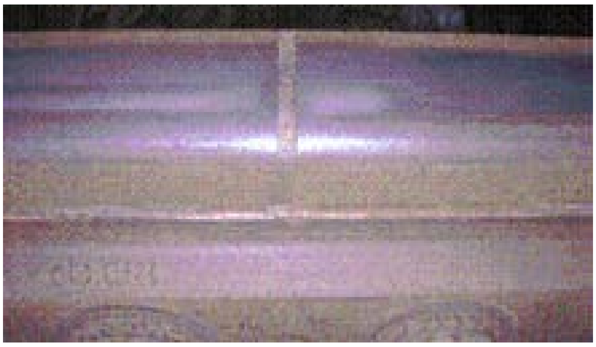


Figure 2 - Good Condition

Figure 3 shows how the wrong clips used can short circuit around the insulation.

Figure 3 – Wrong Clips

Figure 4 illustrates that the IBJ could not be installed correctly because the sleeper spacing is incorrect which places the baseplates in the wrong position and makes it impossible to fit one pair of Clips and Insulators.

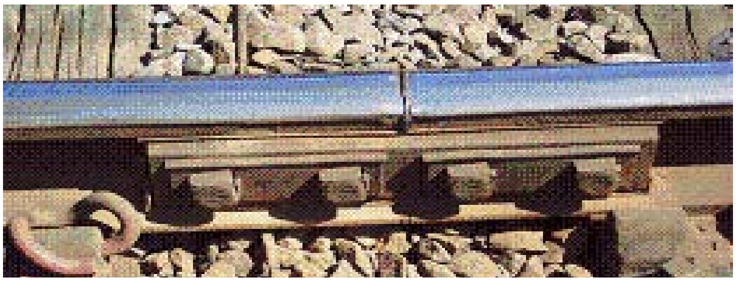


Figure 4 – Incorrect sleeper spacing

Figure 5 shows a lipped joint which causes a track circuit to fail and should be rectified when found

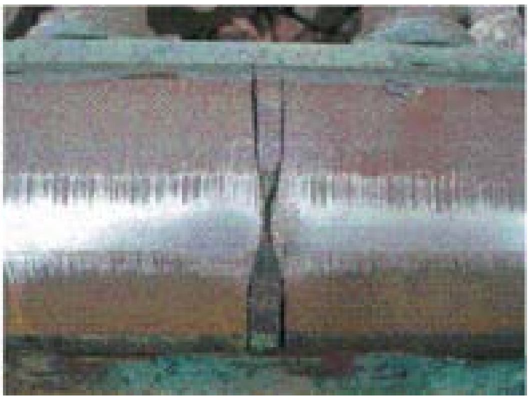


Figure 5 – Lipped Joint

Figure 6 shows a block joint suffering from metallic contamination which causes a track circuit and be rectified when found.

Figure 6 – Metallic Contamination

Figure 7 shows a joint with the end post missing. Often the bottom section of the end post can be found lying beneath the joint where it has been forced out. This causes a track circuit failure and needs rectifying as soon as possible

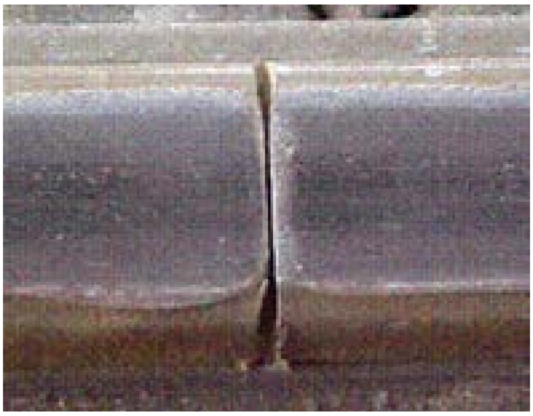


Figure 7 – End Post Missing

END

Includes:	AzL70 Single Rail Contacts with EAK Junction Box, AzL70 and AzL70/30 & AzL70/30S Double Rail Contacts with EAK30 Junction Box
Excludes:	All other types of AzLM and AzLE

Functional tests using the dummy wheel require protection/possession arrangements and liaison with the Signaller first.

These tests are required when the rail contacts are moved or re-aligned. They also usually form part of the annual test of axle counters.

Refer to NR/SMS/Appendix/15 for additional system details.

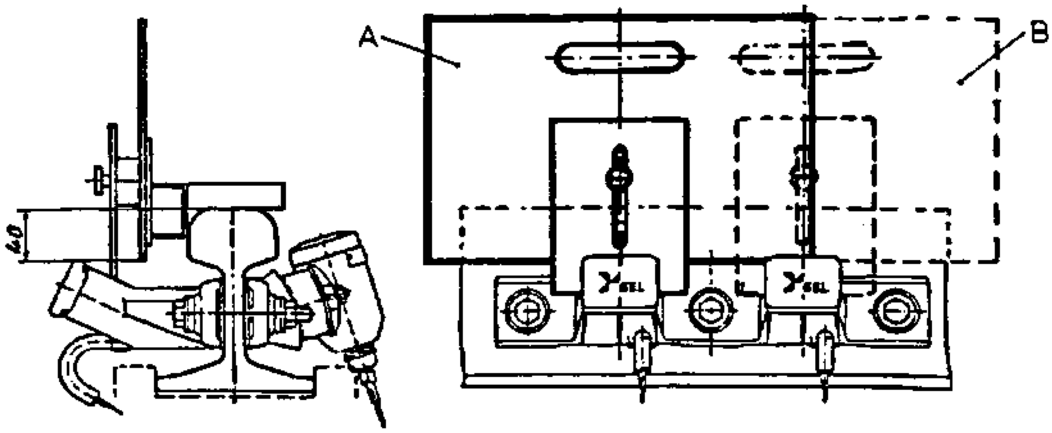


Figure 1 - Position of Dummy Wheel during Testing

Right hand diagram shows a side on view and the left shows the dummy wheel place over rail contact SK1(marked A) and over SK2 (marked B).

To simulate a wheel on an axle counter a dummy wheel supplied by the manufacturer is used. It consists of a metal plate with three plastic brackets.

The bottom edge of the plate is to be adjusted to 30mm for single rail contacts and 40mm for all double rail contacts.

The two brackets are swung out 90° to the metal plate and rest on the top rail.

The third bracket is flat and parallel to the metal plate. It holds the metal plate in the correct position by resting on one of the Rx coils to influence a count head or in double rail contacts across both Rx coils to influence both heads simultaneously.

If it is required to simulate several wheels passing over the rail contacts, loosen the knurled nut and raise the flat bracket so that it is clear of the Rx coils while the device is passing over the heads.

The cut out notch on the third bracket should be aligned with the center mark on the received head when readings are being taken.

All measurements shall be recorded on the record card.

<u>AzL70 Single Rail Contacts with EAK Junction Box (Only)</u>

1. Phase Reversal Test

1.1 Check that the cable cores on the power cable are twisted together. Also check that each Tx and Rx cable have their respective cores twisted together to the point 25mm of termination point.

1.2 Connect a meter to the terminations within the lineside amplifier with the +ve lead to AL4/3 and the –ve lead to AL4/4. Check the voltage is between 400mV to 600mV.

1.3 Insert the dummy wheel (adjusted to a depth of 30mm) over SK1 rail contact on the 6ft rail and check the reading is less than 50mV.

If this voltage reading is not achieved the count head will require adjusting up or down to obtain this.

1.4 Remove the dummy wheel from over SK1 count head and observe that the voltage reading returns to its original value.

1.5 Change the meter connections to the +ve lead to AL4/1 and the –ve lead to AL4/2 and repeat 1.1 to 1.3 with the dummy wheel over SK2 rail contact on the cess rail.

2. Adjustment of Count Heads

2.1 Note which step the relevant TX head is on, slacken the head adjusting bolts and move the head up or down one step.

2.2 Tighten the head adjusting bolts and repeat 1.1 and 1.2.

2.3 Compare the readings between 1.1 and 1.2, if the voltage is now less than 50mV go to 2.4. If the voltage is still outside this limit repeat 2.1

If after adjustments of the count head it is not possible to obtain a voltage of less than 50mV, obtain the lowest difference possible and inform your SM(S).

2.4 Check that after adjusting the rail contacts all adjusting nuts are tightened.

AzL70, AzL70/30, AzL70/30S Double Rail Contacts with EAK30 Junction Box (Only)

3. Phase Reversal Test

3.1 Check that the cable cores on the power cable are twisted together. Also check that each Tx and Rx cable have their respective cores twisted together to the point 25mm of termination point.

3.2 Connect either the Thales Test Unit (silver suitcase) or the BR designed lineside test switch box connected to a meter to the LtAnp card in the EAK30 junction box.

3.3 Select position 10 (MESSAB 1) on the switch box and check the reading is between +55mV to +1000mV.

3.4 Insert the dummy wheel (adjusted to a depth of 40mm) between SK1 TX/RX count head and check the reading is between -55mV to -1000mV.

3.5 Compare the readings between 3.2 and 3.3, if they are within 25mV of each other (with opposite polarities) proceed to 3.5. If the voltage is outside this limit go to section 4.

3.6 Select position 12 (MESSAB 2) and repeat sections 3.2 and 3.3 for the SK2 count head.

3.7 Compare the readings between 3.2 and 3.3, if they are within 25mV of each other (with opposite polarities) proceed to section 5 if the voltage is outside this limit go to section 4.

4. Adjustment of Count Heads

4.1 Note which step the relevant TX head is on, slacken the head adjusting bolts and move the head up one step if the positive reading was higher than the negative one, conversely move the head down one step if the positive reading was lower than the negative one.

4.2 Tighten the head adjusting bolts and repeat 3.2 and 3.3 remembering to select MESSAB 1 for head SK1 and MESSAB 2 for head SK2.

4.3 Compare the readings between 3.2 and 3.3, if they are now within 25mV of each other proceed to section 5. If the voltage is still outside this limit repeat 4.1.

If after adjustments of the count head it is not possible to obtain a voltage of less than 50mV, obtain the lowest difference possible and inform your SM(S).

4.4 Check that after adjusting the rail contacts all adjusting nuts are tightened.

5. Adjustment of PEGUE

5.1 Remove the dummy wheel from the count heads and select position 10 (MESSAB 1) on the test box and measure the reading.

5.2 Select position 11 (PEGUE 1) on the test box and if necessary, by means of the potentiometer on the SE01 card adjust the voltage until the PEGUE 1 reading is the same as the MESSAB 1 reading.

5.3 Repeat 5.1 using position 12 (MESSAB 2).

5.4 Repeat 5.2 using position 13 (PEGUE 2) and if necessary, adjusting the potentiometer on the SE02 card.

6. Output Voltage Checks

6.1 Observe that both green LEDs on the SE01 and 02 cards are lit (flashing on 70/30S), connect the meter to the LTG1 terminals on the lineside test box and select the AC voltage range.

6.2 Insert the dummy wheel at the SK1 head, observe the LED's on card SE01 shows red and SE02 is extinguished. Measure the output voltage and frequency and check the readings are as follows:

a) 400mV to 550mV AC @ 4.15 kHz ±2% (70/30).

b) 400mV to 550mV AC @ 2.04kHz ±2% (70/30S).

6.3 Move the dummy wheel to the SK2 head and observe the LED's now show SE01 extinguished and SE02 red. Measure the output voltage and frequency and check the readings are as follows:

a) 400mV to 550mV AC @ 5.06 kHz ±2% (70/30).

b) 400mV to 550mV AC @ 2.52kHz ±2% (70/30S).

6.4 Remove the dummy wheel and measure the output voltage, check the readings are as follows:

a) 700mV to 1100mV AC (70/30).

b) 600mV to 900mV AC (70/30S).

6.5 Place the dummy wheel over both count heads, observe that both red LED's are lit and the green LED's are extinguished. Measure the voltage at the LTG1 terminals on the test box and check it is less than 100mV AC.

If the voltage is greater than this, switch off the battery charger feeding the EAK and test again. If the voltage is still greater, the cause shall be investigated as corrective maintenance.

6.6 Remove the dummy wheel and observe that both the red LEDs are extinguished and both the green LEDs are lit (flashing on type 70/30S).

END

GENERAL

This test requires the use of the TCAID tester.

1. Preparations for Testing

1.1 Isolate track circuit supply.

1.2 Open the dis-box and, in turn, move each of the sliding links and secure in the open circuit position.

1.3 Fit the four coloured test leads into the TCAID tester matching coloured sockets.

2. Connecting the TCAID Tester

2.1 Connect the tester as shown below (Fig 1- non directional MOD 0-2 versions, Fig 2- non directional MOD 3 versions, Fig 3 – directional), checking that any un-terminated leads are isolated from each other and terminals / metalwork.

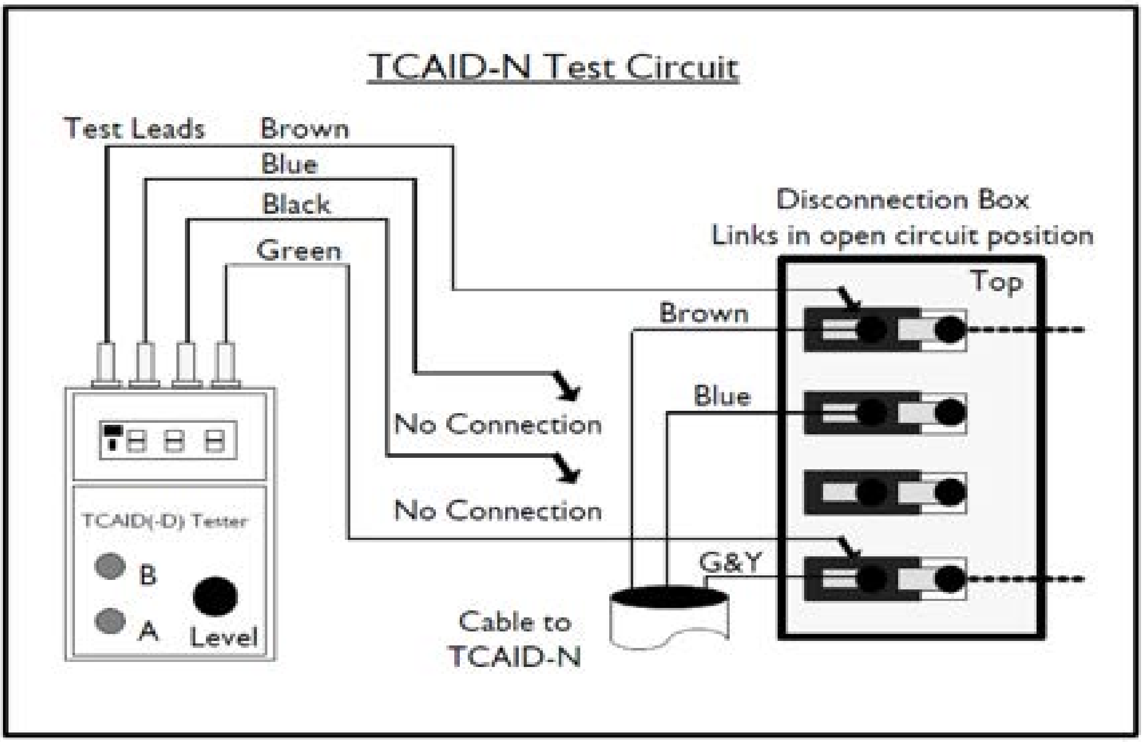


Figure 1 - Tester set up (non-directional) for MOD 0-2 versions

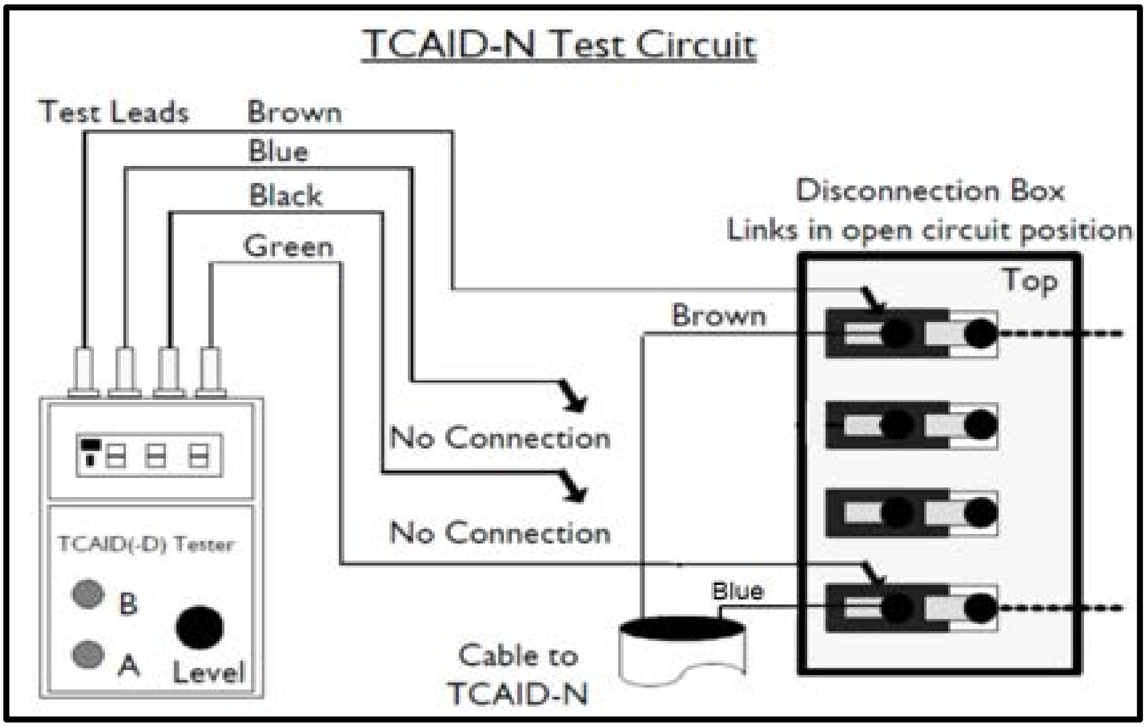


Figure 2 - Tester set up (non-directional) for MOD 3 versions

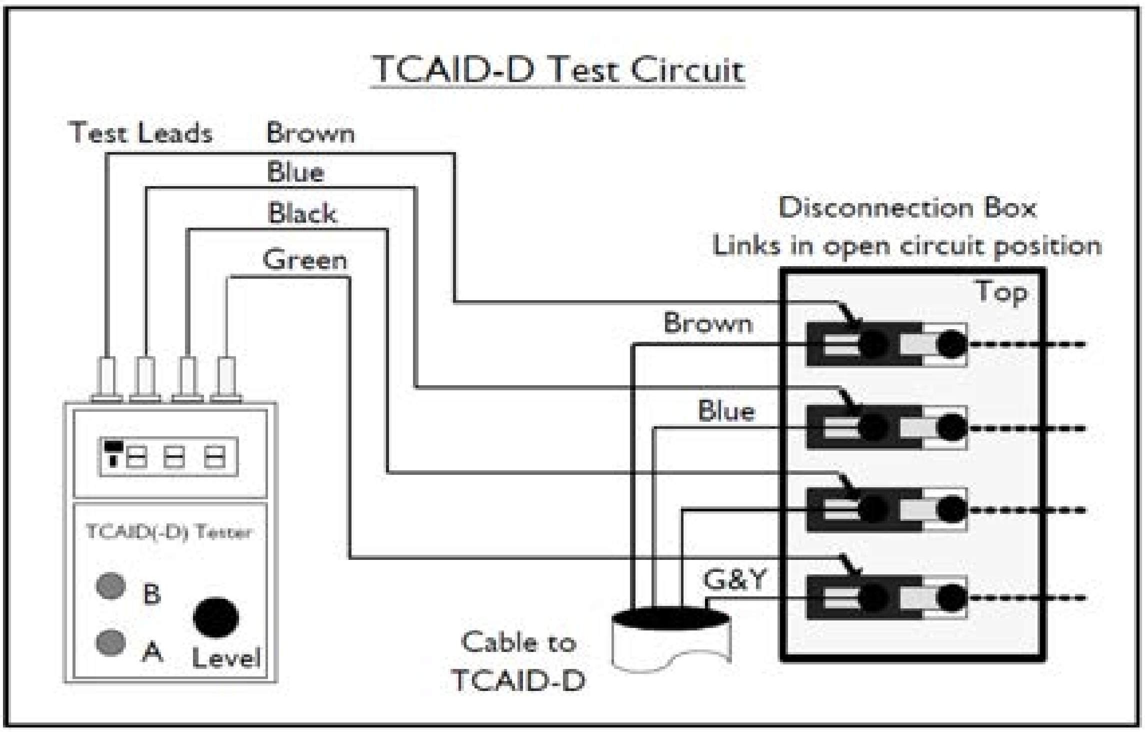


Figure 3 - Tester set up (directional) for all MOD versions

3. Test Procedure for all types of TCAID

A TCAID is only considered healthy if it passes all the tests described for it.

3.1 Using the TCAID tester rotate the level control fully anti-clockwise and press and hold down the PHASE A button - the display can become active.

The button shall be held down for the duration of the first part of the test. If the display goes blank, the test shall be re-started from step 3.1.

3.2 Slowly rotate the level control clockwise until the TCAID OPERATED symbol appears on the display. Note the reading on the display and check it is within the values shown in Table 1:

TCAID Type	Mk1	Mk2
TCAID-N Activates	325mV to 360mV	315mV to 385mV
TCAID-D Activates	405mV to 460mV	315mV to 385mV

Table 1 - Test Limits Activation

Readings outside these limits indicate a failed TCAID.

3.3 Slowly rotate the level control back (anti-clockwise) until the TCAID OPERATED symbol disappears. Note the reading on the display and check it is within the values shown in Table 2:

TCAID Type	Mk1	Mk2
TCAID-N De-Activates	335mV to 265mV	190mV to 270mV
TCAID-D De-Activates	300mV to 330mV	190mV to 270mV

Table 2 - Test Limits De-Activation

Readings outside these limits indicate a failed TCAID.

3.4 Compare the two readings; the first shall be greater than the second by at least 50mV.

The PHASE A button can now be released.

4. Additional test for TCAID-D only

4.1 Using the TCAID tester turn the level control fully anti-clockwise. Press and hold down the PHASE B button, the display becomes active.

The button shall be held down for the duration of the first part of the test. If the display goes blank, the test shall be re-started from Step 4.1.

4.2 Slowly rotate the level control clockwise until it reaches, the fully clockwise position. If at any time, the TCAID operated symbol appears on the display, the TCAID-D has failed the test and shall be considered faulty.

The PHASE B button can now be released.

5. Reconnection of the TCAID

5.1 When the TCAID has passed all the tests, the tester shall be disconnected and then the disconnection links individually moved back and secured in the closed-circuit position, starting from the top downwards.

5.2 Close and lock the disconnection box.

END

Includes:	Single arm (Cautor) and Double arm (Forfex) types
Excludes:	Any other type of mechanical or electronic treadle

This requires possession of the line, because connected control equipment activates. Re-set any effected controls after treadle timing (e.g. automatic level crossings).

The timing adjustment screw may be used to adjust the time. Do not over-tighten or remove the screw from the dashpot.

TESTS

1. Single Arm Treadles

1.1 Bridge out the normally made contacts with a meter set to mA.

1.2 Depress, release and time the movement of the operating arm to the normal position.

1.3 Check the time and adjust if required.

The time is normally 6-8 seconds but can vary at certain installations, refer to the diagrams.

1.4 Remove the meter bridging connection.

2. Double Arm Treadles

2.1 Bridge out the normally made contacts with a meter set to mA.

2.2 Depress and hold down operating arm ‘1’.

2.3 Depress, release, and time the movement of the operating arm ‘2’ to the normal position.

2.4 Check the time and adjust as required.

The time is normally 6-8 seconds but can vary at certain installations, refer to the diagrams.

Adjust arm 2 adjustment screw, as shown in Appendix A.

2.5 Repeat the procedure for the other arm, i.e. hold down arm ‘2’ whilst timing arm ‘1’.

2.6 Depress both arms fully and release simultaneously. The time between simultaneously releasing the arms and the point at which the control rod falls to the bottom of the ‘V’ shall be within 6 to 10 seconds, regardless of the order in which the arms are lowered.

a) If either of the values is lower (or higher) than this, screw up (unscrew) the adjustment screw for the last arm lowered (arm 2 for direction 1 to 2).

b) If both values are lower (or higher) adjust both of the screws.

2.7 Remove the meter bridging connection.

APPENDIX A - Timing Adjustments

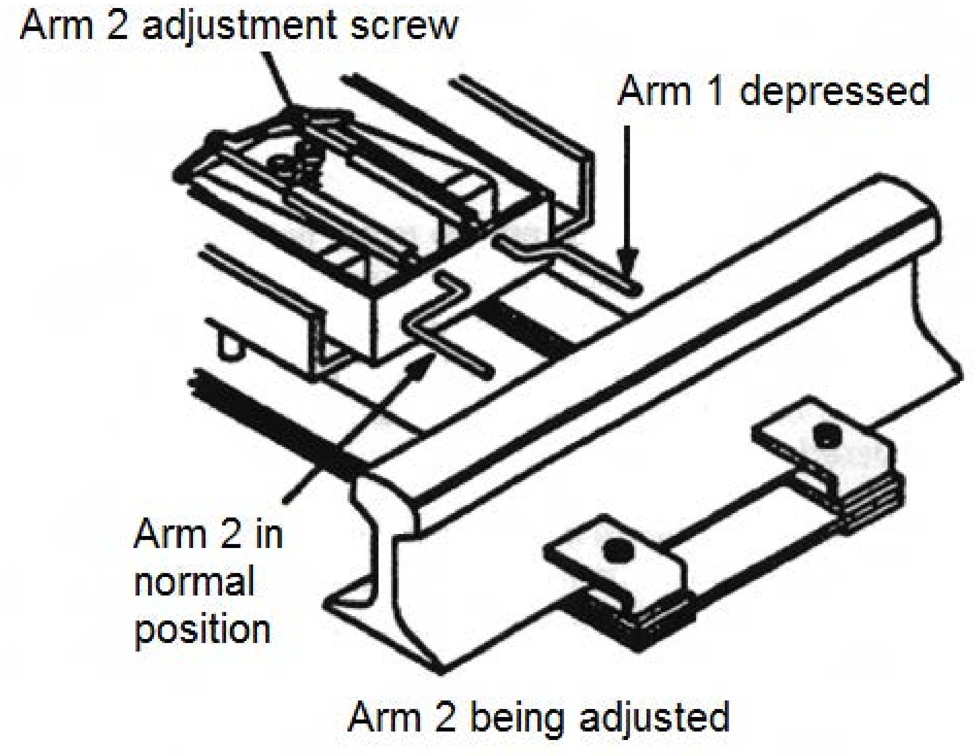


Figure 1 - Timing Adjustments on a Double Arm Treadle

END

Includes:	All AzLM Rail Contacts
Excludes:	All other types of AzL Rail Contact

GENERAL

Functional tests using the dummy wheel shall require relevant protection/possession arrangements and liaison with the Signaller.

These tests are required when the rail contacts are moved or re-aligned. They also usually form part of the annual test of axle counters.

Refer to NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems) for additional system details.

All measurements are to be recorded on the appropriate paper or digital record card.

1. SK30H Dummy Wheel Positioning

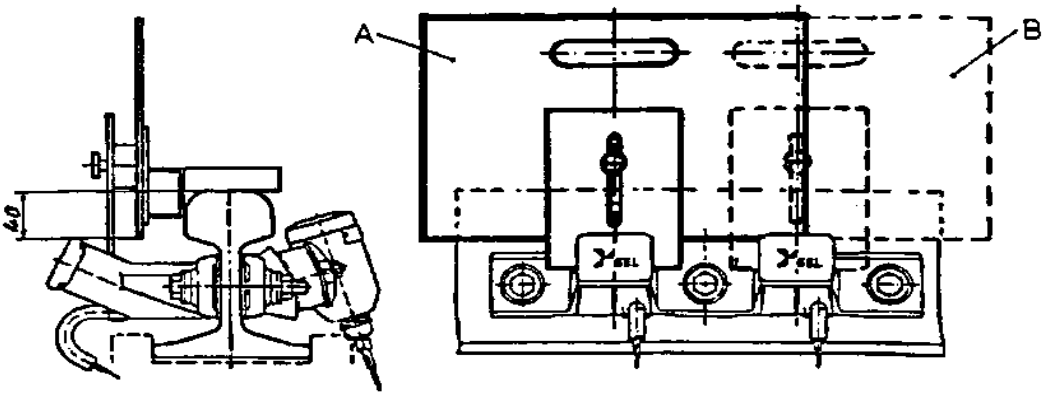


Figure 1 - Position of Dummy Wheel during Testing SK30H

Figure 1 left hand diagram shows a side on view and the right shows the dummy wheel placed over rail contacts SK1(marked A) and over SK2 (marked B).

2. SK30K Dummy Wheel Positioning

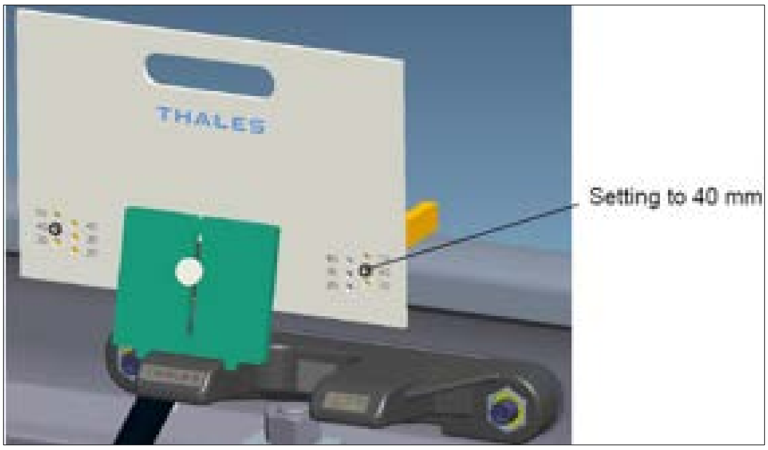


Figure 2 - Position of Dummy Wheel during Testing SK30K

3. All Rail Contacts

To simulate a wheel on an axle counter a dummy wheel supplied by the manufacturer is used. It consists of a metal plate with three plastic brackets.

The bottom edge of the plate is to be adjusted to 40mm for all double rail contacts.

The two brackets are swung out 90° to the metal plate and rest on the top rail.

The third bracket is flat and parallel to the metal plate. It holds the metal plate in the correct position by resting on one of the Rx coils to influence a count head

If it is required to simulate several wheels passing over the rail contacts, loosen the knurled nut and raise the flat bracket so that it is clear of the Rx coils while the device is passing over the heads.

The cut out notch on the third bracket should be aligned with the center mark on the received head when readings are being taken.

4. General Information Relating to SK30H Count Heads

The detection points for AzLM axle counters are fitted with a circuit to detect “drift” in each of the rail contacts.

On earlier versions of the Analogue card and ACE software a problem was identified where drift warnings can become stuck and continue to be reported after the fault has been cleared.

These faults are characterized by the History file downloaded from the Evaluator showing repeated, identical drift warnings every 5 minutes. This is no longer a requirement from ACE software version 6.1.3.

It is possible to fit an SK30K to an EAK30H with a new analogue card.

The SK30K has no mechanical setup and is set up using the potentiometers in the EAK only.

The set-up procedure can cause the associated sections (s) to become disturbed. Therefore, the appropriate protection/possession shall be agreed prior to work commencing

The dummy wheel 3JA 84532 AAAA is suitable for all rail contacts, Sk30, Sk30H and Sk30K

The former dummy wheel 19982 3100x is NOT suitable for Sk30K rail contacts.

5. Set up Procedure for EAK 30 H with SK30H:

A tested ESD strap shall be used to prevent damage to PCB's.

The three M12 rail mounting bolts shall be torqued to 45Nm.

5.1 Before making any adjustments to the SK30H: Using a multi-meter set to ohms, measure the resistance between each of the rail mounted RX heads and the running rail, and RX heads to the M12 bolts. If the resistance is below 2M ohms the rail mountings need to be cleaned or replaced

5.2 Check that the Evaluator (Digital) and analogue cards are fully home in the EAK sub rack if applicable.

5.3 Plug in the Thales 'Axle Counter Test Box' to the EAK.

5.4 Check that the cable cores on the power cable are twisted together. Also check that each Tx and Rx cable have their respective cores twisted together to the point 25mm of termination point.

Select switch position 3 on the test box to measure stabilised power channel 1 and switch position 4 to measure stablised power channel 2 and check they are both between 22Vdc and 35Vdc. If either of them is out of this range then there is a potential fault with the analogue card and this shall be replaced.

Inside the `Axle Counter Test Box`, select switch position 10, SK1 Received Rectified Voltage (+ve MESSAB 1) which shall be between +80 mV DC and +1000mV DC.

Place the dummy centrally over RX1 and measure –ve MESSAB 1, which shall be between -80 mV DC and -1000mV DC i.e. with the same amplitude but opposite polarity as the received rectified signal with no dummy wheel present (+ve MESSAB 1).

5.5 Compare the reading taken in step 4 and 5 these shall be within 10mv of each other (+ve MESSAB 1 shall be slightly higher), if it is proceed to step 5.13.

5.6 Reset the potentiometer R2 until the voltage +ve MESSAB 1 has its greatest value.

5.7 Undo the M8 nuts and adjust the TX head up / down until +ve MESSAB 1 and –ve MESSAB 1 are as near the same amplitude as possible. The +ve MESSAB shall be higher than the –ve MESSAB.

5.8 The rail contactor shall not touch the head of the rail.

5.9 The M8 nuts shall be re-tightened to a Torque setting of 25Nm.

5.10 If, after adjusting the TX head, the difference between +ve MESSAB 1 and –ve MESSAB 1 is more than 10mv then adjust R2 until +ve MESSAB 1 and –ve MESSAB 1 are within 10mv.

5.11 Check the +ve MESSAB is higher than the-ve MESSAB.

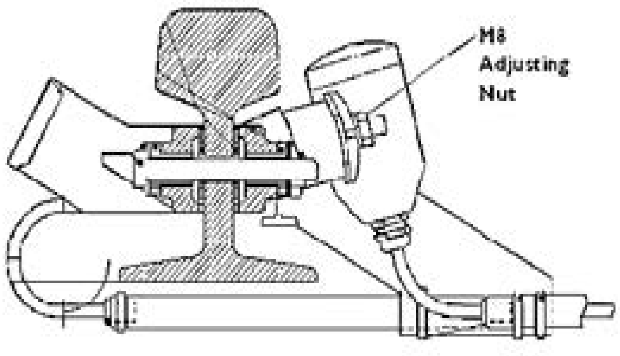


Figure 3 - SK30H M8 Adjustment nuts

5.12 Inside the `Axle Counter Test Box`, select switch position 11, reference voltage (PEGUE 1). Adjust potentiometer R1 (PEGUE 1) so that the reading is equal to +ve MESSAB 1 +/- 2%.

5.13 Check that that green LED H1/2 is flashing continuously.

5.14 Inside the `Axle Counter Test Box`, select switch position 12, SK2 Received Rectified Voltage (+ve MESSAB 2) which shall be between +80 mV DC and +1000mV DC.

5.15 Place the dummy centrally over RX2 and measure –ve MESSAB 2, which shall be between -80 mV DC and -1000mV DC i.e. with the same amplitude but opposite polarity as the received rectified signal with no dummy wheel present (+ve MESSAB 2).

5.16 Compare the reading taken in step 14 and 15 these shall be within 10mv of each other (+ve MESSAB 2 shall be slightly higher), if it is proceed to step 5.24

5.17 Reset the potentiometer R4 until the voltage +ve MESSAB 2 has its greatest value.

5.18 Undo the M8 nuts and adjust the TX head up / down until +ve MESSAB 2 and –ve MESSAB 2 are as near the same amplitude as possible. The +ve MESSAB shall be higher than the –ve MESSAB.

5.19 The rail contactor shall not touch the head of the rail.

5.20 The M8 nuts shall be re-tightened to a Torque setting of 25Nm.

5.21 If, after adjusting the TX head, the difference between +ve MESSAB 2 and –ve MESSAB 2 is more than 10mv then adjust R4 until +ve MESSAB 2 and –ve MESSAB 2 are within 10mv.

5.22 Check the +ve MESSAB is higher than the-ve MESSAB.

5.23 Inside the `Axle Counter Test Box`, select switch position 13 reference voltage (PEGUE 2).

5.24 Adjust potentiometer R3 (PEGUE 2) so that the reading is equal to +ve MESSAB 2 +/- 2%.

5.25 Check that green LED H2/2 is flashing continuously.

5.26 Measure the voltage and frequency of SK1 and SK2.

* Range (A): Analogue cards before version 3CR 01836 AEAA.

** Range (B): Analogue cards including and after version 3CR 01836 AEAA.

Test	Terminals	Range (A) *	Range (B) **
SK1 Voltage	Sk1/S1	40V to 64V AC	40V to 85V AC
SK1 Freq.	Sk1/S2	30 to 31.25kHz	29.8 to 31.3kHz
SK2 Voltage	Sk2/S1	40V to 64V AC	40V to 85V AC
SK2 Freq.	Sk2/S2	27.4 to 28.6kHz	26.8 to 28.6kHz

Table 1 - The Voltage and Frequencies Ranges of the Rail Contacts

6. Setting up and Adjustment of EAK 30H with SK30K Count Heads

A tested ESD strap shall be used to prevent damage to PCB's.

The two M12 rail mounting bolts shall be torqued to 58Nm.

6.1 Check that the Evaluator (Digital) and analogue cards are fully home in the EAK sub rack if applicable.

6.2 Plug in the Thales 'Axle Counter Test Box' to the EAK.

6.3 Check that the cable cores on the power cable are twisted together. Also check that each Tx and Rx cable have their respective cores twisted together to the point 25mm of termination point.

6.4 Check the silica / desiccant bag is not saturated with water and is fitted to each EAK.

6.5 Select switch position 3 on the test box to measure stabilised power channel 1 and switch position 4 to measure stablised power channel 2 and check they are both between 22Vdc and 35Vdc. If either of them are out of this range then there is a potential fault with the analogue card and this shall be replaced.

6.6 Inside the `Axle Counter Test Box`, select switch position 10, SK1 Received Rectified Voltage (+ve MESSAB 1) which shall be between +80 mV DC and +1000mV DC.

6.7 Place the dummy centrally over RX1 and measure –ve MESSAB 1, which shall be between -80 mV DC and -1000mV DC i.e. with the same amplitude but opposite polarity as the received rectified signal with no dummy wheel present (+ve MESSAB 1).

6.8 If the difference between +ve MESSAB 1 and –ve MESSAB 1 is more than 10mv then adjust R2 until +ve MESSAB 1 and –ve MESSAB 1 are within 10mv.

6.9 Check the +ve MESSAB is higher than the-ve MESSAB.

6.10 Inside the `Axle Counter Test Box`, select switch position 11, reference voltage (PEGUE 1). Adjust potentiometer R1 (PEGUE 1) so that the reading is equal to +ve MESSAB 1 +/- 2%.

6.11 Check that that green LED H1/2 is flashing continuously.

6.12 Inside the `Axle Counter Test Box`, select switch position 12, SK2 Received Rectified Voltage (+ve MESSAB 2) which shall be between +80 mV DC and +1000mV DC.

6.13 Place the dummy centrally over RX2 and measure –ve MESSAB 2, which shall be between -80 mV DC and -1000mV DC i.e. with the same amplitude but opposite polarity as the received rectified signal with no dummy wheel present (+ve MESSAB 2).

6.14 If the difference between +ve MESSAB 2 and –ve MESSAB 2is more than 10mv then adjust R4 until +ve MESSAB 2 and –ve MESSAB 2 are within 10mv.

6.15 Check the +ve MESSAB is higher than the-ve MESSAB.

6.16 Inside the `Axle Counter Test Box`, select switch position 13, reference voltage (PEGUE 2). Adjust potentiometer R3 (PEGUE 2) so that the reading is equal to +ve MESSAB 2 +/- 2%.

6.17 Check that green LED H2/2 is flashing continuously.

6.18 Measure the voltage and frequency of SK1 and SK2.

* Range (A): Analogue cards before version 3CR 01836 AEAA.

** Range (B): Analogue cards including and after version 3CR 01836 AEAA.

Test	Terminals	Range (A) *	Range (B) **
SK1 Voltage	Sk1/S1	40V to 64V AC	40V to 85V AC
SK1 Freq.	Sk1/S2	30 to 31.25kHz	29.8 to 31.3kHz
SK2 Voltage	Sk2/S1	40V to 64V AC	40V to 85V AC
SK2 Freq.	Sk2/S2	27.4 to 28.6kHz	26.8 to 28.6kHz

Table 2 - The Voltage and Frequencies Ranges of the Rail Contacts

7. Setting up and Adjustment of EAK 30K with SK30K Count Heads

A tested ESD strap shall be used to prevent damage to PCB’s.

The molded TX cable is always connected to SK1 inside the rail sensor if the direction needs to be change this can be achieved be adjusting the ARD plug (X600).

EAK Switches

The switches S1 and S2 shall be set to position 1 to activate the electrical adjustment. S3 should be set to H (For High), see Figure 4.

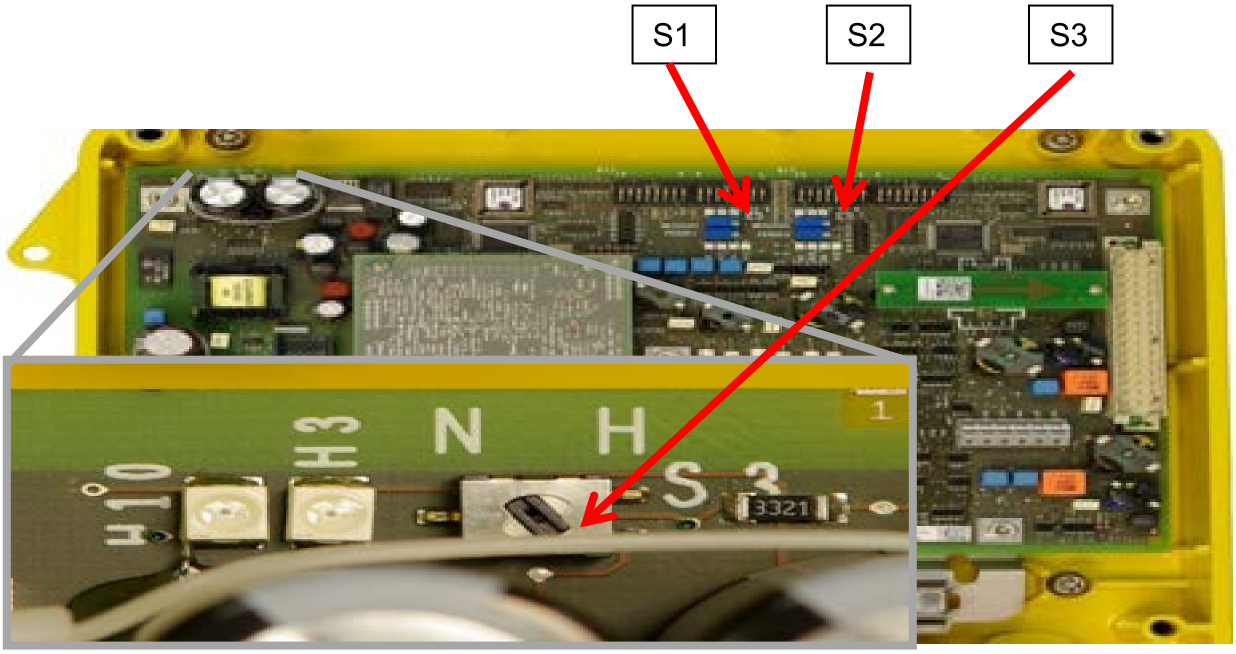


Figure 4 – Inside of the EAK

7.1 Check that the cable cores on the power cable are twisted together. Also check that each Tx and Rx cable have their respective cores twisted together to the point 25mm of termination point.

7.2 Check the silica / desiccant bag is not saturated with water and is fitted to each EAK.

7.3 Select switch position 3 on the test box to measure stabilised power channel 1 and switch position 4 to measure stablised power channel 2 and check they are both between 22Vdc and 35Vdc. If either of them is outside of this range then there is a potential fault with the analogue card and this shall be replaced.

7.4 Inside the `Axle Counter Test Box`, select switch position 10, SK1 Received Rectified Voltage (+ve MESSAB 1) which shall be between +80 mV DC and +1000mV DC.

7.5 Place the dummy centrally over RX1 and measure –ve MESSAB 1, which shall be between -80 mV DC and -1000mV DC i.e. with the same amplitude but opposite polarity as the received rectified signal with no dummy wheel present (+ve MESSAB 1).

7.6 If the difference between +ve MESSAB 1 and –ve MESSAB 1 is more than 10mv then adjust R2 until +ve MESSAB 1 and –ve MESSAB 1 are within 10mv.

7.7 Check the +ve MESSAB is higher than the-ve MESSAB.

7.8 Inside the `Axle Counter Test Box`, select switch position 11, reference voltage (PEGUE 1). Adjust potentiometer R1 (PEGUE 1) so that the reading is equal to +ve MESSAB 1 +/- 2%.

7.9 Check that green LED H1 is flashing continuously.

7.10 Inside the `Axle Counter Test Box`, select switch position 12, SK2 Received Rectified Voltage (+ve MESSAB 2) which shall be between +80 mV DC and +1000mV DC.

7.11 Place the dummy centrally over RX2 and measure –ve MESSAB 2, which shall be between -80 mV DC and -1000mV DC i.e. with the same amplitude but opposite polarity as the received rectified signal with no dummy wheel present (+ve MESSAB 2).

7.12 If the difference between +ve MESSAB 2 and –ve MESSAB 2 is more than 10mv then adjust R4 until +ve MESSAB 2 and –ve MESSAB 2 are within 10mv.

7.13 Check the +ve MESSAB is higher than the-ve MESSAB.

7.14 Inside the `Axle Counter Test Box`, select switch position 13, reference voltage (PEGUE 2). Adjust potentiometer R3 (PEGUE 2) so that the reading is equal to +ve MESSAB 2 +/- 2%.

7.15 Check that green LED H2 is flashing continuously.

7.16 Measure the voltage and frequency of SK1 and SK2, see Table 3.

Test	Terminal Block X106	Terminal Block X106 with Rail Contact Adapter	Reading
SK1 Voltage	Black & White 1 & 2	1 & 3	40V to 85V AC
SK1 Freq.			29.8 to 31.3kHz
SK2 Voltage	Yellow & Brown 7 & 8	6 & 8	40V to 85V AC
SK2 Freq.			26.8 to28.6kHz

Table 3 - The Voltage and Frequencies Ranges of the Rail Contacts

END

High voltages are present in the camera housing, extreme caution shall be taken (See NR/SMS/ EL00 Hazards Associated with Electrical Supplies).

Always obtain permission of the signaller before lowering or adjusting the camera.

Check that the signaller is using the camera that is not under test.

General

Only the Marconi V327 camera has a Camera Control Unit (CCU).

At some locations this is positioned with the camera, which requires it to be lowered first to gain access to the unit, otherwise the CCU will be accessible in the camera rack in the equipment room.

Installations using CCD cameras (e.g. Grundig) and Marconi V332 or Pye super lynx will not have this unit.

Most installations will have a Video Relay and Test Unit (VRTU).

The signaller's controls will override any that are selected on the VRTU. If this unit is not provided connection will have to be obtained via the camera coaxial lead (this will disable the camera from the signaller's control) and function tests on the equipment will have to be performed from the monitoring point.

Equipment Required

- TV Monitor.
- Oscilloscope (Not required for CCD camera's) (A general purpose TV type is suitable).
- BNC leads and BNC 'T' connectors.

1. Maintenance Test

Installations with a combined CCU or CCD cameras and no VRTU

1.1 Connect the test equipment (monitor or oscilloscope) using the BNC leads and connectors to the test socket (were provided) or to the camera coax lead.

1.2 Obtain a picture on the monitor and trace on the oscilloscope by operation of the appropriate test switches (where provided) or by request to the signaller.

Installations with a separate CCU and a VRTU

1.3 Connect the test equipment (monitor and oscilloscope) using the BNC leads and connectors to the video test socket on the VRTU. Obtain a picture and trace by operation of 'On Test' and 'Picture' buttons.

Vidicon cameras require a period of time to 'warm up' before a picture or trace is obtained.

All Installations

1.4 Check (where provided) that on operation of the push buttons on the VRTU the internal illuminations function.

1.5 Check that 'In Use' indication illuminates when that particular camera is selected by the signaller.

1.6 Check (where provided) the operation of the shutter by use of the 'Shutter' button on the VRTU or by selection by the signaller.

1.7 Set the camera for night time viewing by operation of the 'Iris' button on the VRTU or by selection by the signaller. Check the picture remains in focus.

1.8 Examine the resolution (picture detail) in each corner and the centre of the picture.

Crossing fencing can be used the check the horizontal resolution and the running rails the vertical resolution.

If the picture resolution is not satisfactory, the electrical focus, beam or black level may require adjustment. Refer to Appendix B for details of these adjustments.

CCD cameras do not have these adjustments therefore the camera itself may have to be replaced to resolve any problems.

1.9 Set the camera back to daytime viewing by operation of the 'Iris' button or by selection by the signaller and Check the following items:

- The area of the crossing between the barriers is clearly defined.
- The road stop lines (where provided) are clearly visible.
- The crossing area is reasonably central in the picture without the presence of a skyline.
- The picture is complete and without any vertical or horizontal disturbance and is a good representation of the crossing scene.
- The field of view is not obstructed by the camera housing, screen wiper or shutter.
- There is not any streaking, flaring, ringing or negative image on any part of the picture.
- Moving objects do not smear and any small objects (e.g. children) are clearly discernible.

Some cameras are fitted with 'Fisheye' lenses that will give a greater view of the crossing area with a slight proportional distortion.

1.10 Operate the shutter on the camera and set the monitor contrast to maximum.

This will give an image of the Vidicon tube faceplate image burn. If this is found to be severe, arrangements should be made to replace the camera.

1.11 Lower the camera and open the housing. Check the following items (these tests are not applicable to CCD cameras):

- Correct operation of the lens motor by operation of the 'Iris' button or by request to the signaller.
- The settings of the iris are at f/5.6 for daytime and f/1.4 for night time.
- The lens motor limit switches and contact pillars are secure.
- When on night time setting the iris is fully open and does not obstruct the lens aperture in any way.
- When on daytime setting the iris is closed to a aperture of no smaller than 3mm diameter.

Take care when conducting these tests and do not touch the lens or the adjacent heater.

1.12 Close the camera housing and raise the camera.

1.13 Obtain a trace of the composite video signal on the oscilloscope. Check that the values of the signal components are as given in Appendix A. Adjustments to the signal components are given in Appendix B. No adjustments are possible on CCD cameras.

1.14 At the monitoring point check that a satisfactory picture is obtained on the signallers monitor (to correctly set up a monitor see Appendix C).
In liaison with the signaller check the following:

- A person standing at and walking between each corner of the crossing is clearly visible.
- The selections of lens and wiper controls are effective.
- The wiper when switched off parks correctly outside the field of view.
- Check that all functions work correctly on the alternative monitor.

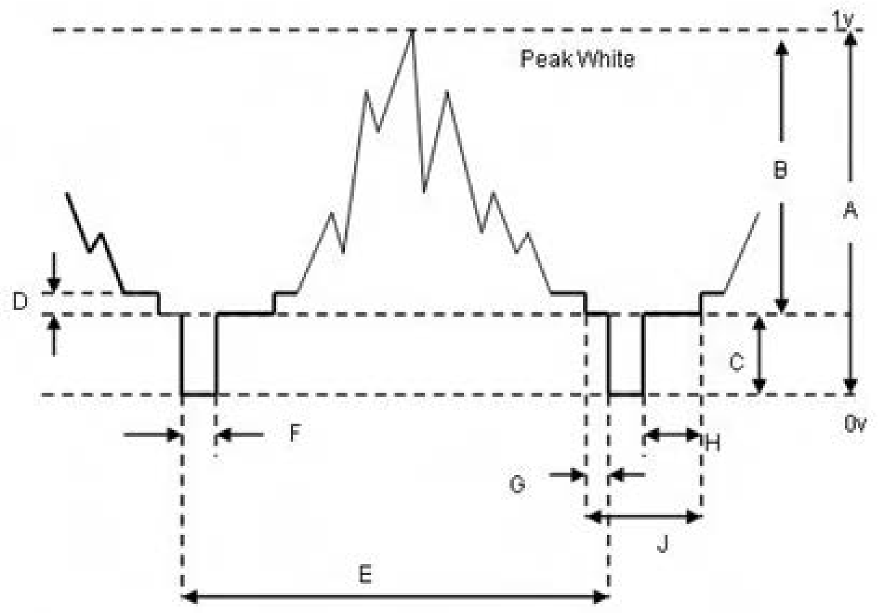
1.15 Repeat 1.1 to 1.14 for the other camera.

1.16 On completion of testing, check that on the VRTU the ‘On Test’ button is left deselected. If left selected the camera will always be ‘On’ even if it is not selected by the signaller.

1.17 Arrange for a check on the quality of the pictures from both cameras during the hours of darkness.

APPENDIX A

Composite Video Signal



A. Composite video signal 1v peak-to-peak (100%).

B. Video component of signal 0.7v (70%).

C. Sync component of signal 0.3v (30%).

D. Black Level 50mV.

E. Complete Line period 64µs

F. Line Synchronising pulse 5µs.

G. Front porch 1.5µs

H. Back porch 7µs

I. Line blanking interval 12µs.

The composite video signal consists of a video signal that has had synchronising pulses added. The ratio of amplitude of video to sync can vary but in the standard 1volt peak-to- peak composite video it is 70:30.

If the sync component of the signal is set at 0.3v then the maximum amplitude of the video will be 0.7v, so that the peak white is at the 1v level and correspondingly the bottom of the sync pulse is at 0v.

APPENDIX B

Focus Adjustment

Set the lens to infinity. Adjust mechanically the Vidicon racking (yoke focus adjusting screw and lock nut) lens screws or lens mount as appropriate.

Obtain the optimum focus by sliding the assembly forwards or backwards then retighten all the fastenings. Set the lens back to its original setting.

If a satisfactory focus cannot be achieved by this method, adjust the electrical focus on the camera or CCU in addition to the mechanical focus to obtain the optimum focus.

Beam Adjustment

This control adjusts the number of electrons forming the beam. Firstly, turn the control on the camera or CCU anti- clockwise to remove the entire picture.

Then slowly advance the control clockwise until all the picture detail including highlights (white portions of the picture) are clearly defined, then advance the control a further 30° or until the focus begins to deteriorate (whichever is sooner).

On the oscilloscope, the video component of the displayed signal should be 0.7v (70%) of the 1v peak-to-peak composite video signal.

Black Level Adjustment

This control affects the processing of the video signal from the target. It operates by cutting off any voltage below a certain level (Black).

It controls the DC level of the darkest part of the waveform with respect to the blanking level (sync pulse base line). It should be adjusted to be 50mV above the blanking level.

On a monitor, this should give detail in the darkest areas of the picture.

Target Bias Adjustment

This control sets the maximum electrical sensitivity of the vidicon tube. If it is set to high, it will allow rapid vidicon ‘image’ burn.

Adjust only with reference to the cameras manufacture’s manual

All adjustments need to be a compromise between correct voltage levels and optimum displayed picture.

APPENDIX C

Monitor Setting Up Procedure

1. Obtain a picture on the monitor. Check the pilot light (if fitted) is illuminated.

2. Set the Brightness and Contrast controls fully anti- clockwise.

3. Advance the Brightness control slowly clockwise until the raster is just visible.

   The raster is the structure of the scanning lines without a visible picture (on most monitors)

4. Advance the Contrast control slowly clockwise until a satisfactory picture is obtained with the highlight details still clearly visible.

   Note that the setting of these controls may vary between individual viewers.

5. Check that the monitor coaxial output is terminated with a 75Ω BNC terminating plug or (if provided) the switch is set to 75Ω.

6. Only where external controls are provided adjust the following to obtain a satisfactory picture:

   - Vertical Hold.
   - Horizontal Hold.
   - Focus.
   - Scan.
   - Sync.
   - Height.

If a satisfactory picture cannot be obtained on a monitor after setting up, it should be replaced. No attempt is to be made to make adjustments within the monitor housing.

End

ANALOGUE HIGH FREQUENCY SYSTEMS

There are several different types of High Frequency (HF) Transmission systems covered by this SMS. Conventional systems include Marconi, Rediffusion, and Philips. Phillips uses Frequency Modulation (FM) while the others use Amplitude Modulation (AM)).

Although the modulation differs between these makes, the principle of operation remains the same for all. The Baseband signal from a CCTV camera is very wideband ranging from 20Hz to over 5MHz.

This signal will not travel far along a cable before the high frequency portions attenuate leaving only the lower frequencies. Simple amplification cannot recover the distorted signal. If the distance between crossing and Signalbox is over 4Km the practice was to install a dedicated HF carrier system from one of the companies above.

The HF system reduces the problem from higher frequencies attenuating faster and makes the transmission system workable up to maximum distances around 30-50Km depending on the system used.

Line Amplifiers are still needed every 3-4Km to boost the signal. An oscilloscope is always needed to monitor both the HF and video signals. A TV monitor can only be connected where there is a “Demodulated” output. There is always a Demodulated output at the signal box end for the Signaller but most HF systems had no intermediate demodulated output at line amplifiers.

The exception is the Marconi HF system which used the same item of equipment as both a line amplifier and as the final “Demodulator” at the Signalbox.

On these systems there is a demodulated output available at each line amplifier that can be used for setting up and fault finding. Some systems have a simple LED indication on the front if the signal level being received is sufficient. This can generally be a help for tracing faults, but can be fooled in certain cases by excessive noise in the system.

Testing and fault finding should generally proceed from the TX end to the RX end. It is advisable to use a pattern generator for the tests on the transmission system rather than relying on a camera picture.

On these systems, the tests will require a possession of the CCTV system.

OPTICAL SYSTEMS

The Coe 300 system uses an optical fibre cable to link the transmitter and receiver of the system; the signals are transmitted by laser technology via a HF FM carrier at 400MHz.

Because of the technology of this system, it differs in its method of operation from the ‘conventional’ systems (no repeaters required for long distances) required for making the system more efficient and reliable and also requiring less maintenance.

GENERAL TEST EQUIPMENT REQUIRED FOR ALL CONVENTIONAL HF SYSTEMS

- Suitable multi-range meter.
- TV Monitor.
- Oscilloscope (Usually 20MHz Bandwidth, but Rediffusion Mk13 up to 50MHz)
- BNC leads and BNC ‘T’ connectors.
- 75ohms BNC terminator plug.
- Insulation tester.
- A monochrome TV pattern generator producing a 1V peak-to-peak/75Ω staircase video signal or similar.

When connecting the oscilloscope to take measurements, it should be done using the BNC ‘T’ piece and the 75Ω terminator plug.

MARCONI / GEC 14.5MHZ AM HF SYSTEM

Details of expected waveforms are in the typical voltage/waveform section.

1. Transmitter (Level Crossing) End

1.1 Check the supply voltage and ripple voltage from the power supply units to the modulator and (if fitted) launch amplifier:

a) Modulator voltage - 12vDC ±0.25V DC, Ripple voltage <50mV (pk-pk).

b) Launch Amp – 28V or 24V DC ±0.25V DC, Ripple voltage <50mV (pk-pk).

1.2 Check any LED indications are correctly illuminated. Power, Carrier etc.

1.3 Disconnect the camera input to the modulator and Check by means of the oscilloscope carrier output signal.

1.4 Connect the TV pattern generator to the modulator input and Check by means of the oscilloscope and/or the monitor the input signal.

1.5 Check by means of the oscilloscope the output signal from the modulator. Check there is no ripple present.

1.6 If fitted Check by means of the oscilloscope the output signal from the launch amplifier. Check there is no ripple present.

1.7 If any of the signals/waveforms are not as depicted in the appendices, the cause will be required to be investigated and rectified before proceeding with the test.

2. Line Amplifiers(s) (If Provided)

2.1 Check at each line repeater location the supply voltage and ripple voltage from the power supply unit to the Line amplifier and (if fitted) launch amplifier:

a) Line Amp - 12vDC ±0.25V DC, Ripple voltage <50mV (pk-pk).

b) Launch Amp – 28V or 24V DC ±0.25V DC, Ripple voltage <50mV (pk-pk).

2.2 Check any LED indications are correctly illuminated. Power, Carrier etc.

2.3 Check by means of the oscilloscope the input and output signal to/from the line amplifier and launch amplifier (if fitted). Check there is no ripple present.

2.4 If a video output socket is available, Check with the monitor the quality of the received video.

2.5 If any of the signals/waveforms are not as depicted in the appendices, the cause shall be investigated and rectified before proceeding with the test.

3. Receiver (Monitoring Point) End

3.1 Check the supply voltage and ripple voltage from the power supply unit to the Demodulator (Line amplifier):

a) Demodulator -+12V DC ±0.25V, Ripple voltage <50mV (pk-pk)

3.2 Check any LED indications are correctly illuminated. Power, Carrier etc.

3.3 Check by means of the oscilloscope and/or monitor the output signal of the demodulator.

3.4 If any of the signals/waveforms are not as depicted in typical voltages/waveforms table below and Appendix C, the cause shall be be investigated and rectified.

4. Final

4.1 At the transmission end of the system disconnect the pattern generator and re-connect the camera output to the modulator.

4.2 Check that the received picture at the monitoring point is of satisfactory quality.

Typical Voltages / Waveforms

Location	Voltage/Waveform
Input to modulator	1Vpk-pk composite video
Output from modulator	3V pk-pk (1V RMS) modulated
Output from launch amp	12Vpk-pk (4V RMS) modulated
Output from Line amp	3V pk-pk (1V RMS) modulated
Output from demodulator	1V pk-pk composite video

Table 1 – typical volumes/waveforms

PHILIPS FM HF SYSTEM EXTRA EQUIPMENT REQUIRED

- A monochrome TV pattern generator producing a staircase video signal and a Multiburst test pattern (both 1V peak-to-peak/75Ω signal).
- Portable Philips FM demodulator unit.

5 Transmission (Level Crossing) End

5.1 Check that the red LED on the power supply module is illuminated and the 'Carrier Fail' LED on the 'FM Rx' (demodulator) is extinguished.

5.2 Disconnect the camera input to the modulator and Check by means of the oscilloscope the unmodulated carrier signal at the FM output socket at the rear of the modulator frame (1V pk-pk ±0.1V undistorted sine wave at approximately 3.4MHz). Check there is no ripple present.

5.3 Connect the TV pattern generator set to a 'staircase' pattern to the modulator input and Check by means of the oscilloscope the input signal (Appendix C).

5.4 Check by means of the oscilloscope the modulated output signal of the modulator (Appendix C). Check there is no ripple present.

5.5 Check by means of the oscilloscope or TV monitor the output of the demodulated video test socket (Appendix C).

6 Transmitter End Launch Amplifiers (If Provided)

6.1 Switch the pattern generator to 'multiburst' and connect it to the launch amplifiers input socket. Connect the oscilloscope to the output socket (75ohms terminated) and Check the waveform.

Check the amplitude of the waveform increases linearly with frequency at each multiburst signal step (Appendix C). Check there is no ripple present.

6.2 Reconnect the modulator output to the launch amplifiers input and the output back to line.

7 Repeaters (If Provided)

7.1 Repeaters should not be adjusted during normal maintenance. However if adjustment is deemed necessary (low measurements at the receiver end), details on how to do this are contained in Appendix D.

8 Receiver (Monitoring Point) End

8.1 Check that the red LED on the power supply module is illuminated.

8.2 Check that with the transmission system operating normally (picture being transmitted) the 'Carrier Fail' LED on the 'FM Rx' (demodulator) module is extinguished. Disconnect the FM input and Check the LED illuminates.

8.3 Check by means of the oscilloscope the demodulated waveform at the 'Test Video O/P' socket (Appendix B).

8.4 Check a picture has been called.

8.5 Connect the monitor to the 'Processed Video O/P, socket. Check that a satisfactory picture is obtained. Check a picture has been called

8.6 Check the switch on the rear of the monitor is set to 'terminated'.

9 Final Checks

9.1 Check that all the cables in the system are correctly refitted and all test equipment is removed.

9.2 Check that the pictures obtained on the signaller's monitors are satisfactory.

COE 300 SYSTEM

Includes:	Earlier Coe 120 System
Excludes:	All other systems

This product contains a class 1 laser. There is no risk to eyesight in normal use. However use of a magnifying glass or a microscope to deliberately examine the laser output could be a hazard and shall not be attempted.

10 Transmitter End

10.1 Check that the Green Power LED Indication is lit and the Red Laser Alarm LED is out.

11 Receiver End

11.1 Check that the Green Video Detect LED Indication is lit and the Red Optical Alarm LED is out.

11.2 Check the received picture quality on the Signallers Monitor.

12 Testing Following Alterations

Whenever alterations have been carried out to the system which can affect the settings, such as a module replaced after failure or a repair to the fibre cable, then the following additional tasks shall be carried out.

12.1 Measure the voltage on the 12V Power supplies. These should be 12V ± 0.5V.

12.2 Using an oscilloscope to monitor the video output at the Signal box, terminated in 75 Ohms, adjust the "Video level Set" on the Receiver to give a Video output of 1V Pk to Pk while there is a signal of 1V Pk to Pk being input at the transmitter. Check the resulting picture on the Signallers Monitor.

APPENDIX A – Block Diagram of a Typical Generic Hf Tx System

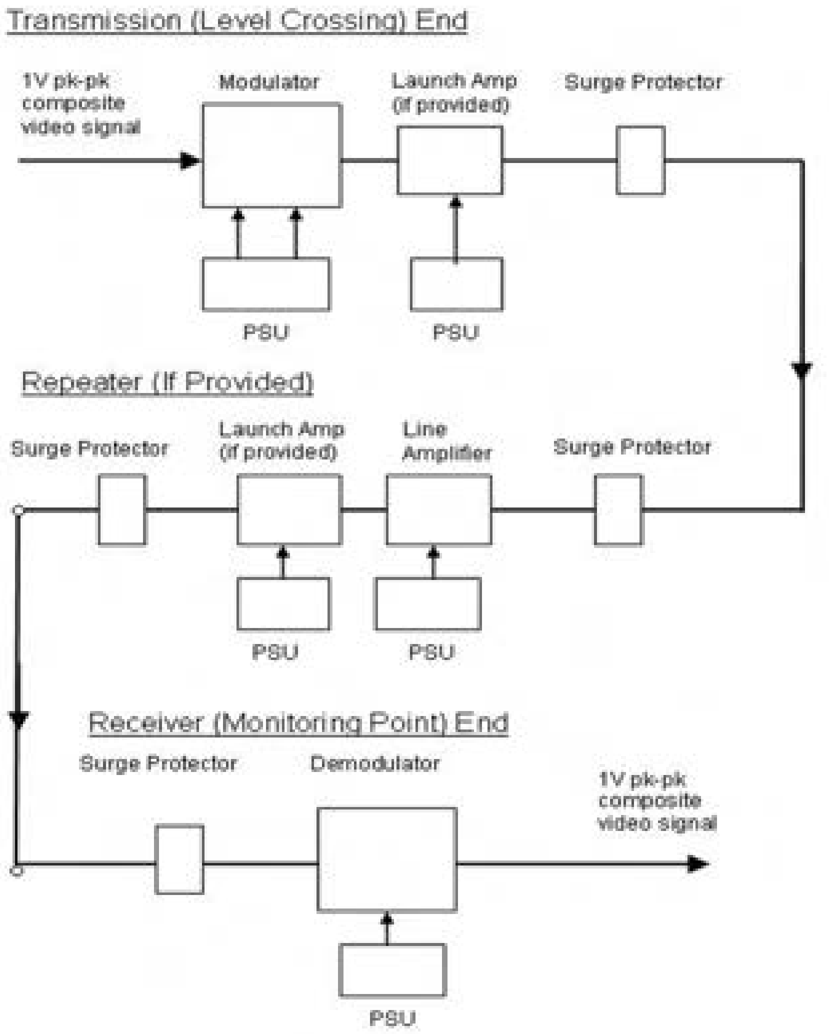


Figure 1 – Block Diagram of a Typical Generic HF TX System

APPENDIX B - Block Diagram of a Coe 300 System

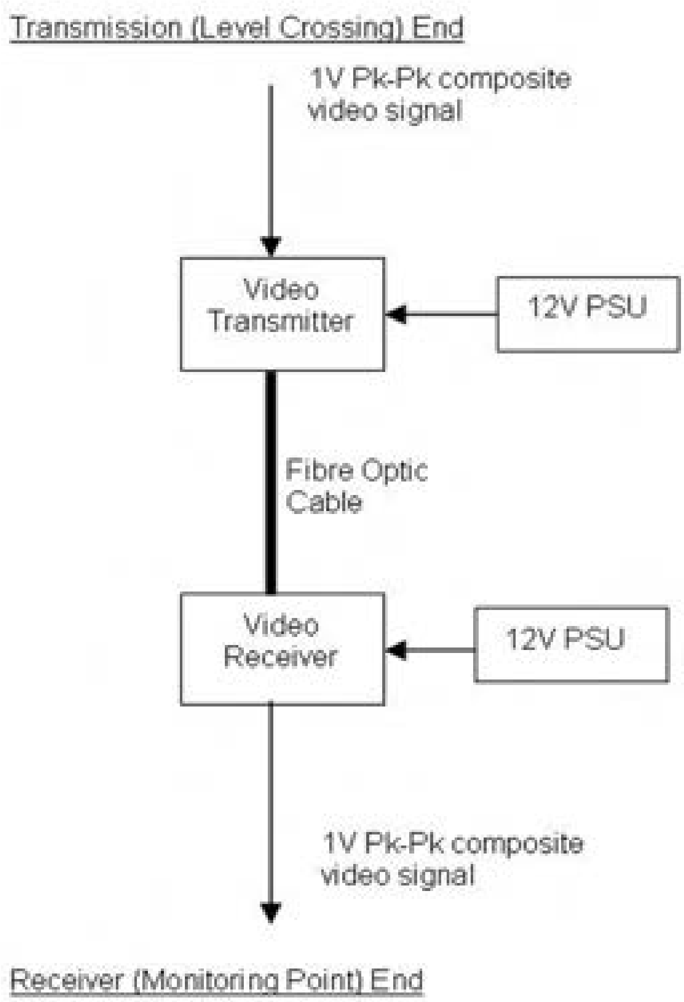


Figure 2 – Block Diagram of a Coe 300 System

APPENDIX C - Waveforms

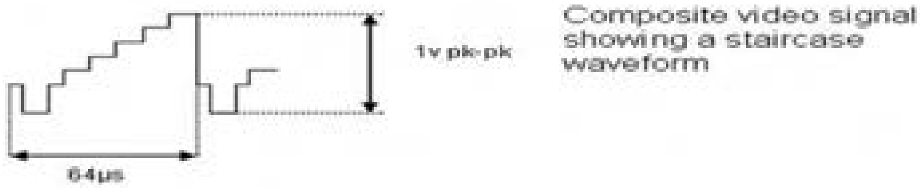


Figure 3 – Staircase waveform

Figure 4 – Staircase waveform (viewed on tv monitor)

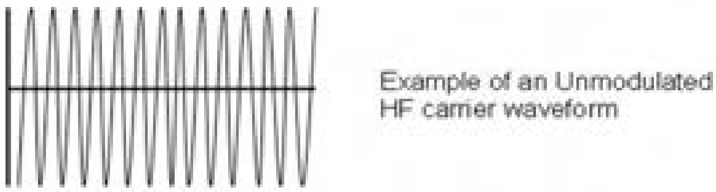


Figure 5 – Unmodulated HF carrier waveform

Figure 6 – Amplitude Modulated HF waveform

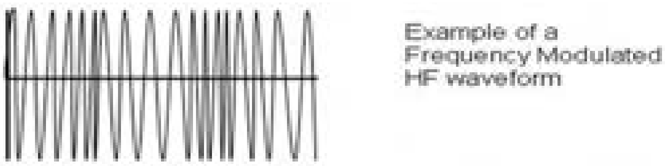


Figure 7 – Frequency modulated HF waveform

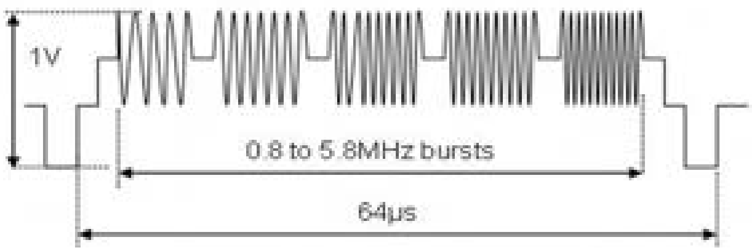


Figure 8 – Multiburst waveform

- The bursts are at 0.8, 1.8, 2.8, 3.8, 4.8 & 5.8MHz. Not all are shown on the diagram.
- The output from a launch amplifier can have the bursts increasing in amplitude linearly with each step from low to high frequency.

APPENDIX D - Repeaters on Philips FM Systems

Repeaters should only be tested or adjusted if deemed necessary by poor reception, if you are in doubt ask your SM(S).

It is important that the repeaters are tested in the correct order (from first to last). Note that a repeater amplifier is sometimes fitted at the demodulator location.

Testing

a. Isolate the coaxial cable between the repeater and transmission modulator (or previous repeater if not the first). Using a suitable meter (e.g. megger)

   Measure the DC loop resistance and insulation resistance of the cable (Inner to outer, inner to earth and outer to earth).

   - Use a test voltage of 500V.
   - Discharge any residual voltage on the cable after this test.

b. Reconnect the coaxial cable at both ends.

c. Check that the neon indicator on the front panel on/off rocker switch is illuminated.

d. At the previous location in the system, (transmission modulator or repeater) connect the pattern generator set to multiburst to the equipment side of the outgoing surge protection module.

   At the repeater under test, connect the oscilloscope to the 'Video Output' (75Ω terminated) socket of the repeater.

e. Check the waveform (Appendix B) and the waveform amplitude (1V pk-pk). If it is not correct, the repeater can be adjusted to achieve a uniform frequency response and signal amplitude (C 11). Check there is no 50 or 100Hz ripple on the waveform.

   TI21 audio frequency track circuits can cause interference on the waveform.

f. At the previous location, set the pattern generator to staircase.

g. Measure using the oscilloscope the FM signal level at the output of the repeater (1V pk-pk). Adjust the repeaters 'Set Gain' control if necessary.

h. Connect the portable demodulator and monitor to the output of the repeater. Check that a satisfactory picture is obtained.

   - The monitoring signal box will have to call a picture via the signaller's controls.

- The picture quality can deteriorate slightly on the output of each successive repeater.

- Check that the switch on the rear of the monitor is set to ‘terminated’.

i. Reconnect all cabling at the repeater for normal working.

j. Repeat a) to i) for all other repeaters in the system.

Adjustment

- Set all the controls (Set Gain, HF1, LF, HF2, MF, HF3) fully counter clock wise.

- Adjust the Set Gain control to give approximately 0.3V sync pulse amplitude.

- Adjust LF to eliminate ‘tilt’ in the signal (e.g. the front and back porch of the sync pulse at the same DC level).

- Adjust MF gain to set 0.8MHz burst to approximately 0.7V.

- Adjust HF2, HF1 and HF3 to give overall a 0.8 to 5.8MHz multiburst level of 0.7V, as flat as possible.

- Make small adjustments, if necessary to MF and Set Gain to set the overall signal amplitude to 1V pk-pk.

End

General

You shall always obtain permission of the Signaller before accessing or adjusting the camera. On duplicated systems Check that the signaller is using the camera that is not under test.

Installations have a Video Relay and Test Unit (VRTU). The signaller's controls can override any that are selected on the VRTU.

Equipment Required

- Colour TV Monitor.
- Oscilloscope (a general purpose TV type is suitable).
- BNC leads and BNC 'T' connectors.

1. Maintenance Test

1.1 Connect the test equipment (monitor and oscilloscope) using the BNC leads and connectors to the video test socket on the VRTU. Obtain a picture and oscilloscope trace by operation of 'On Test' and 'Picture' rocker switches on the VRTU.

The monitor and oscilloscope shall be connected in a 'daisy chain' arrangement, with the last item in the chain terminated in 75Ω. This is easiest done with the monitor as the last item in the chain.

1.2 Check that upon operation of the push buttons on the VRTU, the indication lights function.

1.3 Check that the 'In Use' indication illuminates when that particular camera is selected by the Signaller.

1.4 Examine the resolution (fine picture detail) of the picture.

For example, use vertical fencing or railings for checking horizontal resolution and horizontal sleepers for checking vertical resolution.

If the picture resolution is not satisfactory, the camera itself may have to be replaced to resolve any problems.

1.5 Check the following items:

a) The red tail lamps at the rear of all trains stopped at the platform are clearly visible.

b) The red tail lamps of non-stop trains are clearly visible.

c) The tail lamp area of stationary trains reasonably central in the picture and that there is little (if any) sky visible in the picture.

d) The picture is complete and without any vertical or horizontal disturbance, or patterning and is a good representation of the actual scene.

e) The field of view is not obstructed by the camera housing, screen wiper or shutter.

f) There is no streaking, flaring, ringing or negative image on any part of the picture.

If necessary, the lens focus and focal length settings can be adjusted, as shown in Appendices B & C.

If two cameras are provided they can have different ‘zoom’ lens focal length settings, to allow clear views of trains of differing lengths.

1.6 Access the camera and open the housing. Check the following items:

a) The locking screws for the lens iris and focal length adjusting rings are tight.

b) The 15-way “D” type and BNC connectors are securely mated with the camera.

c) The plug at the end of the cable coming from the lens/lens iris drive adaptor is securely mated with the camera.

d) The camera is securely fixed in position within the weatherproof housing.

Care shall be taken when conducting these tests not to touch the front of the lens or the adjacent screen demisting heater.

1.7 Close up the camera housing.

1.8 Obtain a trace of the composite video signal on the oscilloscope. Check that the values of the signal components are as given in Appendix A.

No adjustments are possible on CCD cameras.

1.9 At the monitoring point Check that a satisfactory picture is obtained on the Signallers monitor in use in liaison with the signaller, check the following:

a) The tail lamps of trains are clearly visible.

b) The wiper controls are effective.

c) The wiper when switched off parks correctly outside the field of view.

d) Check all functions work correctly on the alternative monitor.

To correctly set up a monitor see Appendix D

1.10 If provided, repeat 1.1 to 1.9 for the other camera.

1.11 On completion of testing, check that on the VRTU the ‘On Test’ button is left deselected.

If left selected the camera is always 'ON' even if it is not selected by the signaller.

Arrange for a check on the quality of the pictures from both cameras during the hours of darkness.

APPENDIX A - Composite Video Signal

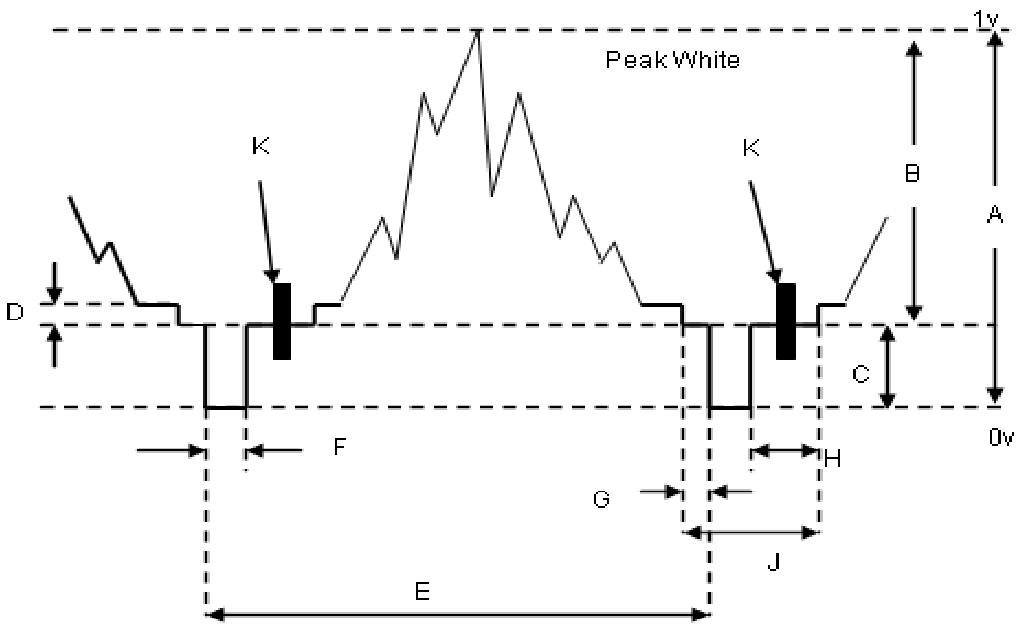


Figure 1 – Composite Video Signal

- A: Composite video signal 1v peak-to-peak (100%).
- B: Video component of signal 0.7v (70%).
- C: Sync component of signal 0.3v (30%).
- D: Black Level 50mV (approximate).
- E: Complete Line period 64μs.
- F: Line synchronising pulse 5μs.
- G: Front porch 1.5μs.
- H: Back porch 7μs.
- J: Line blanking interval 12μs.
- K: Colour burst (a 4.43MHz sinewave) signal

The composite video signal consists of a video signal that has had synchronising pulses added.

The ratio of amplitude of video to sync can vary but in the standard 1volt peak-to-peak composite video it is 70:30.

If the sync component of the signal is set at 0.3v then the maximum amplitude of the video can be 0.7v, so that the peak white is at the 1v level and correspondingly the bottom of the sync pulse is at 0v.

APPENDIX B - Lens Optical Focus Adjustment

Slacken the locking screw on the lens focus ring and slowly adjust (rotate) the focus ring to give a sharp image of the rear of trains standing at the platform.

Tighten the locking screw.

APPENDIX C - Lens Focal Length (zoom) adjustment

Slacken the locking screw on the lens focal length ring and slowly adjust (rotate) the ring to give the correct area of view.

The ring white reference line on it and the adjacent scale is marked in several focal length settings (millimetres).

It can also be necessary to adjust the optical focus ring in order to retain a well-focussed picture.

The ‘zoom’ setting of each camera can be different, in order to give the best view of tails lamps, for trains of varying lengths.

Tighten the locking screw.

APPENDIX D - Monitor Setting up Procedure

This applies to ‘TEW’ TFT LCD types only, details on other type monitors can be found in NR/SMS/Test/046 Appendix C

1 Obtain a picture on the monitor. Check the ‘pilot’ light is illuminated.

2 Call up the on-screen menu. Set the Brightness and Contrast controls ranges to minimum (zero).

3 Advance the Brightness level until the screen is just illuminated.

4 Advance the Contrast level slowly until a satisfactory picture is obtained with the highlight (brightest areas) details still clearly visible.

The setting of these controls can vary between individual viewers.

Call up the sharpness adjustment and set it to give a picture with sharp vertical trailing edges.

Excessive use of sharpness can cause a “black after white” effect.

5 Check that, on the monitor with two coaxial leads connected (usually Monitor 1), the small “slider” switch by the BNC sockets is set to “bridged” and that on the other monitor (usually Monitor 2), the switch is set to the “terminated/75Ω” position.

It should not be necessary to adjust any other setting in the monitor’s ‘on screen’ menu system If a satisfactory picture cannot be obtained on a monitor after setting up, it shall be replaced.

No attempt shall be made to make adjustments within the monitor housing.

The plastic screen on TFT monitors should only be cleaned in accordance with the manufacturer’s recommendations. Use of inappropriate cleaning materials (cloths, liquids and sprays) can cause permanent damage to it.

END

Includes:	Ultra If the Circuit Contact Box
Excludes:	All other types of Circuit controller box

Contact Setting procedure

1. Secure the inclinometer to the barrier.

2. Connect a suitable buzzer or meter across the micro-switch under adjustment.

3. Lift and hold the barrier at the desired angle.

4. Rotate the cam until the switch contacts just make.

5. Secure the cam on the lever shaft by torque tightening the first grub screw at 3.0 to 3.5 Nm.

   Raise or lower the barrier to gain access to the second grub screw and repeat the tightening procedure.

   It may be necessary to temporarily disconnect the barrier from the barrier box lever to gain access to the second grub screw.

6. Only tighten 2 out of the 3 grub screws for each cam.

7. Apply firm thumb pressure to each cam to confirm security to the lever shaft.

8. Check the switch operating correctly? If it is move to step 10.

9. If the switch is making when it should be breaking, loosen the grub screws and go back to step 3 using other contact slope on the cam.

10. Does the switch make at the correct angle? If not refer to the table below for fine tuning adjustments.

    The fine adjustment screw should be adjusted in increments of ¼ turn or less.

11. Repeat the process in flowchart 1 until satisfactory results are obtained.

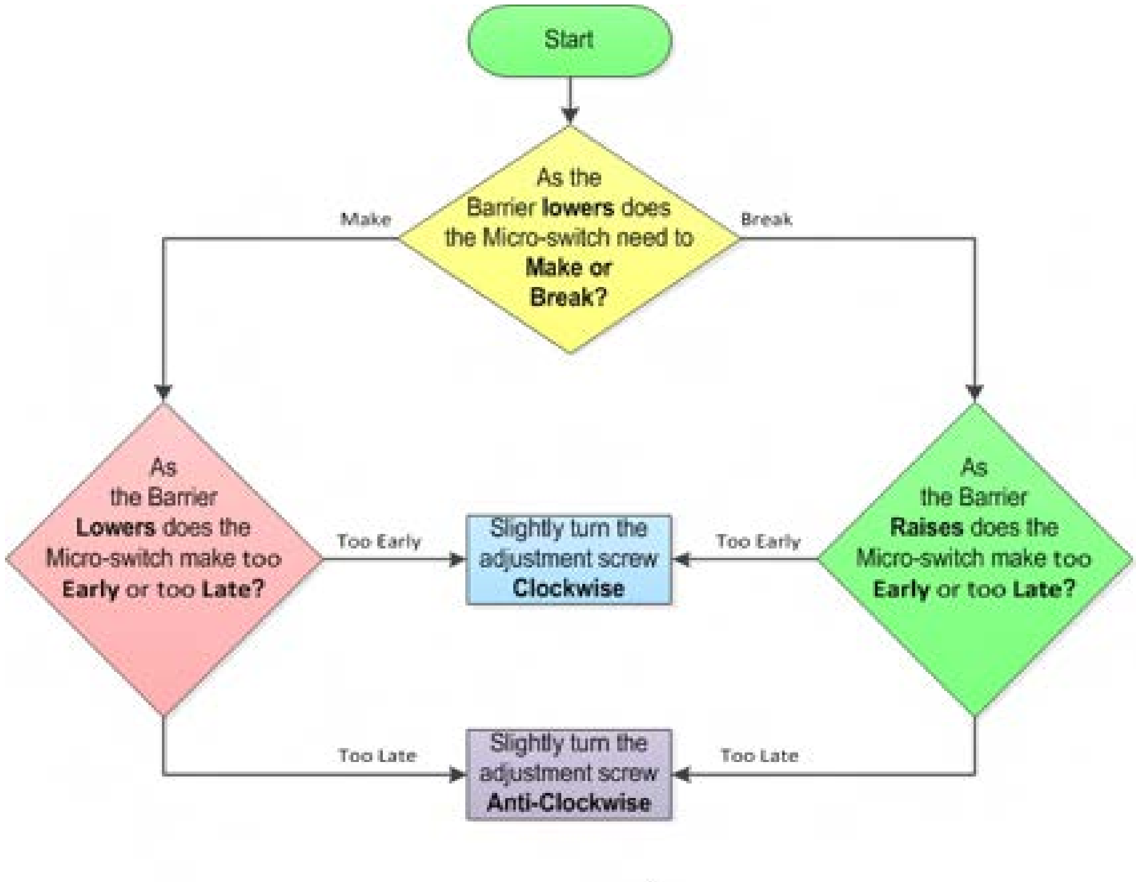
12. If satisfactory results cannot be gained, reset the fine adjustment screw to mid position as follows:

    a) Fully tighten the fine adjustment screw such that the switch mounting plate is in contact with the brass spacer.

    b) Slacken the adjustment screw by one and one quarter (1¼) full turns.

    c) The switch should now be at mid position of its fine adjustment.

    d) Slacken the two grub screws securing the cam to the lever shaft & return to step 3.



Flowchart 1 – Micro-switch adjustment process

13. Once a satisfactory result has been achieved for the micro-switch, repeat the above procedure for all remaining micro-switches.

End

Includes:	Busbar Earth Tests
Excludes:	All Busbar fitted with an Electronic Monitoring Device.

The tests require to be carried out on busbars that do not exceed a nominal 110V AC or 120V DC.

General

These tests are not normally required on equipment that is continuously monitored; see NR/SMS/PartC/EL00 - Electrical Equipment General, for further details. If you are in doubt, ask your SM(S).

The definition 'busbar' includes all power fed from a supply to equipment/circuits.

Signalling Circuits that are Intentionally Connected to Earth

These circuits (e.g. earth return circuits) do not need testing by the methodology in this test. If a second earth fault occurs, the affected circuit might not operate or operate irregularly indicating the problem.

Earth Values

Earth test values are detailed in NR/SMS/PartZ/Z07 – Earth Leakage Reference Values.

The reportable earth test result is the value that should be reported to your SM(S).

The maximum acceptable earth test result relates to the minimum insulation value that a signalling circuit is expected to meet to continue to operate safely.

The safety maximum earth test result relates to an insulation value, less than the acceptable value, below which the margin of safety provided is considered inadequate for the continued safe operation of the signalling equipment.

Investigation of Earth Faults

There is a zero tolerance to earth faults outside the defined acceptable limits across the network.

Report all test results indicating earth problems, at any level, to your SM(S), to be dealt with as detailed in NR/SMS/PartC/EL21 – Trackside Apparatus Case and NR/SMS/PartC/EL31 - Equipment and Relay Rooms.

1 DC Earth Test up to a Nominal 120V

Use a calibrated electronic meter with an input impedance of >1MΩ fitted with a 150kΩ shunt.

1.1 Measure the busbar voltage, record the results.

1.2 Connect one meter lead to the positive busbar, the other to earth, record the voltage (V1) – ignore polarity.

1.3 Connect one meter lead to the negative busbar, the other to earth, record the voltage (V2) – ignore polarity.

1.4 Disconnect the meter and compare the results with the safety values detailed in NR/SMS/PartZ/Z07 - Earth Leakage Reference Values.

If the required busbar voltage is not shown, use the next available lower voltage.

1.5 Investigate any readings that are outside the required values shown in the tables in Part Z. Any investigations shall be reported to your SM(S).

2 AC Earth Test up to a Nominal 110V

Use an electronic meter with an input impedance of >1MΩ (Do not use the 150kΩ shunt). Also use the AC busbar earth test adapter.

2.1 Connect the meter set to volts dc to the red and one of the black terminals of the earth test adapter.

2.2 Connect the green and other black terminal of the earth test adapter together and record the battery voltage (Vb). Renew the battery if the reading is less than 8V.

2.3 Connect the green terminal to earth and the black terminal to either the BX or NX busbar. Record voltage V1.

2.4 Reverse the leads to the same busbar (i.e. the black lead connected to earth and the green to the busbar) and Record voltage V2.

2.5 Disconnect the test equipment and compare the results with the relative Vb safety values in NR/SMS/PartZ/Z07 - Earth Leakage Reference Values.

If the required voltage Vb is not shown, use the next available lower voltage.

2.6 Investigate any readings that are outside the required values shown in the tables in Part Z. Any investigations shall be reported to your SM(S).

END

General

Dynamic Earth Testing is broken into Un-monitored and Electronically Monitored Busbars.

Only one of the tests should be completed.

The tester should choose the type depending on the equipment to be tested.

Method for connecting test equipment is as NR/SMS/PartB/Test/051 (Busbar Earth Tests) - Section 1 for DC circuits and Section 2 for AC circuits.

UN-MONITORED BUSBARS

1. Power Worked Points

1.1 Whilst the points are moved from both N-R and R-N measure and record the maximum positive and negative drive voltage between busbar and earth.

1.2 Measure and record the voltage across each leg of the detection circuit.

1.3 Measure and record the voltage between each leg of the detection circuit and earth for each lie of the points.

1.4 Compare the results with the table in NR/SMS/PartZ/Z07 (Earth Leakage – Reference Values).

1.5 Investigate any readings that are outside the required values shown in the tables in Part Z.

1.6 This test shall be repeated following the investigation / clearance of any earths.

Any investigations shall be reported to your SM(S).

2. Level Crossing Barriers

2.1 Measure and record the maximum positive and negative drive voltage between 24v busbar and earth during a complete cycle of the crossing.

2.2 Compare the results with the table in NR/SMS/PartZ/Z07 (Earth Leakage – Reference Values).

2.3 Investigate any readings that are outside the required values shown in the tables in Part Z.

2.4 This test shall be repeated following the investigation / clearance of any earths.

Any investigations shall be reported to your SM(S).

3. Generic Dynamic Earth Test (Including AWS Electro magnets)

3.1 Liaise with the Signaller to set up the conditions by asset to be tested is energised.

3.2 Measure and record the voltage across each leg of the magnet feed circuit as the equipment changes state.

3.3 Compare the results with the table in NR/SMS/PartZ/Z07 (Earth Leakage – Reference Values).

3.4 Investigate any readings that are outside the required values shown in the tables in Part Z.

3.5 This test shall be repeated following the investigation / clearance of any earths.

Any investigations shall be reported to your SM(S).

ELECTRONICALLY MONITORED BUSBARS

4. Power Worked Points

4.1 Observe the readings displayed by the Electronic Monitoring Device whilst the points are moved from both N-R and R-N twice.

4.2 Record and investigate any alarms that are triggered.

4.3 This test shall be repeated following the investigation / clearance of any earths.

Any investigations shall be reported to your SM(S).

5. Level Crossing Barriers

5.1 Observe the readings displayed by the Electronic Monitoring Device whilst the barriers are raised and lowered twice.

5.2 Record and investigate any alarms that are triggered.

5.3 This test shall be repeated following the investigation / clearance of any earths.

Any investigations shall be reported to your SM(S).

END

Includes:	930 Type, P Style Units, Bender IR145, Bender IR425
Excludes:	All other ELD's and Bender units

GENERAL

Due to the number of different styles of Earth Leakage Detector (ELD) that are now fitted across the Network this test is broken into three parts.

The tester carrying out this task should identify the type of ELD they are testing from the list below and only carry out the tasks within that test and its Setup Appendix (if required):

- **Part A** - 930 Type and P Style Units.
- **Part B** - Bender IR145.
- **Part C** - Bender IR425.
- **Part D** – Siemens ELD.

PART A - 930 Type and P Style Units

Equipment Identification

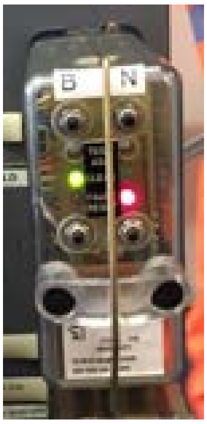


Figure 2 - 930 Style ELD

Figure 1 - P Type ELD

1. Function Test - 930 Type and P Style Units

1.1 Measure and record the busbar voltage/s on the record card.

1.2 Check and record the indications shown on the earth leakage detector.

1.3 If an earth fault is indicated, attempt to clear the indication and record the result.

Where fault persists, investigate the cause, and carry out NR/SMS/PartB/Test/051 (Earth Busbar Test).

Rectify any earth faults above the reportable limit. NR/SMS/PartZ/Z07 (Earth Leakage – Reference Values).

All faults shall be reported to your SM(S).

If the fault is unrectified your SM(S) shall be advised within 24 hours.

2. Calibration Test - 930 Type and P Style Units

2.1 Remove the ELD using the correct SMTH test plan.

2.2 Measure and record the voltage across each busbar.

2.3 Carry out NR/SMS/PartB/Test/051 (Earth Busbar Test) on each busbar.

Rectify any earth faults above the reportable limit. NR/SMS/PartZ/Z07 (Earth Leakage – Reference Values).

All faults shall be reported to your SM(S).

If the fault is unrectified your SM(S) shall be advised within 24 hours.

2.4 Re-instate ELD using the SMTH Test Plan.

2.5 Observe the ELD shows earth free indication.

2.6 Connect an electronic calibrated meter on resistance range to the inputs of the 22K ohms resistor box. Record the reading. If the reading is not within 22K ±5% then do not use and report this to your SM(S).

2.7 Connect the 22Kohms resistor (earth fault) between:

a) Earth to each monitored busbar in turn (DC circuits).

b) or Earth and one busbar (AC circuits) for a maximum of 7 seconds.

Observe the ELD correctly indicates the earth fault. Some units indicate after one second, some can take up to six seconds, if you are in doubt about the units you are testing, ask your SM(S).

2.8 Operate ELD test button and observe the ‘Earth Fault’ indication, for one leg of the supply.

2.9 Reset the ELD and repeat for the other leg of the supply.

2.10 If a DC ELD does not operate correctly, it might require adjustment (See Appendix A).

If the unit fails to operate on the test buttons, this can be due to a faulty main earth or test earth connection.

2.11 Reset to restore the ELD to service.

If the ELD is found to be defective:

a) Isolate the defective ELD safely from the operational busbar and label it as faulty.

b) Immediately carry out NR/SMS/PartB/Test/051 (Earth Busbar Test).

c) Treat circuits as not monitored by ELD until remedial action is completed.

Rectify any earth faults above the reportable limit. NR/SMS/PartZ/Z07 (Earth Leakage – Reference Values).

All faults shall be reported to your SM(S).

If the fault is unrectified your SM(S) shall be advised within 24 hours.

PART B – IR145 Bender Units

Equipment Identification

Figure 3 - IR145 Bender Unit

3. Operation

Within the IR145Y a measuring signal is generated which is connected to the system via the terminals L1/L2 and is connected to ground via the terminals /KE.

These connections are monitored continuously. If one of these connections is interrupted, this is indicated by flashing alarm LEDs and alarm relay.

4. Function Test - IR145 Bender Units

4.1 Measure and record the busbar voltage/s on the record card.

4.2 Check and record the indications shown on the earth leakage detector.

4.3 Check the green power on LED is illuminated.

4.4 Push and hold depressed the “Test / Reset” button for more than 2.5 seconds.

During a successful test both fault LEDs should illuminate while the button is depressed and extinguished when it is released.

4.5 If either of the fault LED’s fails to illuminate during the test or remains lit after the button has been released it shall be investigated as a fault.

4.6 If you are unable to eliminate the fault condition, then the following action shall be taken:

a) Isolate the defective ELD safely from the operational busbar and label it as faulty

b) Carry out NR/SMS/PartB/Test/051 (Busbar Earth Test) Immediately.

c) Advise your SM(S).

d) Treat the circuits as unmonitored by ELD until remedial action has been completed.

4.7 Reset the unit by pressing the “Test / Reset” button for less than 1 second. Observe the ELD unit for a period of 60 seconds for further alarms.

5. Calibration Test - IR145 Bender Units

5.1 Measure and record the voltage across each busbar.

5.2 Observe the unit alarm indications are clear.

5.3 Connect an electronic meter on resistance range to the inputs of the 22K ohms resistor box. Record the reading. If the reading is not within 22K ±5% then do not use and report this to your SM(S).

5.4 Connect the 22Kohms resistor (earth fault) between:

a) Earth to each monitored busbar in turn (DC circuits).

b) or Earth and one busbar (AC circuits) for a maximum of 7 seconds.

5.5 Observe the alarm Illuminate.

5.6 If none of the Fault LED's illuminate, then the following action shall be taken:

a) Remove and label the failed ELD.

b) Immediately carry out NR/SMS/PartB/Test/051 (Earth Busbar Test on each busbar).

c) Advise your SM(S).

d) Treat the circuits as unmonitored by ELD until remedial action has been completed.

5.7 Reset the unit by pressing the "Test / Reset" button for less than 1 second. Observe the ELD unit for a period of 60 seconds for further alarms.

PART C – IR425 Bender Units

Equipment Identification

Figure 4 – IR425 Bender Unit

6. Operation

The IR425 generates a pulsating measuring voltage which is superimposed on the power supply system being monitored via the terminals L1/L2 and KE/earth.

The current measured insulation resistance is shown on the display of the device.

A distinction is made between insulation faults on the AC or DC side. In the event of insulation faults on the plus or minus conductor, the corresponding +/- symbol is activated on the display.

7. Function Test – IR425 Bender Unit

7.1 Measure and record the busbar voltage/s on the record card.

7.2 Check and record the indications shown on the earth leakage detector.

7.3 Push and hold depressed the “T” button for 2.5 seconds.

The display should now indicate “TES” followed, after a short period by all three LED’s illuminating. This indicates a successfully completed test.

In the case of the unit failing this test all three LED’s flash and an error code is displayed. The meanings of these error codes are as follows:

a) E01 = PE connection fault, indicating a low-resistance connection between “E” and “KE” terminals.

b) E02 = System connection fault a low-resistance connection between “L1” and “L2” terminals.

c) E03...Exx = An Internal Device error.

7.4 Investigate and rectify all faults, if you are unable to eliminate the fault condition then the following action shall be taken:

a) Isolate the defective ELD safely from the operational busbar and label as faulty.

b) Carry out NR/SMS/PartB/Test/051 (Busbar Earth Test) immediately.

c) Advise your SM(S);

d) Treat the circuits as unmonitored by ELD until remedial action has been completed.

7.5 Reset the unit by pressing the "R" reset button for more than 1.5 sec. Observe the ELD unit for a period of 60 seconds for further alarms.

8. Calibration Test – IR425 Bender Unit

8.1 Measure and record the busbar voltage/s on the record card.

8.2 Check and record the indications shown on the earth leakage detector.

8.3 Observe the unit alarm indications are clear.

8.4 Observe the current resistance reading on the display, if the reading is smaller than 100K ohms, investigate the cause, if unable to find the cause report this to your SM(S), isolate the ELD and carry out NR/SMS/PartB/Test/051 (Earth Busbar Test).

If the current resistance reading is equal to or more than 100K ohms then proceed to the next step.

8.5 Connect an electronic calibrated meter on resistance range to the inputs of the 22K ohms resistor box. Record the reading. If the reading is not within 22K ±5% then do not use and report this to your SM(S).

8.6 Connect the 22Kohms resistor (earth fault) between:

a) Earth to each monitored busbar in turn (DC circuits).

b) or Earth and one busbar (AC circuits) for a maximum of 7 seconds.

8.7 Observe the following:

a) For monitoring supply >72v alarm 1 & alarm 2 LEDs are lit.

b) For monitoring supply <72v alarm 1 LED is lit.

Alarm 1 might not trigger if the current resistance reading displayed is showing >500K ohms on the display.

If this is the case observe the resistance reading on the display with the 22K ohm resistor connected, if the reading falls gradually to just below 22K ohms but higher than 20K ohms then record this test as ok.

Some units can have a delay setting of more than 7 seconds, in this case Alarm1 and/or Alarm 2 might not light within the seven seconds.

If this is the case, then do the test as in Step 8.5 (b) above by observing the resistance reading.

8.8 If any of the tests carried out in Step 8.5 have failed, then the following action shall be taken:

a) Isolate the defective ELD safely from the operational busbar and label it as faulty.

b) Carry out NR/SMS/PartB/Test/051 (Busbar Earth Test) Immediately.

c) Advise your SM(S).

d) Treat the circuits as unmonitored by ELD until remedial action has been completed.

8.9 Reset the unit by pressing the "R" reset button for more than 1.5 sec. Observe the ELD unit for a period of 60 seconds for further alarms.

PART D – Siemens ELD

Equipment Identification

Figure 5 – Siemens ELD

9. Function Test - Siemens ELD

Visual Settings Configuration Check

9.1 Visually confirm that LED 1 is a standard type (no DC label present) and that ELD 2 is a high-speed type (DC label on the front panel).

9.2 Visually confirm that each earth leakage detector has been configured as follows:

Earth Leakage Detector 1 - Point Detection Circuit

9.3 Sensitivity setting: confirm that the kΩ rotary control is set to 40kΩ.

If the setting looks incorrect, do not adjust the control by eye; the completed Calibration Test shall be performed.

9.4 DIP switches: confirm that top DIP switch “Reset” is in the left position and the bottom DIP switch for the output relay mode is in the right position.

Earth Leakage Detector 2 - Point Machine Power

9.5 Sensitivity setting: confirm that the kΩ rotary control is set to 50kΩ. If the setting looks incorrect, do not adjust the control by eye; the completed recalibration process shall be performed.

9.6 DIP switches: confirm that top DIP switch “Reset” is in the left position and the bottom DIP switch for the output relay mode is in the right position

Trip Operation Confirmation

The PAM auxiliary supply shall be live during this test. All resistors used in this procedure might be +/- 10% of their nominal value and the wattage =>0.25 W. Care shall be taken when connecting the probes to check that the correct terminals are used as other terminals nearby might be live.

This test requires a simulated earth fault to be connected between the monitored cables and earth. This is to confirm that the alarm activates when required.

To conduct these tests a resistor box shall be used (alternatively a series of resistors of correct value could be used).

One end of the resistor is connected to an earth terminal in the PAM using a lead terminated in a crocodile clip. The other end of the resistor is connected to a terminal on the earth device using a lead terminated with a male test probe.

Earth Leakage Detector 1: Point Detection Supply

9.7 In the case of the earth leakage detector being set to the lower level, use an 8kΩ resistor in place of the 30kΩ and an 18kΩ in place of the 68kΩ.

9.8 Disconnect links 54 and 55 to isolate the auxiliary supply.

9.9 Remove lightning suppressors 10 and 11 to disconnect the ELD from the detection circuit.

9.10 Reconnect links 54 and 55 to restore the auxiliary supply.

9.11 Using the 30kΩ resistor, connect the crocodile clip to earth. Confirm that the earth leakage detector is powered up and not showing an alarm condition.

9.12 Touch and hold the probe end of the resistor lead to the L1 terminal of the earth leakage detector. Within 5 seconds both yellow alarm LEDs should light up.

9.13 Remove the probe and reset the fault on the detector. Then touch and hold the probe end of the resistor lead to the L2 terminal of the earth leakage detector. Within 5 seconds both yellow alarm LEDs should light up.

9.14 Remove the probe, reset the fault on the detector and change the resistor to 68kΩ. Then touch and hold the probe end of the resistor lead to the L1 terminal of the earth leakage detector. After 15 seconds NEITHER yellow alarm LED should have illuminated on the ELD.

9.15 Remove the probe. Then touch and hold the probe end of the resistor lead to the L2 terminal of the earth leakage detector. After 15 seconds NEITHER yellow alarm LED should have illuminated on the ELD.

9.16 Disconnect links 54 and 55 to isolate the auxiliary supply.

9.17 Replace lightning suppressors 10 and 11.

9.18 Reconnect links 54 and 55 to restore the auxiliary supply.

<u>Earth Leakage Detector 2: Point Machine Power</u>

9.19 In the case of the earth leakage detector being set to the lower level, use an 18kΩ resistor in place of the 39kΩ and a 27kΩ in place of the 82kΩ.

9.20 Disconnect links 54 and 55 to isolate the auxiliary supply.

9.21 Remove lightning suppressors 7, 8 and 9 to disconnect the ELD from the point machine power circuit.

9.22 Remove and retain the 10kΩ ELD dummy load module from the WAGO terminal position 36A and replace with a temporary 1kΩ ELD calibration dummy load module.

9.23 Reconnect links 54 and 55 to restore the auxiliary supply.

9.24 Using the 39 kΩ resistor connect the croc clip to earth. Confirm that the earth leakage detector is powered up and not showing an alarm condition.

9.25 Touch and hold the probe end of the resistor lead to the L1 terminal of the earth leakage detector. Within 2 seconds the 'Alarm +' yellow alarm LED should light up.

9.26 Remove the probe and reset the fault on the detector. Then touch and hold the probe end of the resistor lead to the L2 terminal of the earth leakage detector. Within 2 seconds the 'Alarm -' yellow alarm LED should light up.

9.27 Remove the probe, reset the fault on the detector and change the resistor to 82kΩ. Then touch and hold the probe end of the resistor lead to the L1 terminal of the earth leakage detector. After 10 seconds neither yellow alarm LED should have illuminated on the ELD.

9.28 Remove the probe. Then touch and hold the probe end of the resistor lead to the L2 terminal of the earth leakage detector. After 10 seconds neither yellow alarm LED should have illuminated on the ELD.

9.29 Disconnect links 54 and 55 to isolate the auxiliary supply.

9.30 Remove and retain the temporary 1kΩ ELD calibration dummy load module from the WAGO terminal position 36A and replace with the 10kΩ ELD dummy load module.

9.31 Replace lightning suppressors 7, 8 and 9.

9.32 Reconnect links 54 and 55 to restore the auxiliary supply.

NOTE: *If a move is called with the 1kΩ ELD calibration dummy load module connected then it might be damaged. Confirm that it is disconnected before moving the points.*

10. Calibration Test - Siemens ELD

Calibration requires a simulated earth fault to be connected between the monitored cables and earth. This is to confirm that the alarm activates when required.

To conduct these tests a resistor box shall be used (alternatively a series of resistors of correct value could be used).

One end of the resistor is connected to an earth terminal in the PAM using a lead terminated in a croc clip. The other end of the resistor is connected to a terminal on the earth device using a lead terminated with a male test probe.

<u>Earth Leakage Detector 1: Point Detection Supply</u>

10.1 In the case of the earth leakage detector being set to the lower level, use an 8kΩ resistor in place of the 30kΩ, an 11kΩ in place of the 40kΩ and an 18kΩ in place of the 68kΩ.

10.2 Disconnect links 54 and 55 to isolate the auxiliary supply.

10.3 Remove lightning suppressors 10 and 11 to disconnect the ELD from the detection circuit.

10.4 Reconnect links 54 and 55 to restore the auxiliary supply.

10.5 Check that the small switches on the front of the ELD are set to top switch left and bottom switch right. Turn the ELD calibration knob to approximately 30kΩ.

10.6 Using the 40kΩ resistor, connect the crocodile clip to earth. Confirm that the earth leakage detector is powered up and not showing an alarm condition. Touch and hold the probe end of the resistor lead to the L1 terminal of the earth leakage detector.

10.7 Turn the ELD calibration knob very slowly clockwise (upwards) until the ELD unit just produces a fault. Note that the response time of the ELD unit is 5 s, so it is necessary to move the control a little at a time, waiting at least 5 seconds before moving it again.

10.8 Remove the probe, reset the fault on the detector and change the resistor to 30 kΩ. Then touch and hold the probe end of the resistor lead to the L1 terminal of the earth leakage detector. Within 5 seconds both yellow alarm LEDs should illuminate.

10.9 Remove the probe and reset the fault on the ELD. Then touch and hold the probe end of the resistor lead to the L2 terminal of the earth leakage detector. Within 5 seconds both yellow alarm LEDs should Illuminate.

10.10 Remove the probe, reset the fault on the detector and change the resistor to 68 kΩ. Then touch and hold the probe end of the resistor lead to the L1 terminal of the earth leakage detector. After 15 seconds neither yellow alarm LED should have illuminated on the ELD.

10.11 Remove the probe. Then touch and hold the probe end of the resistor lead to the L2 terminal of the earth leakage detector. After 15 seconds neither yellow alarm LED should have illuminated on the ELD.

10.12 Check the setting of the calibration control on the ELD graduated scale. If it appears to be more than 10kΩ from the setting of 40kΩ desired, then suspect there is a problem with the detector or wiring. Investigate and correct as necessary.

10.13 Disconnect links 54 and 55 to isolate the auxiliary supply.

10.14 Replace lightning suppressors 10 and 11.

10.15 Reconnect links 54 and 55 to restore the auxiliary supply.

<u>Earth Leakage Detector 2: Point Machine Power</u>

In the case of the earth leakage detector being set to the lower level, use an 18kΩ resistor in place of the 39kΩ, a 22kΩ in place of the 50kΩ and a27 kΩ in place of the 82kΩ

10.16 Disconnect links 54 and 55 to isolate the auxiliary supply.

10.17 Remove lightning suppressors 7, 8 and 9 to disconnect the ELD from the point machine power circuit.

10.18 Remove and retain 10kΩ ELD dummy load module from the WAGO terminal position 36A and replace with a temporary 1kΩ ELD calibration dummy load module.

10.19 Reconnect links 54 and 55 to restore the auxiliary supply.

10.20 Check that the small switches on the front of the ELD are set to top switch left and bottom switch right. Turn the ELD calibration knob to approximately 40kΩ.

10.21 Using the 50kΩ resistor, connect the crocodile clip to earth. Confirm that the earth leakage detector is powered up and not showing an alarm condition. Touch and hold the probe end of the resistor lead to the L1 terminal of the earth leakage detector.

10.22 Turn the ELD calibration knob very slowly clockwise (upwards) until the ELD unit just produces a fault.

NOTE: *The response time of the ELD unit is 2 s, so it is necessary to move the control a little at a time, waiting at least 2 seconds before moving it again.*

10.23 Remove the probe, reset the fault on the detector and change the resistor to 39kΩ. Then touch and hold the probe end of the resistor lead to the L1 terminal of the earth leakage detector. Within 2 seconds the "Alarm +" yellow alarm LED should illuminate.

10.24 Remove the probe and reset the fault on the ELD. Then touch and hold the probe end of the resistor lead to the L2 terminal of the earth leakage detector. Within 2 seconds the "Alarm -" yellow alarm LED should illuminate.

10.25 Remove the probe, reset the fault on the detector and change the resistor to 82kΩ. Then touch and hold the probe end of the resistor lead to the L1 terminal of the earth leakage detector. After 10 seconds neither yellow alarm LED should have illuminated on the ELD.

10.26 Remove the probe. Then touch and hold the probe end of the resistor lead to the L2 terminal of the earth leakage detector. After 10 seconds neither yellow alarm LED should have illuminated on the ELD.

10.27 Check the setting of the calibration control on the ELD graduated scale. If it appears to be more than 10kΩ from the desired setting of 50kΩ, desired then suspect there is a problem with the detector or wiring. Investigate and correct as necessary.

10.28 Disconnect links 54 and 55 to isolate the auxiliary supply.

10.29 Remove and retain the temporary 1kΩ ELD calibration dummy load module from the WAGO terminal position 36A and replace with a 10kΩ ELD dummy load module.

10.30 Replace lightning suppressors 7, 8 and 9.

10.31 Reconnect links 54 and 55 to restore the auxiliary supply.

NOTE: *If a move is called with the 1KΩ ELD calibration dummy load module connected then it might be damaged. Confirm that it is disconnected before moving the points.*

APPENDIX A - Calibration and Adjustment - 930 Type and P Style Units

This test is only applicable to Type DC ELK (S)1 and DC ELK(S)2 for DC supplies (pin code 239).

This test shall only be undertaken at times when train movements have stopped, as the set up requires an earth fault to be simulated.

If automatic reset straps are fitted (C6 C7 C8), these shall be removed for the duration of the adjustment test and reconnected on completion.

1. Check the signalling supply is earth free before any adjustments are made by carrying out NR/SMS/PartB/Test/051 (Busbar Earth Test).

   Rectify any earth faults above the reportable limit. NR/SMS/PartZ/Z07 (Earth Leakage – Reference Values).

   All faults shall be reported to your SM(S).

   If the fault is unrectified your SM(S) shall be advised within 24 hours.

   The calibration shall not be carried out on a supply with an earth, as the adjustment made would mask the presence of the earth.

2. For the 50V DC supply, connect a 50KΩ resistor of at least 0.25W, between B50 and main earth.

   These connections shall be made at positions A3 and B3.

3. For the 120V DC supply, connect a 33KΩ resistor of at least 2W, between B120 and main earth.

   These connections shall be made at positions A1 and B1.

4. Whilst pressing the (B) test button, carefully set the left hand “adjust” screw, so that the point is reached at which the fault indication is only just given.

   For the 50V DC supply, connect the resistor between C3 and B3.

   For the 130V DC supply, connect the resistor between C1 and B1.

5. Whilst pressing the (N) test button, carefully set the left hand “adjust” screw, so that the point is reached at which the fault indication is only just given.

6. Remove resistor.

7. Reset to restore the ELD to service.

APPENDIX B - Unit Controls, Indications and Connections- IR145

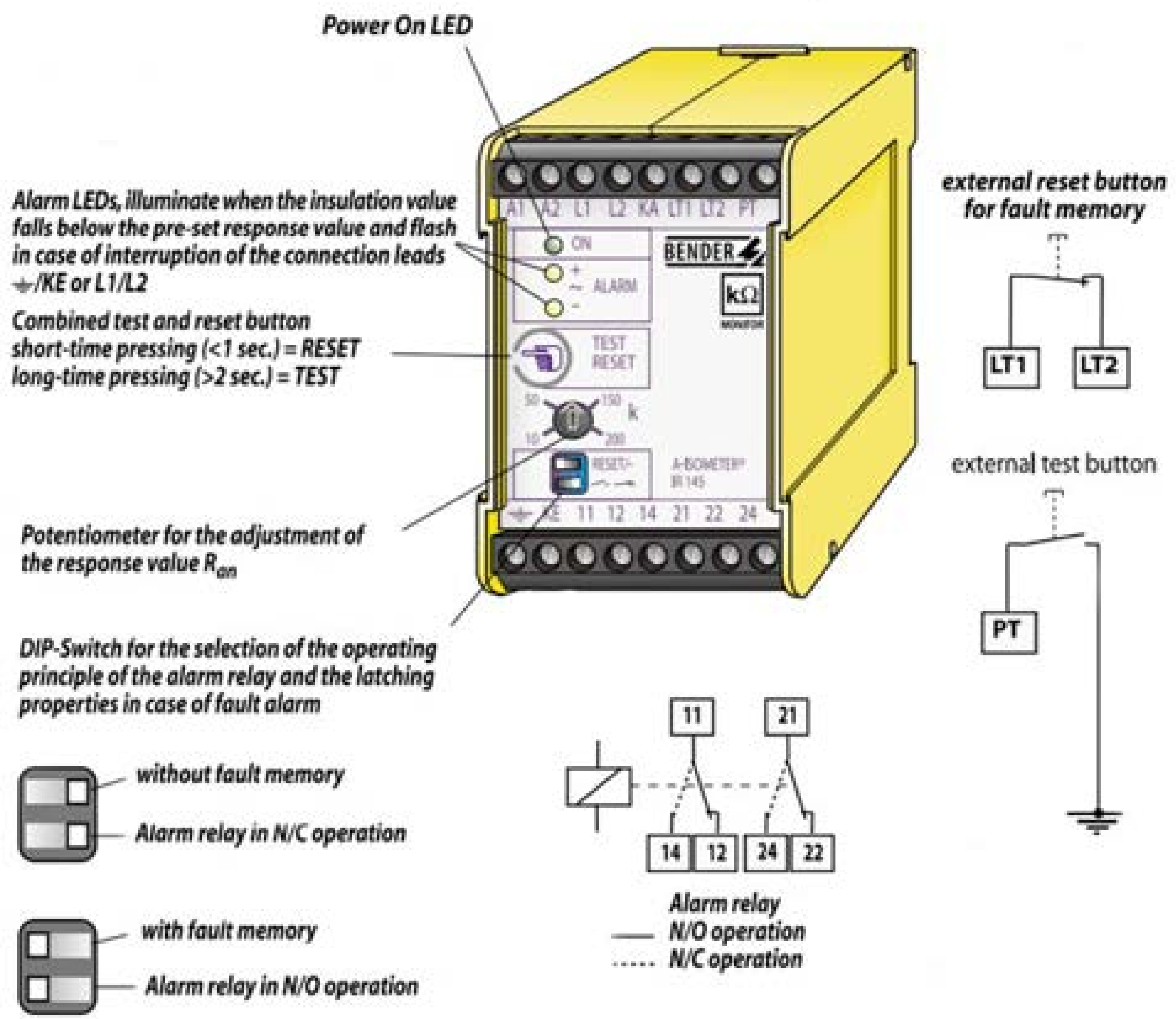


Figure 6 - IR145 Layout

1. Activating / Deactivating the Fault Memory

   The fault memory is Activated / Deactivated using the top toggle switch on the front of the unit as indicated in Figure 5.

2. Alarm Relay

   This option is used to change the behaviour of the contacts between normally closed (N/C) (non-failsafe) mode and normally open (N/O) (failsafe) mode.

   The contact operation is controlled by using the bottom toggle switch on the front of the unit as indicated in Figure 5.

APPENDIX C - Unit Controls and Indications IR425 Bender Units

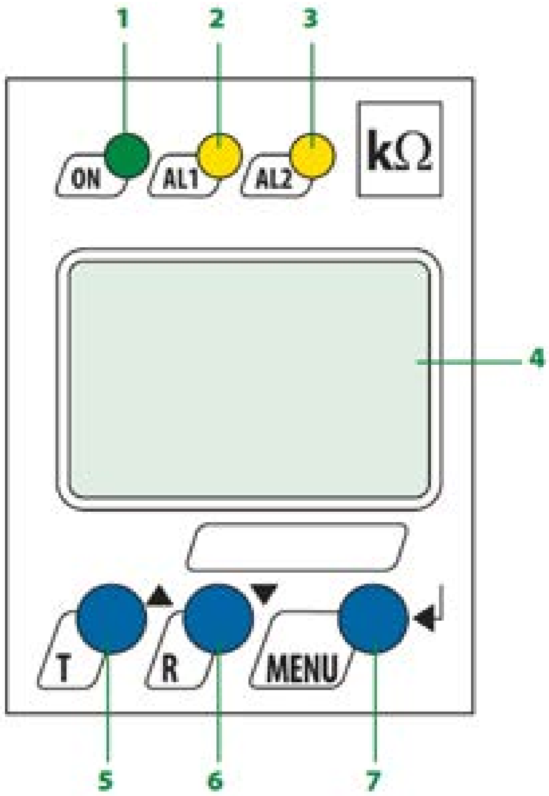


Figure 7 –IR425 Bender Units

1. LED power “ON”, (flashes in case of interruption of the connecting leads E/KE or L1/L2).

2. Alarm LED “AL1”, lights when the value falls below the set response value Alarm 1 and flashes in case of interruption of the connecting leads E/KE or L1/L2.

3. Alarm LED “AL2”, lights when the value falls below the set response value Alarm 2 and flashes in case of interruption of the connecting leads E/KE or L1/L2.

4. LC display.

5. Test button “T”: to call up the self-test.

   Arrow up button: parameter change, to move up in the menu.

6. Reset button “R”: to delete stored insulation fault alarms.

   Arrow down button: parameter change, to move down in the menu.

7. Menu button “MENU”: to call up the menu system. Enter button: Confirms parameter changes.

APPENDIX D - Setting up the Parameters – Bender Unit IR425-D4M1C

WARNING Default Settings

After connecting the unit to both the power supply to be monitored and the supply voltage for the first time, the following default setting are applied:

Response value (R2)	>72V = 23 kΩ ≤72V = 10 kΩ
Operating Mode R2	N/O operation
R2 Fault memory	Deactivated
M1C current output	0-20mA
Starting delay	t=0s
Response delay	t_{on}=0s
Password	1, disabled

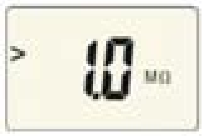
Table 1 – Default Setting

If the unit is reset the default settings automatically become active again.

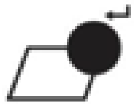
The default response values are not acceptable on Network Rail Infrastructure and shall be adjusted to meet the Network Rail Parameters, using the process explained in this Appendix.

<u>Parameter R2</u>

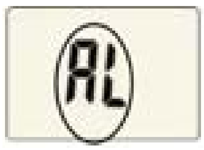
1. From the Monitoring Screen.



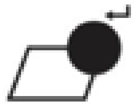
2. To enter the Menu Mode, press the MENU/Enter button on the front display for more than 1.5 seconds.



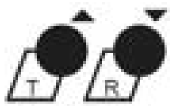
3. A flashing “AL” symbol appears on the screen.



4. This is the Alarm Mode screen. Press the MENU/Enter button for less than 1.5 seconds.



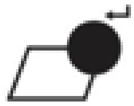
5. The parameter R1 flashes.



6. Press the R / Down key to select the parameter R2.

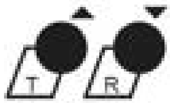
7. The parameter R2 flashes.

8. Confirm this by pressing the MENU/Enter button for less than 1.5 seconds.

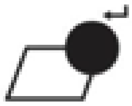


9. The current R2 value in kΩ then flashes.

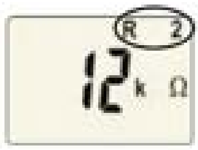
10. Use the T / Up or R / Down key to adjust the parameter value to the require figure.



11. Press the MENU/Enter button for more than 1.5 seconds.



12. The parameter R 2 flashes.



13. The new parameter is now set, and you can exit the menu by:

    a) pressing the Enter key for more than 1.5 seconds to reach the next higher level.

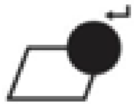
    b) or selecting the menu item ESC and confirming with Enter to reach the next higher level.

14. This returns you to the Monitoring Screen.

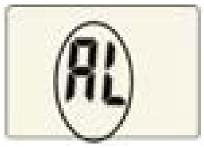
Current Output Parameter (M1C)

15. From the Monitoring Screen.

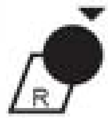
16. To enter the Menu Mode, press the MENU/Enter button on the front display for more than 1.5 seconds.



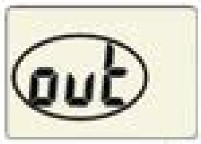
17. A flashing “AL” symbol appears on the screen.



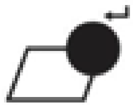
18. Press the R / Down button once.



19. The word “out” appears and flashes.

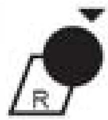


20. To enter the current output, press the MENU/Enter once for less than 1.5 seconds.



    On or OFF appears (as appendix C section7).

    Press the R / Down button twice.

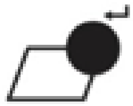


21. The display “0.20mA” or “4.20mA” appears steady with a flashing **I**.

22. Press the MENU/Enter once for less than 1.5 seconds.

23. Select the required range (4.20mA). The display continues to flash during this process.

24. Press the MENU/Enter once for more than 1.5 seconds.



25. The new parameter is now set, and you can exit the menu by:

    a) pressing the Enter key for more than 1.5 seconds to reach the next higher level.

    b) or selecting the menu item ESC and confirming with Enter to reach the next higher level.

26. This returns you to the Monitoring Screen.

APPENDIX E - Setting up the Parameters – Bender Unit IR425 (Not D4M1C type)

WARNING Default Settings

After connecting the unit to both the power supply to be monitored and the supply voltage for the first time, the response values Ran1/Ran2 (Alarm 1/2) are automatically set to the following:

For voltages greater than 72 V

- Response value 1 = 46 kΩ
- Response value 2 = 23 kΩ

For voltages less than or equal to 72 V

- Response value 1 = 20 kΩ
- Response value 2 = 10 kΩ

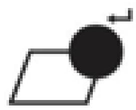
If the unit is reset the default settings automatically become active again.

These values are not acceptable on Network Rail Infrastructure and shall be adjusted meet the Network Rail Parameters, using the process explained in this Appendix.

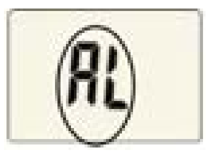
<u>Parameter R2</u>

1. From the Monitoring Screen.

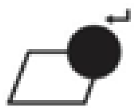
2. To enter the Menu Mode, press the MENU/Enter button on the front display for more than 1.5 seconds,



3. A flashing “AL” symbol appears on the screen.

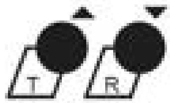


4. This is the Alarm Mode screen. Press the MENU/Enter button for less than 1.5 seconds.



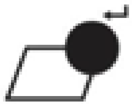
5. The parameter R1 flashes.

6. Press the R / Down key to select the parameter R2.

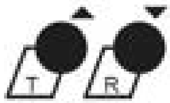


7. The parameter R2 flashes.

8. Confirm this by pressing the MENU/Enter button for less than 1.5 seconds.

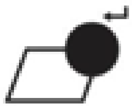


9. The current R2 value in kΩ flashes.



10. Use the T / Up or R / Down key to adjust the parameter value to the require figure shown in [NR/SMS/PartZ/Z07]() (Earth Leakage – Reference Values).

11. Press the MENU/Enter button for more than 1.5 seconds.



12. R 2 flashes.

13. The new parameter is now set, and you can exit the menu by:

    a) pressing the Enter key for more than 1.5 seconds to reach the next higher level.

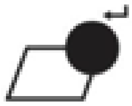
    b) or selecting the menu item ESC and confirming with Enter to reach the next higher level.

14. This returns you to the Monitoring Screen.

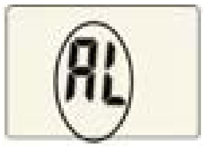
Parameter R1

15. From the Monitoring Screen.

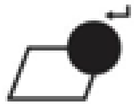
16. To enter the Menu Mode, press the MENU/Enter button on the front display for more than 1.5 seconds.



17. A flashing “AL” symbol appears on the screen.

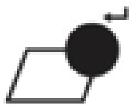


18. This is the Alarm Mode screen. Press the MENU/Enter button for less than 1.5 seconds.



19. The parameter R1 flashes.

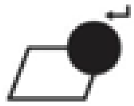
20. Confirm this is the parameter you want to adjust by pressing the MENU/Enter button for less than 1.5 seconds.



21. The current R1 value in kΩ then flashes.

22. Use the T / Up or R / Down key to adjust the parameter value to the require figure shown in NR/SMS/PartZ/Z07 (Earth Leakage – Reference Values).

23. Press the MENU/Enter button for more than 1.5 seconds.



24. R 1 flashes.

25. The new parameter is now set, and you can exit the menu by:

    a) pressing the Enter key for more than 1.5 seconds to reach the next higher level.

    b) or selecting the menu item ESC and confirming with Enter to reach the next higher level.

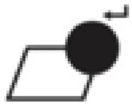
26. This returns you to the Monitoring Screen.

APPENDIX F - Activating / Deactivating the Fault Memory- All IR425 Bender Units

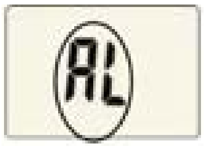
Changing this setting to “ON” causes the IR420-D4 to latch in the event of an alarm and require a manual reset if the alarm clears. Changing this setting to “OFF” causes the IR425 to automatically reset if the alarm clears. For location cases utilising the Atkins Signalling Method the fault memory should be set to “OFF”.

1. From the Monitoring Screen.

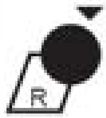
2. To enter the Menu Mode, press the MENU/Enter button on the front display for more than 1.5 seconds.



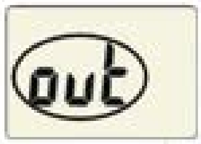
3. A flashing AL symbol appears on the screen.



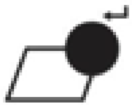
4. Press the R / Down button once.



5. The word “out” appears and flashes.

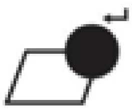


6. To enter the Latching Mode (Fault Memory), press the MENU/Enter once for less than 1.5 seconds.



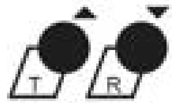
7. The word “on” or “off” appears with a flashing “M” under it. This indicates you are in the Latching Mode.

8. Press the MENU/Enter once for less than 1.5 seconds.



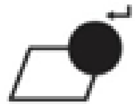
9. The word “on” or “off” appears and starts to flash.

10. The T / Up or the R / Down buttons can now be used to move the Latching Mode (Fault Memory) to the required position. The display continues to flash during this process.



11. Once the required position is set.

12. Press the MENU/Enter once for more than 1.5 seconds.

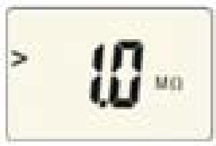


13. The new parameter is now set, and you can exit the menu by:

   a) pressing the Enter key for more than 1.5 seconds to reach the next higher level;

   b) or selecting the menu item ESC and confirming with Enter to reach the next higher level.

14. This returns you to the Monitoring Screen.



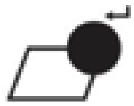
APPENDIX G - Contact operation – All Bender IR425 Units

Use this option to change the behaviour of the contacts between normally deenergized (non-failsafe) mode and normally energized (failsafe) mode.

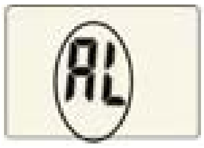
Note that the IR425 labels normally deenergized operation as “N/O” and normally energized operation as “N/C”. For location cases utilising the Atkins Signalling Method the R2 contact output should be normally energised “N/C”.

1. From the Monitoring Screen.

2. To enter the Menu Mode, press the MENU/Enter button on the front display for more than 1.5 seconds.

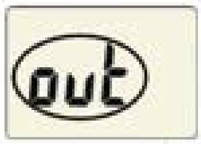


3. A flashing AL symbol appears on the screen.

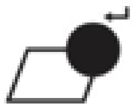


4. Press the R / Down button once.

5. The word “out” appears and flashes.



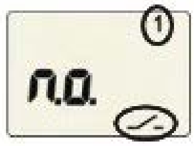
6. To enter the Latching Mode (Fault Memory), press the MENU/Enter once for less than 1.5 seconds.



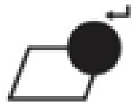
7. The word “on” or “off” appears with a flashing “M” under it. This indicates you are in the Latching Mode.

8. Press the R / Down button once.

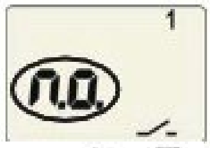
9. This screen shows the current position of the contacts “n.o.” (Normally Open) with a flashing open contact graphic and the contact number.

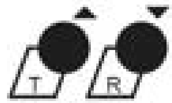


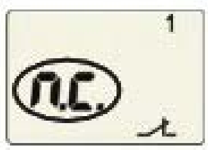
10. To adjust the contact operation, press the MENU/Enter once for less than 1.5 seconds.



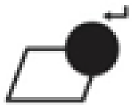
11. With the “n.o.” now flashing the T / Up or the R / Down buttons can be used to set the contacts to the “nc” (Normally Closed) position. The display continues to flash during this process.







12. Press the MENU/Enter once for more than 1.5 seconds.



13. The new parameter is now set, and you can exit the menu by:

    a) pressing the Enter key for more than 1.5 seconds to reach the next higher level;

    b) or selecting the menu item ESC and confirming with Enter to reach the next higher level.

14. This returns you to the Monitoring Screen.

END

Includes:	Existing Cables and when bringing spare cores back into use. Cables being replaced under Signal Maintenance Testing Handbook CA02 and CA07
Excludes:	New cables shall be tested using Signalling Works Test Handbook TS3-01

General

Insulation testing shall be undertaken where cable insulation values cannot be checked by earth busbar testing or by reference to an ELD indication.

It is more onerous than busbar testing as it requires the isolation of the whole cable or specific cores, before testing.

Insulation testing is usually restricted to the following cables:

a) Earth balanced / return circuits:e.g. telephones, block circuits.

b) Power cables: With a nominal voltage greater than 110V AC or 120V DC.

Cables that have a voltage greater than 175V shall be disconnected and isolated in accordance with authorised electrical safety procedures.

c) Defective cables: In connection with NR/SMTH.

A 1000V insulation tester (e.g. Megger) shall be used to test power cables.

A minimum of a 250V insulation tester shall be used to test lineside cables. For telecom cables carrying signalling circuits, reference shall be made to NR/L2/TEL/30070.

Testing should be avoided during dry or frosty weather.

Section 1, 2, and 3 are for all cables except those carrying vital FDM systems which are covered in sections 4 & 5.

If you are in any doubt about the functionality of the cable you are testing, ask your SM(S).

See NR/SMS/PartZ/Z05 (Cable Reference Values) for typical cable values.

Previous results on the NR/SMS record card might give you an indication of the state of the cable insulation (see also NR/SMS/Part/R – Maintenance Record Cards).

Check the record card for any trends. If the previous results are in the 'good' range and you now find readings are in the 'acceptable' or 'defective' range, then its most likely the insulation has been damaged.

Includes:	All cables carrying signalling circuits and non-vital FDM circuits
Excludes:	Cables carrying vital FDM circuits

1. Maintenance Test (Signalling circuits and non-vital FDM circuits only)

1.1 Carry out a continuity test between the earth terminal to be used during this test and earth.

1.2 For a test to be valid, the number of spare cores that need to be tested in each cable is as follows:

a) Less than10 cores: 2 spares.

b) 10-21 cores: 3 spares.

c) Greater than 21cores: 4 spares.

If inadequate spare cores are available, then working conductors shall be disconnected to make up the difference.

1.3 Isolate the cable cores by slipping links at both ends but leave the conductors connected to the terminals.

1.4 Measure the resistance between conductors connected together and earth.

1.5 Measure the core-to-core resistance.

If any results are less than 1M ohm a Full Insulation Test shall be carried out.

1.6 Record the test results on the record card. Actions detailed in Table 1 shall be taken in line with the obtained results:

Obtained Values	**Actions**
Greater than 10M ohms	This indicates that the insulation is in **Good Condition** and no further action is required.
Between 1M ohm and 10M ohms	This indicates that the insulation is in **Acceptable Condition** and no immediate action is required.
Below 1M ohm	This indicates that the insulation has degraded or is **Defective**. It shall be reported to your SM(S) immediately and shall not be left in service without the relevant authority (see NR/SMS/PartZ/Z05 (Cable Reference Values).

Table 1 – Maintenance Test Actions Table

1.7 Under the direction of the SM(S) divert circuits onto good / acceptable spare cores as shown in NR/SMTH/Part01/Module/12 (The Diversion of a Circuit/Relay Contact or Emergency Equipment Relocation).

Append the local site diagrams with details of the diversions and the Technician's name, date and signature of when the diversion was applied.

2. Full Insulation Test (Signalling circuits and non-vital FDM circuits only)

This test shall be undertaken if measurements taken in the maintenance test are less than 1Mohm.

2.1 Confirm that the earth terminal to be used during this test is connected to earth.

2.2 Test all cores in the cable.

2.3 Isolate the cable cores by slipping links at both ends but leave the conductors connected to the terminals.

2.4 Measure the resistance between conductors connected together and earth.

2.5 Measure the core-to-core resistance.

2.6 Record the test results on the record card. The actions detailed in Table 2 shall be taken in line with the obtained results:

Obtained Values	Actions
Greater than 10M ohms	This indicates that the insulation is in **Good Condition** and no further action is required
Between 1Mohm and 10M ohms	This indicates that the insulation is in **Acceptable Condition** and no immediate action is required.
Below 1M ohm	This indicates that the insulation has degraded or is **Defective**. It shall be reported to your SM(S) immediately and shall not be left in service without the relevant authority (see NR/SMS/PartZ/Z05 (Cable Reference Values).

Table 2 – Full Test Actions Table

2.7 Under the direction of the SM(S) divert circuits onto good/acceptable spare cores as shown in NR/SMTH/Part01/Module/12 (The Diversion of a Circuit/Relay Contact or Emergency Equipment Relocation).

Append the local site diagrams with details of the diversions and the Technician's name, date and signature of when the diversion was applied.

3. Cables Carrying Vital Reed FDM Circuits

Includes:	Cables carrying vital FDM circuits.
Excludes:	Cables carrying vital or non-vital FDM circuits on routes Running Parallel to FS2600 Track Circuits or on Routes Carrying Class 92 or Class 373 Trains (See section 4).

There are three ways of testing these cables (Table 3):

Method	**Details**
A	Reed non-intrusive earth leakage adaptor & digital multi-meter
B	Reed earth leakage tester
C	As detailed in section1

Table 3 – Testing Methods

Methods A and B are preferred as they test all the components connected to the cable as well as the cable itself.

It also has the advantage of not having to take the cable out of service during the tests.

The readings for both methods A&B should be taken on the line amplifier and the line-isolating transformer for each individual circuit.

3.1 Connect the adaptor/tester (Appendix A). Test the cable and record the results on the record card. Table 4 details actions that shall be taken on results obtained for existing cables:

Method	**Acceptable Reading**	**Report to SSM**	**Treat as Defective**
A&C	3M Ω & above	Between 1M Ω & 3M Ω	Less Than 1M Ω
B	3M Ω or above	Between 1.5M Ω & 2.9M Ω	1.5M Ω or Less

Table 4 – Actions One

4. Reed FDM Cables Carrying Vital or non-Vital Circuits Running Parallel to FS2600 Track Circuits or on Routes Carrying Class 92 or Class 373 Trains

Includes:	Cables carrying vital or non-vital FDM circuits on routes Running Parallel to FS2600 Track Circuits or on Routes Carrying Class 92 or Class 373 Trains only
Excludes:	Any other cables

4.1 Connect the adaptor/tester (Appendix A). Test the cable and record the results. Table 5 details actions that shall be taken on results obtained for existing cables:

Method	Acceptable Reading	Report to SM(S)	Treat as Defective
A&C	6M Ω & above	Between 1M Ω & 6M Ω	Less Than 1M Ω
B	3M Ω or above	Between 0.7M Ω & 2.9M Ω	0.7M Ω or Less

Table 5 – Actions Two

APPENDIX A - Testing Methods

Method A - Testing using the Reed Non-Intrusive Earth Leakage Adaptor and digital multi-meter

1. Confirm that the earth terminal to be used during this test is connected to earth.

2. Select DC volts on the meter and connect it to the adapter. Connect the red and green leads together and check the meter reading. If less than 9V, replace the batteries.

3. Connect the green lead to the test earth and the red lead to the circuit under test. Note the meter reading as V1.

4. Connect the red lead at the adaptor end to the terminals on the adaptor in turn in the following order (Table 6):

Order	Terminal	Reference Resistance
1st	White	1M Ω
2nd	Brown	3M Ω
3rd	Yellow	6M Ω
4th	Green	10M Ω
5th	Blue	15M Ω

Table 6 – Testing Order

The meter reading from each terminal should be noted as V2. This should reduce as the resistance value increases.

5. When V2 is lower than V1 the cable resistance to earth is lower than the reference resistance for that terminal.

Line Resistance

This can be worked out using the Reed Non-Intrusive Earth Leakage Adaptor and digital multi-meter. The method is as follows:

6. Measure the voltage across resistor R15 with the red lead strapped to the green lead. This is V1.

7. Measure the voltage across resistor R15 with the red lead connected to the cable under test and the green lead connected to earth. This is V2.

8. The resistance value (RC) can now be worked out from the application of the following formula: RC = 5 x 106 [V1/V2 – 1]. The result is shown in Ohms.

Method B - Testing using the Reed Earth Leakage Tester Values

9. Confirm that the earth terminal to be used during this test is connected to earth.

10. Connect the tester between the test earth and the circuit under test. Operate the tester and note the value on the scale. Table 7 gives the equivalent resistance to earth for the scale on the meter (Figure 1).

Meter Reading	Earth %	Equivalent ohms to Earth
Red	100%	0 Ω
9	90%	55.5k Ω
8	80%	125k Ω
7	70%	214k Ω
6	60%	333k Ω
5	50%	500k Ω
4	40%	700k Ω
3	30%	1.2M Ω
2	20%	2M Ω
1	10%	4.5M Ω
0.5	5%	9.5M Ω

Table 7 - Resistance to earth for the scale

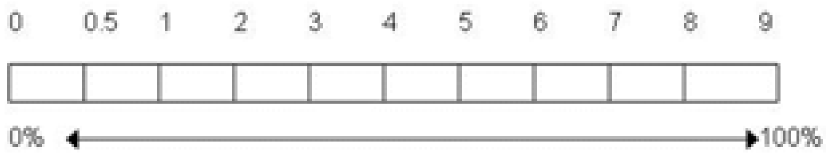


Figure 1 - Meter Scale

END

General

NR/SMS/PartC/EL00 (Secondary Cell Test) details the risks associated with testing secondary cells.

Liaise with the Signaller before turning any battery chargers off as power/equipment failure indications can be given.

1. Lead Acid / Alkaline Secondary Cells (Unsealed)

1.1 Switch the battery charger off and measure each individual cell voltage.

Allow a few minutes for the cell voltages to stabilize before taking the readings.

Cell Type	Nominal Voltage	Minimum Voltage
Lead Acid	2.2V	2V
Alkaline	1.1V	1V

Table 1 – Cell Voltages

1.2 Record the lowest reading on the record card and arrange for cells below the minimum to be replaced.

Alkaline cells usually come in banks of 3 or 5 cells (except single TC feeds). It is advisable to replace the whole bank if one is found defective.

1.3 Measure and record the full battery voltage.

1.4 Connect the voltmeter across one cell. Switch the battery charger on.

The cell voltage should rise slightly above the nominal voltage.

This indicates that the charger is working.

The nominal voltage times the number of cells.

2. Cyclon Cells (including Modular Cyclon Cells used on Point Installations)

Figure 1 - Types of Cyclon Cells

These cells are 'sealed for life' therefore topping up is not required.

2.1 With battery charger switched on, measure the full battery voltage (2.35 times the number of cells). Record the result.

2.2 Switch the battery charger off. Measure the battery voltage. Check the battery voltage does not significantly deteriorate under load. Record the results.

An ideal time for the batteries to be on load is 30 minutes, although this might not be possible in all circumstances.

2.3 Switch the battery charger on. Check that the battery voltage rises.

3. ALCAD Vantage Cells

3.1 Measure the battery voltage.

3.2 Measure the voltage of each cell, then add the highest and lowest readings together and divide the result by the total number of cells. Record the answer on the record card.

The preferable value is 1.42 to 1.43V per cell with an absolute maximum of 1.43V per cell.

Inform your SM(S) if the value is greater than 1.43V.

Appendix B lists nominal/maximum voltages for batteries. Allow the battery to stabilise if adjusted.

3.3 Switch the battery charger off and measure the battery voltage again.

Check the battery voltage does not significantly deteriorate under load.

An ideal time for the batteries to be on load is 30 minutes, although this might not be possible in all circumstances.

3.4 Record the time "on load" on the record card.

3.5 Check electrolyte levels and note the following:

- Any cells where the level that has moved significantly down from maximum towards minimum top up to the maximum line (Appendix A).

- Any cells that are below minimum but above warning level, and by how much – reported to your SM(S).

- Any cells below the warning level – report as corrective maintenance.

3.6 Measure the battery voltage after 30 minutes and compare with previous readings.

3.7 Switch the charger back on.

4. Power Box (PB) (Modular) Cells

These are 'sealed for life' cells, therefore no topping up is required.

If this test is being carried out as part of testing a replaced battery pack, it should be carried out after allowing the battery to build up its charge.

4.1 With battery charger switched on, Measure the full battery voltage on the Battery Pack between monitoring points Red 1 and Black 5.

Record the result on the record card.

4.2 Switch the battery charger off. Measure the battery voltage on the Battery Pack between monitoring points Red 1 and Black 5.

4.3 Check the battery voltage does not significantly deteriorate under load.

4.4 Record the time "on load" on the record card.

An ideal time for the batteries to be on load is 30 minutes, although this might not be possible in all circumstances

4.5 Switch the battery charger on and check that the battery voltage rises.
Redundant Power Supplies Check

4.6 Switch one of the battery strings OFF. Check that the only indication change is that the associated Battery Charger module's 24V LED changes from green to red.

4.7 Switch the battery string ON and check the associated battery charger module's 24V LED changes back to Green.

4.8 Repeat above process for the other battery string.

APPENDIX A - ALCAD Vantage Cells topping up procedure

Caution: These cells are pressurised

a) Slowly remove pressure vent cap to release pressure Do not place filler neck into cell.

b) Position over vent cap opening and inject water, observing level on external fill lines.

c) Check the vent seal is intact and not damaged before refitting vent cap. Tighten the cap until a positive stop is felt.

d) If the vent seal is not in good condition, report to your SM(S), noting whether the cap is bayonet or thread fitting.

After topping up cells, the fluid level can go up or down as the cell pressurises.

APPENDIX B - Battery Voltages for Vantage Cells

No. of Cells in Battery	Nominal Voltage	Maximum Voltage
1	1.42V	1.43V
2	2.84V	2.86V
3	4.26V	4.29V
5	7.1V	7.15V
10	14.2V	14.3V
15	21.3V	21.45V
20 #1	28.4V	28.6V
25	35.5V	35.75V
30	42.6V	42.9V
35	49.7V	50.05V
40 #2	56.8V	57.2V
45	63.9V	64.35V

No. of Cells in Battery	Nominal Voltage	Maximum Voltage
50	71V	71.5V
55	71.8V	78.65V
60	85.2V	85.8V
65	92.3V	92.95V
70	99.4V	100.1V
75	106.5V	107.25V
80	113.6V	114.4V
85 #3	120V	121.55V
90	127.8V	128.7V
95	134.9V	135.85V
100	142V	143V

#1: 24V Battery.
#2: 50V Battery.
#3: 110V Battery.

END

General

The Avel-Lindberg User Handbook contains information on settings and fault finding.

Inverters can be connected in following modes:

a) Hot standby (inverter running but not on load).

b) Cold standby (inverter not running).

c) Running permanently on load.

The 'hot' standby mode is the preferred method of connection.

Inverter systems can be a single unit only or two units acting as 'master' and 'slave'.

Due to the 'rectified DC' output from some battery chargers, it is advisable not to run the inverters from the output of a charger only as this can lead to damage of the inverter's electronics.

Switching between inverter modes (Main, Standby, Generator) can cause certain circuits (stick, indication etc) to drop and not re-pick. Always liaise with the Signaller and check all circuits are normalised on completion of testing.

All the test results shall be recorded on the record card.

1. Battery Charger

Some cells require a constant voltage charger. NR/SMS/PartC/EL00 (Electrical Equipment - General) gives you more details on these. If in doubt, ask your SM(S).

1.1 Disconnect the battery charger for 5 minutes and then test the batteries - carry out NR/SMS/PartB/Test/055 (Secondary Cell Test).

1.2 Reconnect the battery charger and (if applicable):

Measure the trickle charge current.

The charging rate is controlled electronically and is not adjustable.

1.3 Remove the BX110 and B110 fuses in turn and check that the 'Charger Supply Failed' lamp illuminates after about 10 seconds.

1.4 Replace the fuses and (if applicable) re-check the trickle charge current.

2. Automatic Switching Cabinet (Hot & Cold Standby Modes Only)

2.1 Check that all cut outs on the inverters are 'IN'.

The cut-out switches should be in the left-hand position.

Inverters on cold standby are prone to tripping when an inductive load is switched in.

If an inverter has tripped, you should also look for:

a) A low dc supply voltage, or

b) More than 10% AC ripple.

If the system is master and slave, the slave unit shall be re-set first followed by the master unit.

2.2 Check the indications on the switching cabinet.

The indications provided vary between installations. Any indicated faults shall be dealt with as corrective maintenance.

2.3 With the co-operation of the Signaller, test the standby supply.

Switch off the main power supply at its source. The inverter(s) should switch in after about 250ms. This delay can cause most relays to de-energise.

2.4 Check that a power failure is indicated on the switching cabinet and in the signal box.

2.5 Measure the following power supply values:

a) Input DC volts to the inverter switching cabinet (B110 bus-bar).

b) Output AC volts to equipment.

c) BX110 bus-bar voltage.

2.6 Check that the inverter can maintain the load without any system failures for a period representing 50% of the time that it is expected to cover. After this period, repeat step 2.5.

2.7 Test the load capability of the inverter.

Where a common 110V inverter / point battery exists, operate a double ended set of points both ways for three operations.

2.8 Restore the power supply and check that:

a) The inverters switch off.

b) The charger switches on.

c) Any cut-outs remain 'IN'.

d) Normal indications are obtained.

After carrying out a load test, you should check that the batteries are fully charged. If possible, this check should be on the following day.

3. Automatic Switching Cabinet (Permanently on Load Systems Only)

3.1 With the co-operation of the Signaller; switch off the supply to the inverter battery charger.

3.2 Check that a power failure is indicated on the switching cabinet and in the signal box.

3.3 Measure the following power supply values:

a) Input DC volts to the inverter switching cabinet (B110 bus-bar).

b) Output AC volts to equipment.

c) BX110 bus-bar voltage.

3.4 Check that the inverter can maintain the load without any system failures for a period representing 50% of the time that it is expected to cover. After this period, repeat step 3.3.

3.5 Test the load capability of the inverter.

Operate the equipment the inverter supplies.

3.6 Restore the supply to the inverter charger and operate the RESET button on the switching cabinet. Check that normal indications are received on the switching cabinet and in the signal box.

4. Generator Facility (If Fitted)

Some inverters are fitted with a generator socket.

4.1 Plug in a generator that has a large enough load capacity. Start it up and allow it to settle down.

4.2 Check all indications are normal.

4.3 Get the Signallers co-operation and switch off the main power supply.

This can switch Hot and Cold systems to inverter operation. Permanently on systems only indicate a power failure.

4.4 Turn the switch on the switching cabinet to the ‘Generator’ position to connect the generator supply.

4.5 Check that the generator is supplying satisfactory power to the signalling system. Measure the bus-bar voltages.

4.6 Disconnect the generator by turning the switch on the switching cabinet to the ‘Normal’ position and restore the main power supply.

4.7 Check that the inverter switching cabinet and signal box indications are normal.

Some systems require the operating of the reset button on the switching cabinet.

4.8 Switch off and unplug the generator.

END

Includes:	Uninterruptible Power Supplies, and the Powernetics Systems at Cromer

GENERAL

UPS systems contain mains supply voltages of 230V AC. Relevant safety procedures shall be complied with when working on this equipment.

1. UPS Tests (Not the Powernetics Systems at Cromer).

1.1 Check the indications on the unit so that it is working correctly. Investigate and rectify if any problems are found.

1.2 Simulate a power failure by disconnecting a fuse or link to the input supply of the UPS. Observe that the UPS maintains the load and that the relevant indications of a power failure are given.

1.3 Check that the UPS can maintain the load without any system failures for a period representing 50% of the time that it is expected to cover.

Measure the voltage at the start, middle and end of this period. Use these readings to estimate the UPS voltage at 100% of the expected period (where possible use manufacturers discharge graphs).

If the UPS voltage either falls below the lower supply limit or is predicted to do so it shall be reported to your SM(S).

1.4 Reconnect the power to the UPS and observe that the correct indications are given.

1.5 Where the batteries are external to the UPS, check that after the reconnection of power they are charging, NR/SMS/PartB/Test/055 (Secondary Cell Test).

1.6 Where the batteries are internal to the UPS or are maintenance free, they shall be tested and/or replaced at intervals recommended by the manufacturer.

2. Powernetics UPS at Cromer only UPS

2.1 Select “LOAD ON BYPASS” and operate Manual Bypass Switch to the UPS/BYPASS position.

2.2 Switch unit OFF in the correct sequence.

2.3 Move the Manual Bypass Switch to the BYPASS position.

2.4 Remove unit covers, check that loose earth leads are safely taped up.

2.5 Clean the inside of the unit.

2.6 Carry out a visual inspection of the system (Mechanical Electrical and Electronics, including connectors). Rectify and/or report defects.

2.7 Check PCB’s and other components for signs of overheating. Rectify as necessary.

2.8 Check that fans spin freely when operated with finger and that they feel ‘smooth’.

3. Batteries

3.1 Check the state of battery terminals. Clean and grease if required.

4. System Parameters

4.1 Move the Manual Bypass switch to the BYPASS/UPS position and power up the unit in the correct sequence.

4.2 Check that all fans turn at full speed.

4.3 Press the Auto Bypass switch to select “LOAD ON BYPASS” and move the Manual Bypass switch to the UPS position.

4.4 Record the following parameters on the NR/SMS Record Card :

a) Supply Voltage.

b) Charger Float Voltage.

c) Load Current (RMS) – with load on bypass.

d) Load Current (PEAK) – with load on bypass.

e) Output Voltage – with load on bypass.

f) Charger Current – after battery hold-up test.

g) End of discharge voltage.

If any adjustments requiring a load are to be done, then these adjustments shall be made using a dummy load, with the manual bypass switch in the BYPASS/UPS position.

4.5 Check that all displays and alarm functions operate satisfactorily. Rectify as necessary.

The common alarm verification can be done by contacting the Signaller.

5. Battery Hold-up Test

5.1 With the normal system load, switch off the I/P supply isolator and record the total battery voltage against elapsed time on the NR/SMS Record Card.

NOTE: *The duration of this test should be 30 minutes.*

6. Final Actions

6.1 If covers have been removed, select LOAD ON BYPASS on the unit and move the Manual Bypass switch to the UPS/BYPASS position. Switch off the unit in the correct sequence. Check that all fans stop slowly.

6.2 Move the Manual Bypass Switch to the BYPASS position.

6.3 Move the unit back to its normal position if it has been moved. If this is the case, check the tightness of incoming and outgoing connections.

6.4 Move the Manual Bypass Switch to the UPS/BYPASS position and power up the unit in the correct sequence.

6.5 When the unit is up and running, transfer the load onto the inverter.

6.6 Upon completion of the maintenance tasks check that all the breakers are in the ON position and all the panel/cover screws are tight.

END

Includes:	SAFT Air Saline Cells and Dry Cells
Excludes:	CEGASA Air Alkaline Cells

Disposal of old cells shall be as per current environmental policy (SMS/Part/A14).

General

Dry battery cells shall be stored in an upright position in a dry and clean environment.

They can deteriorate in storage therefore they shall be tested as below to check they are in a fit state for use.

SAFT air saline cells shall be set up according to the manufactures instructions taking care that the distilled water used to fill them is within the given limits.

Due to the chemical reaction when these cells are ‘activated’ heat is produced which can make the case of the cell hot.

Care shall be taken when handing newly ‘activated’ cells.

When SAFT air saline and dry primary cells are brought into service, caps and breathing holes should be treated as per the manufactures instructions.

Details about the maintenance and the replacement of CEGASA air alkaline cells can be found in NR/SMS/EL00

1. Primary Cell Test

1.1 Using a suitable meter connect an approved 1Ω shunt across the positive and negative terminals. Test the 1Ω shunt on the meters resistance range before use to check it is not open circuit.

Do not use a train shunt box for this task.

1.2 With the approved shunt in place and the meter on the DC volts range Measure the voltage across each primary cell.

1.3 Do not apply the shunt to the cells whilst they are connected in circuit unless you reach an agreement with the signaller.

Due to load put on the cell apply the shunt only momentarily. Do not continually use the shunt for periods of more than five minutes.

1.4 The cell shall be replaced if the obtained reading is at or below 0.9V

In some cases, it is advisable to replace the cell at a higher threshold (e.g. 1.1V) if there is a possibility due to the loading of the cell of it failing before the next maintenance visit

End

Includes:	System installed in the Seven tunnel
Excludes:	Any other emergency pull cable alarm systems

GENERAL

Carry out these tests in liaison with the Signaller during a no train period preferably under a system possession. It is also necessary to have competent person to observe the indications and alarms

TESTS

Severn Tunnel System (Only)

1. Tunnel Emergency Signals Cold Filament Proving

1.1 Ask the Signaller to operate the tunnel protecting signal on the road open to traffic to a proceed aspect.

1.2 Remove the lamp of the first tunnel emergency signal and observe that the tunnel protecting signal reverts to a red aspect.

1.3 Renew the lamp in the tunnel emergency signal and check that the Signaller is able to operate the tunnel protecting signal on the road open to traffic to a proceed aspect.

1.4 Repeat 1.2 and 1.3 for the other tunnel emergency signals.

1.5 Arrange for the tunnel emergency signals to be illuminated. Measure the lamp voltages and check they are within specification NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests).

2. Pull Cable Test

2.1 Start at the beginning of the system (the Welsh portal of the tunnel). Operate the Pull Cable by physically pulling it.

2.2 Check that the Signaller’s Pull Cable display and alarm unit at Newport PSB and the Technicians unit at Seven Tunnel Junction interlocking indicate the correct Pullkey activation.

2.3 Check that the Pull Cable failed alarm is also sounded and that the red visual indication is illuminated on the Signaller’s panel at Newport PSB.

2.4 In liaison with the Signaller, check that any tunnel protecting signals that were displaying a proceed aspect prior to the test are now displaying a red aspect.

2.5 If visible in the tunnel, check that the tunnel emergency signals have illuminated.

2.6 On the Signaller's panel at Newport PSB check that the tunnel emergency signals are indicating illuminated.

2.7 Check that the two LED indications on the activated Pullkey unit are illuminated.

2.8 Reset the Pullkey unit by rotating the red knob on the front of the unit. Check that the two LED indications extinguish.

2.9 Check that the Pull Cable Display and Alarm units at Newport PSB and Seven Tunnel Junction interlocking are showing a normal indication with no active alarms.

2.10 If visible in the tunnel, check that the tunnel emergency signals have extinguished.

2.11 On the Signallers panel at Newport PSB check that the tunnel emergency signals are indicating extinguished.

2.12 Check that the Signaller's 'Emergency Pull Cable System' failed alarm is now showing a (white) clear indication and that it is possible to operate the tunnel protecting signals and can be cleared to a proceed aspect on the line open to traffic.

2.13 Repeat 2.2 to 2.12 for each of the Pull Cable sections.

<u>Chipping Sodbury Tunnel System (Only)</u>

3. Pull Cable Test

3.1 Start at the beginning of the system. Operate the Pull Cable by physically pulling it.

3.2 Check that the corresponding alarm and indication activate at the controlling signal box and indicate the correct section activation.

3.3 Check that any alarms or indications at any intermediate location are also activated.

3.4 In liaison with the Signaller, check that any tunnel protecting signals that were displaying a proceed aspect prior to the test are now displaying a red aspect.

3.5 Check that the two LED indications on the activated Pullkey unit are illuminated.

3.6 Reset the Pullkey unit by rotating the red knob on the front of the unit. Check that the two LED indications extinguish.

3.7 Check that the corresponding indication at the controlling signal box (and any other intermediate indication point) is showing a normal indication with no active alarms.

3.8 Check that it is possible to operate the tunnel protecting signals can be cleared to a proceed aspect on the line open to traffic.

3.9 Repeat for each of the Pull Cable sections.

END

These tests are only to be carried out during a no-traffic period and with permission of and in liaison with the Signaller.

There are two different systems that enable this function on SSI interlockings, one uses an ESOC relay, and one cuts the feed directly. Westlock Electronic Interlocks perform the function electronically.

With a system using an ESOC relay the Signaller will lose the 'Emergency Signals on Control' for the interlocking to be tested. With systems that cut the feed directly all signals within the interlocking area being tested will return to red.

TESTS

1 Systems using an ESOC Relay

Your SM(S) will issue a temporary strap so that you can carry out this test. Return the strap to your SM(S) when you have completed the test.

Only carry out this test if you have been given authority to do so by your SM(S).

This test enables the Emergency Signals On Control (ESOC) facility to be tested without shutting down the SSI interlocking.

Only applies to an SSI interlocking with an ESOC relay function that places all signals to danger by disconnecting the BX110 interlocking supply. For Westlock systems see section 3.

Carry out this test for each SSI interlocking within the signalling centre control area.

Applying the Temporary Strap

1.1. Check the continuity of the test strap using a meter.

1.2. Using the record copy diagrams; identify the ESOC circuit to be tested.

1.3. Strap-out the front contact of the ESOC relay within the BX110V interlocking supply circuit.

Testing the ESOC Relay

1.4. Connect a suitable meter on a resistance (ohms) range across the spare front contact of the ESOC relay.

1.5. Observe that the ESOC relay red LED is illuminated.

Non Ansaldo Systems Only

1.6. Arrange with the Signaller to press and release the ESOC button for the interlocking to be tested. Observe the following:

a) The red LED goes out when the button is pressed.

b) The ESOC relay de-energises, when the button is pressed. Watch the meter connected across the spare front contact.

c) The red LED illuminates when the button is released.

d) The ESOC relay re-energises not less than 15s after the button is released. Time this from the moment the LED illuminates.

e) Record the ESOC test date, interlocking name and relay energisation time (15s) in the site logbook. If the time is less than 15s or has significantly changed from the last test, tell your SM(S).

Ansaldo Systems Only

1.7. Arrange with the Signaller to press the red button at the bottom left of the Signaller's key pad, then press '0' and then 'ENTER' for the interlocking to be tested. Observe the following:

a) The red LED goes out when the red button is pressed.

b) The ESOC relay de-energises, when the red button is pressed. (Watch the meter connected across the spare front contact).

c) The red LED illuminates when 'ENTER' is pressed.

d) The ESOC relay re-energises not less than 15s after 'ENTER' is pressed. (Time this from the moment the LED illuminates).

1.8. Record the ESOC test date, interlocking name and relay energisation time (15s) in the site logbook.

If the time is less than 15s or has significantly changed from the last test, tell your SM(S).

Recovering the Temporary Strap

1.9. Disconnect and put away the temporary strap.

1.10. Ask a second competent signalling technician to check that the temporary strap has been disconnected from the circuit.

1.11. When you have completed the test on each interlocking, return the test strap to your SM(S).

2 Systems that Directly Cut the Feed

This test will return all signals in the interlocking area to red.

In liaison with the Signalman, this test shall only be undertaken when no trains are in or approaching the interlocking area.

Observe at least one of the trackside signals returning to danger

2.1. Check the Technicians terminal for faults. Rectify as necessary before undertaking the test.

2.2. Arrange with the Signaller for an external signal to be cleared on the interlocking to be tested and check by visual observation that the signal has cleared.

2.3. Ask the Signaller to depress the all signals on button for a minimum of 15 seconds.

2.4. Check that all signals on the associated IECC panel have returned to danger.

2.5. Check that the signal that was cleared outside has returned to red.

2.6. Ask Signaller to release button.

2.7. Check that Signaller can clear signals within the interlocking area.

2.8. Check Technician’s terminal for faults.

3 Emergency Signals on Control (ESOC) Test for Westlock Systems

During the test the Signaller will lose the ESOC for the interlocking being tested. For this reason, only carry out this test during a no-traffic period and with the authority of your SM(S)

Do not attempt to test or disconnect ESOC during an ESOC operation.

While the ESOC Test Wizard is running, no other Technician's Controls can be issued.

The ESOC Test Wizard allows the WESTLOCK Technician's Workstation user to test the Emergency Signals On Control (ESOC) button located on the Signaller's workstation, without actually setting the signals to their most restrictive aspect.

It does this by issuing a 'Disconnect ESOC' technician's request, valid for a maximum of five minutes. This allows the user to operate the ESOC button during this period, and to have the operation detected.

To operate the ESOC wizard and test the ESOC button, proceed as follows:

3.1. At the WESTLOCK Technician's Workstation, click in the Controls menu and select 'ESOC Test Wizard'. The 'Disconnect ESOC' dialogue box is displayed (See Figure 1):

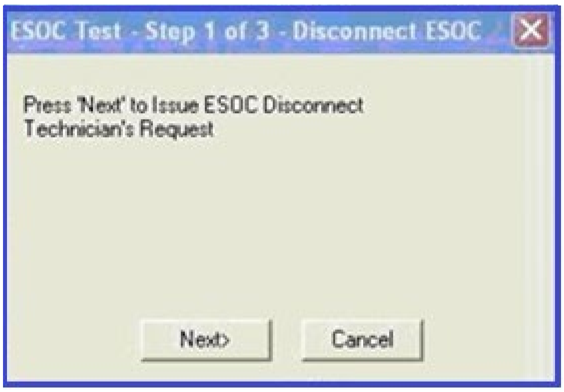


Figure 1 Disconnect ESOC Dialogue Box

3.2. Click 'Next'.

3.3. A Technicians' Request Confirmation dialogue box is displayed (See Figure 2). Type 'CIP' in the 'Confirm' box and click OK to confirm request.

Figure 2 Technician's Request Confirmation Dialogue Box

If the request is not confirmed within a short period, then 'CIP Cancelled Request' result is displayed (See Figure 3):

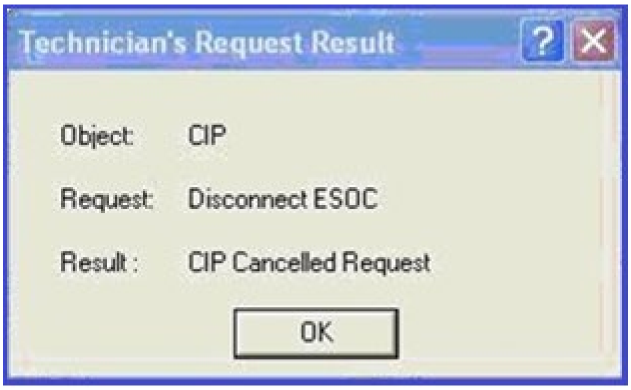


Figure 3 – 'CIP Cancelled Request' Result

If the request confirmation is successful, then 'Request Completed' result is displayed (See Figure 4):

Figure 4 – 'Request Completed' Result

3.4. Click OK. This causes the TW(L) to issue a ‘Disconnect ESOC’ technician’s request.

When the request is successfully completed the ‘Test ESOC’ dialogue box is displayed (See Figure 5) and a 5 minute timer is started and can be seen to count down. Clicking on ‘Cancel’ will close the dialogue box and cancel the procedure.

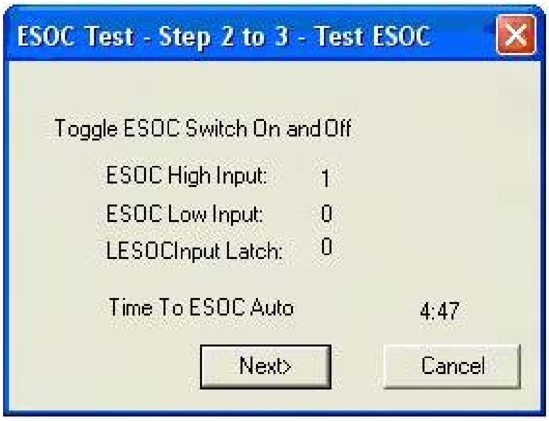


Figure 5 – ESOC Test Dialogue Box

3.5. Observe the dialogue box and check the values shown against the lines are as follows:

a) 'ESOC High Input' 1

b) 'ESOC Low Input' 0

c) 'LESOC Input Latch' 0

3.6. Request the Signaller to operate the ESOC button on his workstation and check the values shown against all three of these lines are updated as follows:

a) 'ESOC High Input' 0

b) 'ESOC Low Input' 1

c) 'LESOC Input Latch' 1

3.7. Request the Signaller to release the ESOC button on his workstation and check the values shown against all three lines in the dialogue box return to their original settings (See Figure 6).

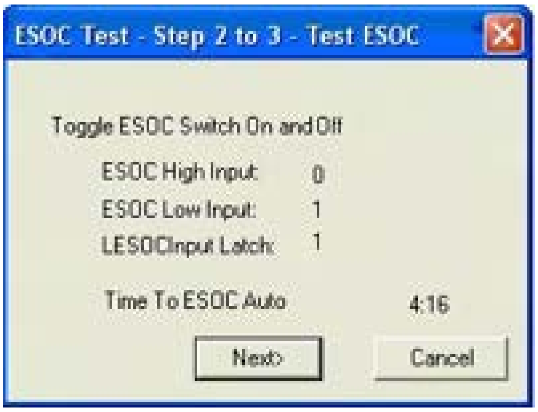


Figure 6 – ESCO Test Dialogue Box

3.8. Repeat 3.3 to 3.5 several times to confirm the operation of the ESOC switch is not intermittent.

It is essential that this is completed within the 5-minute timer period. On completion click 'Next' in the dialogue box.

If the end of the 5-minute period is reached, the ESOC will be automatically re-connected and an 'ESOC Reconnect' dialogue box displayed.

If the signaller presses the ESOC button after this time then the signals will be set to their most restrictive aspect.

The following dialogue box is displayed:

Figure 7 – ESOC Reconnect

3.9. Click on 'Finish'. An 'ESOC Connect' request is issued by the TW(L), and on successful completion the dialogue box is closed, and the procedure is completed.

If the ESOC input is automatically re-connected during the sequence by the 5-minute timer reaching zero, then the ESOC Reconnect dialogue box is displayed. Click on 'OK' in the dialogue box to close it.

Figure 8 ESOC Reconnect Dialogue Box

4 Emergency Signals on Control (ESOC) Test for Smartlock Systems Only

During the test the Signaller will lose the ESOC for the interlocking being tested. For this reason, the test shall only be carried out during a no-traffic period and with the authority of your SM(S).

ESOC testing shall not be undertaken if an axle counter has been reset and a sweep train has yet to prove the section clear.

ESOC testing shall not be undertaken if the support system has failed, as the central interlocking (CIXL) requires the support system to be operational in order to perform a restart.

Operation

4.1 Check the current state of the technician's controls against the written record.

4.2 Request that the Signaller press and immediately release one ESOC button.

4.3 Observe that the power is removed from the CIXL and TICC through all their indications being extinguished for at least 15 seconds.

4.4 Request that the Signaller confirms the standard alarms and behaviour for loss of communication between their panel or VDU system and the interlocking.

4.5 Once power has been seen to restore to the power supplies on both the CIXL and TICC(s), repeat steps 4.2 to 4.4 for each ESOC button provided for the CIXL.

It is not necessary for the system to be allowed to boot fully before performing subsequent tests using other ESOC buttons on the same CIXL.

Post ESOC test

Following the final ESOC button operation the system shall be allowed to complete its power up, which will take 2-3 minutes, at which time the technician will observe communication to restart through flashing of the LED indicators on the CIXL I/O cards.

Once started, the interlocking enters a 4-minute timeout, during which the VIXL within the affected CIXL will declare themselves in ‘Timing Out’ mode (‘tim’ on the Redman card's cyclic display and flashing green / grey on the Support System's CIXL mimic).

At the start of this timeout, the Signaller will observe tracks on the panel flood red, and then recover. Some tracks, near internal interlocking boundaries, may take a few seconds longer to clear.

Route locking will be seen to be applied, but this shall release after a timeout providing track sections are clear (or any occupied sections are behind signals). The system will not respond to requests made by the Signaller until this 4-minute timeout has expired.

Upon expiry of the 4-minute timeout, the technician will see the VIXL enter the on-line mode ("On" on the Redman card's cyclic display and green on the Support

System's CIXL mimic). The Signaller's panel, or VDU based system, will then respond to Signaller requests.

4.6 Request that the Signaller key all points to their current positions, and then to centre (or centre then back to their current position) and cancel any emergency replacement of auto signals which were not in place before the test.

4.7 Verify the applied technician's controls against the written record.

Multiple CIXL

4.8 Repeat steps 4.6 to 4.7 for each CIXL.

END

This test is applicable to all safety related timing function relays including:

- Level crossing timers (HJR, CON JR, reset timers etc).

This is usually done as part of LC annual test.

- Approach Locking Timers (e.g. ALSR).
- Track circuit timers (e.g. TJR).
- Signal approach control timers (e.g. AJR).
- Other Interlocking timers (OJR, USJR etc).

1. Test

1.1 Arrange for the function to be operated to cause the timer relay to run.

1.2 Check the timer operates within the required time cycle (i.e. the time specified on the signalling record). Adjust as necessary.

1.3 Record the result on the NR/SMS record card with the actual time, extent of any adjustment made and initial/ date of test.

If the timer is significantly out of adjustment and it cannot be corrected or replaced immediately, the signaller shall be advised and the relay reported as a fault.

Disconnection of the affected signalling controls shall be considered against the scope of the timing error.

Arrangements shall be made to have the relay replaced.

Point machine cut-out timers (e.g. WJR) are usually tested as part of a point machine service.

End

Includes:	All surge and lightning protection units connected to TDM, FDM, TD, SSI and other electronic equipment

Tests on any line protection units shall not be carried out if there is or the possibility of a thunderstorm in the vicinity of either end of the protected line.

GENERAL

Line Protection Units are used to protect equipment connected by line cables from actual or induced high voltage surges caused by lightning.

They can take the form from a basic ‘spark gap’ contained within a glass tubes to an electronic unit with LED indications.

They are connected between line cables and earth and under normal conditions they provide a very high resistance or open circuit path to earth.

If high voltages are present on the line, they can provide a low resistance or short circuit path to earth preventing the high voltage damaging the equipment they are protecting.

Line protection units can be connected in series or parallel with the line.

Removing the unit can disconnect the equipment from the line; always liaise with the signaller before attempting any disconnections.

Lightning and other types of extreme electrical surges can stress line protection units whilst they are providing protection. Each surge causes a small amount of degradation which can eventually cause the unit to fail.

In most cases, such a failure will not prevent the equipment it is fitted to working correctly, although surge protection can be reduced or lost leaving the system vulnerable to the next surge.

In electronic systems failed line protection units can cause noise levels to increase leading eventually to failure.

To protect against this line protection units shall be tested (or health unit lights inspected) at the next opportunity where it is known that they have been exposed to a lightning strike or other large electrical surge.

If any units are found to be faulty or not working correctly, report the matter as a corrective maintenance item immediately

1. Surge Arrestors AEI 16 or 26 Series Tubes in Bases

1.1 Remove the tube and examine the spark gaps on the base (use a magnifying glass and torch) for cracking or flaking plating.

a) If any is observed the unit is to be replaced.

b) Measure using a suitable meter on the Ohms range that the surge arrestor is not short circuit.

c) Replace the tube back into its base and replace the cover (if fitted).

Surge arrestor spark gaps are pre-set at the factory.

No attempt shall be made to alter this setting.

These are also now known as Semitron 1026 Series.

2. Surge Arrestors Units on 11 Pin Bases (Usually to BR 1937)

2.1 Unplug the unit. For any type, using a suitable meter Measure the resistance across the respective pins to

Check that the diodes, resistors and gas discharge tube are not short or open circuit as appropriate. (Appendix A).

For the Furse Unit, the Furse ESP PTE 002 test device shall be used since it gives a more accurate health check.

3. Line Connection Units (With Glass Covers)

3.1 Disconnect the LCU, remove the glass cover and remove the lightning protector.

3.2 Using a suitable insulation tester (e.g. Megger) on the 50V range connect the leads between the centre ring and one end of the protector. The obtained reading should be very high (MΩ) to infinity.

3.3 Repeat 3.2 with the insulation tester on the 500V range. The obtained reading should now be very low (Ω) to short circuit.

3.4 Reconnect the LCU to circuit.

4. Other Protection Units (not units with LED indications)

This is a generic test for units not covered by the other sections.

4.1 Disconnect the protection unit from the line.

4.2 Using a suitable insulation tester (e.g. megger) on the 50V range connect the leads between the terminal on the unit that is normally connected to the line and the terminal that is normally connected to earth.

The obtained reading should be very high (MΩ) to infinity.

4.3 Repeat 4.2 with the insulation tester on the 500V range. The obtained reading should now be very low (Ω) to short circuit.

700V or 1000V devices fitted to AC track circuits need to be tested at 1000V.

4.4 Reconnect the protection unit to the line.

5. Line Protection Units with LED Indications

Check the status of the line protection units taking action as stated below:

- Green lit only: No Action Required.
- Green and Red Lit: Replace unit within 7 Days.
- Red lit only: Replace unit immediately.

For units with other LED configurations, establish the equivalent indications from the manufacturer's data sheet.

APPENDIX A – Furse Units

Circuits of SSI Surge Protection Units (Numbers refer to base pins) Clippit Unit.

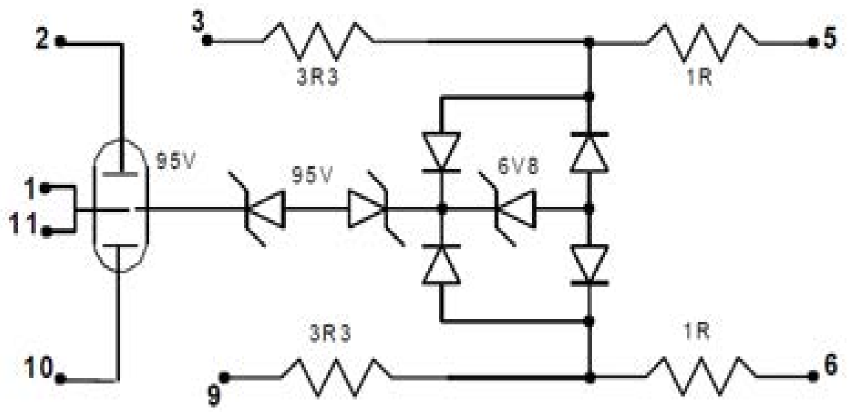


Figure 1 – Furse Unit (post 1994)

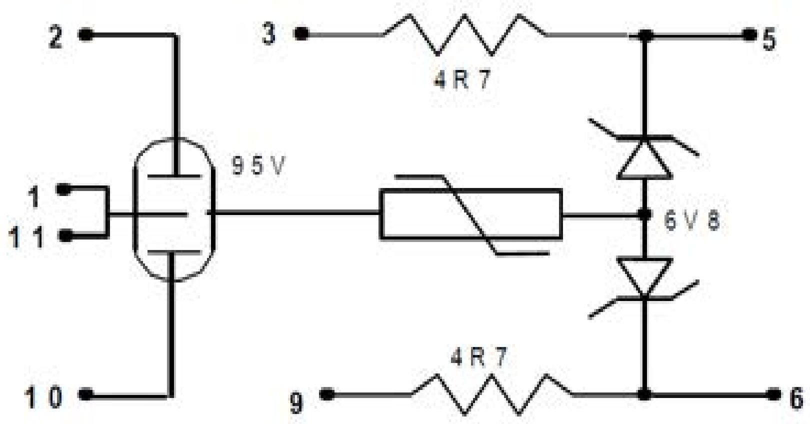


Figure 2 – Pre 1994 Furse units had components with different values.

ISPU

The ISPU is similar to the Furse Unit (post 1994) but has an isolating transformer with its secondary coil connected across pins 5 and 6 and its primary connected across the pair of Zener diodes.

There are several types of ISPU in use, and these differ only in the type of isolating transformer used.

The current model of ISPU is recognised by its orange case.

The ISPU is not interchangeable with the Furse or Clippit units, and shall only be fitted where indicated on the site wiring.

End

System Checks / Tests

1. Signallers Control Console

1.1 Check operation of the handset, headset and desk mic, including the associated PTT switches.

1.2 Check console (Figure 1), headset and loudspeaker volume controls on inbound calls.

Figure 1 – Console Volume Controls

1.3 Check that inbound and outbound audio is clear.

1.4 Check the console LEDs (red Tx LED on outbound calls, green Rx LED on inbound calls), Figure 2.

Figure 2 – Console LEDs

1.5 Check that the connectors to the rear of the console are seated correctly.

1.6 Clean the console touch screen.

2. 2-Wire Dial-Up Interfaces

2.1 Using the Signallers Control Console (Figure 3), carry out a Full System Test over the 4-wire and confirm that a response is received from each site.

2.2 Connect a 2-wire dial-up (the 2-wire icon change to green).

2.3 Disconnect the system 4-wire interface (4-wire icon changes to red).

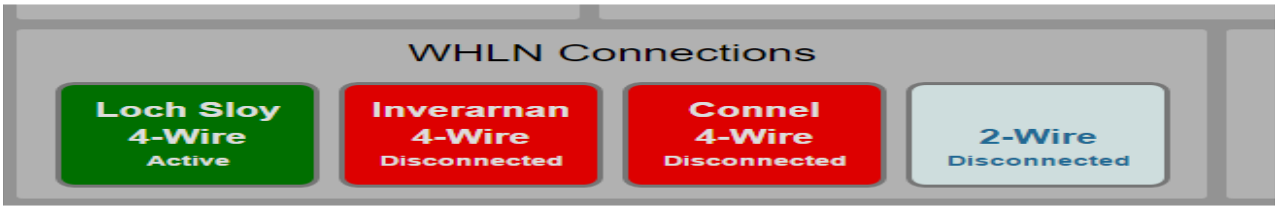


Figure 3 – Signallers Control Console

2.4 Perform audio tests and token exchanges to confirm access to the radio chain.

2.5 Perform a Full System Test over the dial-up and confirm that a response is received from each site.

2.6 Disconnect the dial-up (the 2-wire icon returns to grey).

2.7 Repeat steps 2.1 to 2.6 for each dial-up present on the system.

2.8 Reconnect the 4-wire interface (the 4-wire icon returns to green).

3. Basic Radio Rack Checks

3.1 Dust the cabinet.

3.2 Check that all the shelves and equipment are securely mounted.

3.3 Check that all the cable connectors are secure and undamaged.

3.4 Check the external cables are undamaged and in good condition.

3.5 Check there is satisfactory ventilation around the cabinet and that any cooling fans are working correctly.

3.6 Check any fan filters are clean, replace if necessary.

3.7 Check that the terminal connections to the following 4 items at the back of the rack are secure and in good condition:

a) Wire
b) 2 Wire
c) Signallers console
d) SSI

3.8 Check that the auto test/enable/disable function works for each base station that should be able to be accessed.

4. Extended Radio Rack Checks

4.1 Use the MSS graphing tool to check the system controller internal power supplies, and unit temperature. Compare readings with limits, and with historical data. Identify and report any changes/issues.

4.2 Check that all cables and connectors are secure and undamaged.

4.3 Check that only the green 'Lightning' LED on the power distribution unit (PDU) - (Figure 4) at the rear of the control rack is lit. Investigate if 'polarity' or 'Earth' indicators LEDs are lit. Replace the PDU if necessary.

Figure 4 - PDU

4.4 Check that the 'AC OK' and 'DC OK' LEDs on the two power supply modules (Figure 5) at the front of the rack are green. If any are red, investigate and replace the module if necessary.

Figure 5 – Power Supply Module

4.5 Check that the cooling fans on the PSUs are running and are unobstructed. Clean if necessary.

5. System Current Issues Checks

5.1 Log in to the MSS and select Current Issues.

5.2 Use the filtering options in the left hand pane to select the RETB line of interest, issue types, and timespan.

5.3 Review any logs displayed in the right hand pane. Note any that require immediate attention, e.g. Mains Supply alarm, Battery Low alarm.

6. Network Data Integrity Testing (end-to-end BER testing)

This test is system-invasive and should only be carried out with the co-operation of the signaller.

6.1 Check that the 4-wire interface is connected and all 2-wire dial-ups are disconnected.

6.2 Select MSS > Live System > System Testing > BER.

6.3 Select the radio site at one end of the radio segment of interest from the 'Source ID' pull-down menu, e.g. Mallaig Cell.

6.4 Select the radio site at the other end of the segment from the 'Sink ID' menu, e.g. Banavie SC.

6.5 Click 'Initialise test'.

6.6 Click 'Start test'. A test data packet is sent over the radio network to the radio ID entered. This performs a bit error rate (BER) check.

6.7 If the number of Repeats/Test Runs is set to 1, the following message appears in the small window after a few seconds:

Reply from (for example if using radio unit 1234).

1234, bits: 2176 (expected: 2176), errors: 0

The number of errors should be 0. If it is not, repeat the test a number of times to confirm consistency of bit errors. If bit errors persist then there is a weak point in the radio chain and further testing and diagnostics (e.g. received signal strength (RSS) checks) should be performed over smaller sections to isolate it.

(The number of bits is increment by 2176 for each test run. 'Initialise test' resets the bit counter to 0)

6.8 Repeat for remaining segments of the radio network. Record any weak links that need attention.

6.9 Repeat the BER test with 2-wire dial-up connected instead of the 4-wire, and the Source and Sink IDs reversed.

END

On-Site Power Supply Checks

Mains voltages at 240V AC are present in the power supply. Extreme caution shall be taken (See NR/SMS/PartC/EL00 (Electrical Equipment General) - Hazards Associated with Electrical Supplies.

The equipment includes a UPS function - Power might still be present even though external power has been disconnected.

Batteries are present with large current capacity. Care shall be taken not to short battery contacts. For installations with multiple batteries, do not connect batteries together in any other arrangement other than prescribed in the manufacturer's instructions.

Batteries shall have satisfactory ventilation. Explosive gases are released in charging which shall be allowed to dissipate prior to any works. Keep sparks and flames well away.

UPS Reset Procedure

The UPS (Figure 1) shall be reset, if it has shutdown, before any power is applied to the wall-frame. This would be necessary following:

a) Disconnection and then re-connection of a battery, or
b) If a battery is discharge to a very low level and replaced with a charged battery while no mains is present.

Reset is actioned by pressing the Yellow button mounted within the PSU cabinet. The UPS operation can be verified by an orange LED lights on DRU30 unit.

Figure 1 - UPS

Voltage is also present at the output.

1. Equipment Required

a) PSU cabinet key.

b) Digital multimeter (accurate to 0.1V).

c) Battery tester (e.g. Hioki 3554).

Alarms might be heard on the FSI loudspeaker.

Readings outside of the prescribed limits should fault the equipment.

2. PSU In-Service Health Indication Check

2.1 Open the PSU cabinet and check that the LEDs on all PSU modules (DRE240, DBR60, DRU30, Figure 2) are green.

Figure 2 – PSU Modules

2.2 Visually inspect the battery/batteries for signs of swelling or leakage. Replace if damaged.

2.3 Check that the LEDs on the front of the FSI are as follows: AC: green, BATT: off, PSU: green.

2.4 Measure the voltage across the red and black DIN terminals (Figure 3) on the 'Site Interface' panel.

Expected voltage: 12.5V (Limits 12.0V to 14.0V).

Figure 3 – Red and Black DIN Terminals

3. Basic PSU Output and Alarm Check

3.1 Disconnect the mains.

3.2 Confirm that the Signaller receives a 'mains failure' alarm from the site (displayed on console).

3.3 Check that the FSI LED indications change to: AC: off, BATT: green, PSU: green.

3.4 Check that the LED on the DRU30 unit indicates orange.

3.5 Measure the voltage across the red and black DIN terminals on the 'Site Interface' panel.

Expected voltage: 12.5V (Limits 12.0 to 14.0V assuming healthy state of charge).

3.6 Reconnect the mains.

3.7 Confirm that the Signaller receives a 'mains fault cleared' message from the site.

3.8 Check that the FSI LED indications return to: AC: green, BATT: off, PSU: green.

3.9 Check that the LED on the DRU30 unit returns to green.

4. Battery Tests - Standard Capacity PSU (one 12V battery)

4.1 Disconnect the battery (Figure 4) by separating the grey SBS Anderson connectors inside the cabinet.

Figure 4 – Battery Disconnection

4.2 Visually inspect the battery for signs of swelling or leakage. Replace if damaged.

4.3 Measure the voltage across the battery terminals.

Expected voltage: 12.0V to 13.6V.

4.4 Configure the battery tester for a 20V and 20mΩ range.

4.5 Place the probes onto the battery terminals, wait until a steady reading is established and measure internal resistance.

Model	Good (mΩ)	Warning (mΩ)	Fail (mΩ)
XL12V85	<8.6	8.6-11.5	>11.5

Table 1 – Internal Resistance Values (1)

4.6 If the internal resistance is within the warning zone notify your SM(S).

4.7 If the battery is above the fail limit the battery should be replaced.

4.8 Compare with historical results.

5. Battery Tests - High Capacity PSU (two 6V batteries)

5.1 Disconnect the batteries by separating the yellow SBS Anderson connectors from the "Y" adaptor cable (P1062-CBL-12-03).

Figure 5 – High Capacity PSU

5.2 Visually inspect the batteries for signs of swelling or leakage. Replace if damaged.

5.3 Measure the voltage across the terminals of each battery, in turn.

Expected voltage: 6.0V to 6.8V

5.4 Configure the battery tester for a 20V and 20mΩ range.

5.5 Place the probes onto the terminals of one battery, wait until a steady reading is established and measure internal resistance.

Model	Good (mΩ)	Warning (mΩ)	Fail (mΩ)
XL6V180	<2.4	2.4-3.2	>3.2

Table 2 – Internal Resistance Values (2)

5.6 If the internal resistance is within the warning zone notify your SM(S).

5.7 If the battery is above the fail limit the battery should be replaced.

5.8 Compare with historical results.

5.9 Repeat steps 5.5 to 5.8 for the other battery.

6. Battery Charger Test

6.1 Batteries should still be disconnected following the battery tests above, if required, disconnect the battery(s) by separating the grey SBS Anderson connector inside the PSU cabinet. On a High Capacity PSU, separate the grey connector on the "Y" adaptor cable.

Figure 6 - PSU

6.2 Measure the voltage across the BATT +/- screw terminals on the DRU30 unit (s).

6.3 Expected voltage: 13.6V (Limits: 13.2 to 14.0V).

6.4 Reconnect the battery / batteries to the PSU.

6.5 Reset the UPS (press Yellow button and check Orange LED lights on DRU30 unit).

END

On-Site Antenna System Checks

High power RF signals are generated by the radio equipment. Always disconnect the DC power feed to the fixed station radio or frame before removing or reinstating any connections to the antenna.

Inspection and maintenance of the aerial tower, fall arrest system, antennas, and feeders shall be undertaken as detailed in NR/L2/TEL/30088, by others, and is not part of these checks.

Equipment Required, antenna tester (VSWR meter / Bird Watt Meter).

1. Antenna System Inspection

1.1 Check that the site fixture cabling is secure and undamaged and that all RF connectors are finger tight.

1.2 From ground level, visually inspect the condition of the mast, the security of feeder cables and the antenna elements for obvious defects, including approximate bearing.

2. Antenna VSWR Measurements

2.1 Using the results obtained during Fixed Station Radio & Site Interface Equipment testing - Radio Test – TX Output Power Plot the Forward and Reverse power reading on a VSWR Chart to obtain VSWR Value.

2.2 A VSWR reading in excess of 2.0 should prompt investigation. The reading for each antenna should be compared with historical measurements and the result report by the Maintenance terminal.

2.3 Re-connect the feeder to the bulkhead after making the measurement.

2.4 Repeat for each VHF antenna at the site.

END

Pre-Visit Fixed Site Checks using MSS (Maintenance Support Sub-System)

1. 4-Wire Line Level Check

With the 4-wire connected, check the gains at both ends of the line (Rack and FSI) as follows:

1.1 Select MSS > Live System > System Testing > Line.

1.2 Select the 4-wire interface site, e.g. Crianlarich, from the 'Site' pull-down menu.

1.3 Click 'Test'. The following message should be received:

a) Rx level at Rack: X.X dB, Rx level at FSI: Y.Y dB

b) The target for both reported levels : 0.0 dB (Limits : -1.0 dB to +1.0 dB).

If adjustments are necessary, they are to be made onsite in the FSI configuration.

If the reported Rx level at the Rack is -1.0 dB, then an increase of 1.0 dB is required to the output gain of the FSI.

If the reported Rx level at the FSI is +1.0 dB, a reduction of 1.0 dB in the input gain of the FSI is required.

2. 2-Wire Dial-Up Line Level Check

With the 2-wire connected, check the gains at both ends of the line (Rack and FSI) as follows:

2.1 Select MSS > Live System > System Testing > Line.

2.2 Select the 2-wire interface site, e.g. Buchannan House, from the 'Site' pull-down menu.

2.3 Click 'Test'. The following message should be received:

a) Rx level at Rack: X.X dB, Rx level at FSI: Y.Y dB

b) The target for both reported levels : 0.0 dB (Limits : -1.0 dB to +1.0 dB).

If adjustments are necessary, they are to be made onsite in the FSI configuration. If the reported Rx level at the Rack is -1.0 dB, then an increase of 1.0 dB is required to the output gain of the FSI.

If the reported Rx level at the FSI is +1.0 dB, a reduction of 1.0 dB in the input gain of the FSI is required.

3. Site Interface Parameter Check

3.1 Log in to the MSS, select Graphs and then use the filter in the left hand side pane to select an RETB system, e.g. WHLS.

3.2 Select the site of interest, e.g. Loch Sloy.

3.3 Select ‘Site Interface’, and then select the ‘Supply & temperature’ report type.

3.4 Set the start and end search date and time appropriately, e.g. from date of last service.

3.5 Click ‘Submit’ to plot the graph. Inspect the 3 graphs displayed.

a) Maximum temperature should be < 40 degC.

b) Minimum temperature should be > 0 degC.

c) Supply Voltage should be between 12.0 and 14.0 V.

d) Supply Current should be < 1.0 A.

3.6 Plot the ‘Line levels’ graphs if the site has a line interface. Inspect it for line levels less than 1.0 dB or greater than +1.0 dB.

3.7 Compare the latest FSI graphs with historical data and report any significant changes.

4. Radio Parameter Check

4.1 If present in the Filter tree, select the ‘Cell’.

4.2 Plot the ‘Temperature’ graphs.

a) Maximum Unit and Power Amp temperatures should be < 45 degC.

b) Minimum Unit and Power Amp temperatures should be > 0 degC.

4.3 Plot the ‘Supply & VSWR’ graphs.

a) VSWR is only recorded when the transmitter is active and should be less than 1.7V.

b) Supply Voltage should be between 12.0 and 14.0 V.

c) The supply voltage should dip by no more than 0.5V during keying events.

d) The supply current level when the unit was not keyed should be less than 0.6 A.

e) The supply current level when the unit was keyed should be between 3.5 and 5.0 A, if configured for 25W / +44dBm output power.

4.4 Plot the 'Interference calls' graphs.

Note and report any unusually high numbers of interference events.

4.5 Plot the 'Received signal strength' graph with 'Fixed sites' selected as the 'Linked site'.

4.6 Check the Mean and Min RSS level reported for the neighbouring Link site(s). The levels should not drop below -95 dBm. Variation should be less than 10 dB.

4.7 Repeat steps 4.2 to 4.6 for each Link radio in the Filter tree. In this case the Linked site is the neighbouring Cell.

On-Site Radio Equipment and Site Interface Checks

Equipment Required:

a) Transportable Token Unit (TTU).

b) Digital multimeter.

c) Engineering Terminal laptop and cables.

5. Installation Checks

5.1 Check that all equipment is clean and tidy. Clean and dust as necessary.

5.2 Check the cabling is secure and undamaged and that all RF connectors are finger tight.

5.3 Check the condition of the BT (or other telecom service provider) to railway internal telephone system connection sockets.

5.4 Check the 'RJ' connectors of all inter-unit cables on the fixed site frame are clicked in place. Replace any cables with broken clips.

6. FSI LED Check

6.1 Check that the FSI front panel LEDs indicate a 'No Fault' status as follows (See Table 1):

AC	Green
BATT	Off
PSU	Green
GPS	Green
'Mimic'	Orange (where a radio is fitted)
2W Line	Orange, periodically flashing Red (when the 2-wire dial-up is active)
4W Line	Orange, periodically flashing Red (when the 4-wire interface is active)

Table 1 – FSI Front Panel LEDs

7. FSI Line Level Adjustment (where applicable)

This is only required at sites with 2 or 4-wire line interfaces that require level adjustment, as highlighted by Pre-Visit checks.

7.1 Connect the Engineering Terminal to the FSI using a standard network cable, open the Chrome browser and direct it to 192.168.1.200.

7.2 Select the FSI > Line testing tab.

7.3 If the site has a 4-wire interface, click 'Line test'.

7.4 If the site has a 2-wire dial-up interface, have the signaller connect the dial-up and then click 'Line test'.

Line level figures for Rx Power and Reported Tx Power is displayed in units of dB.

The target for each is 0.0 dB (Limits : -1.0 dB to +1.0 dB).

7.5 If adjustment to either level is necessary, perform the following steps:

a) Click on the FSI > Configuration tab.

b) Click 'Read from device'.

c) To adjust a 4-wire interface, use the '4 wire line output gain' and '4 wire line input gain' controls.

d) To adjust a 2-wire dial-up interface, use the '2 wire line output gain' and '4 wire line input gain' controls.

e) To adjust the 'Rx Power' figure use the INPUT gain (step size = 0.5).

f) To adjust the 'Reported Tx Power' figure use the OUTPUT gain (step size = 1.0).

g) After incrementing or decrementing the required control, click 'Write to device'.

h) Return to the FSI > Line testing tab and re-test the levels. Adjust again if required until both figures are as close to 0.0 as possible.

8. Radio Tests – Reported Parameters

These tests are intrusive or disruptive to network operation and should only be carried out with the co-operation of the signaller.

8.1 Connect the Engineering Terminal to the FSI, if not already connected.

8.2 Click the 'Overview' tab.

8.3 For the first active radio, e.g. a Cell radio, use the 'Tx Key' button to key and de-key the unit.

8.4 The following should be observed on the radio overview (See Table 2):

Supply voltage (idle)	12.0 V min
Supply voltage (keyed)	11.5 V min
Supply current (idle)	0.5 A max
Supply current (keyed)	3.5 to 5.0 A (Tx Power set to +44dBm)
	1.5 to 2.5 A (Tx Power set to +37dBm)
Antenna VSWR (keyed)	< 1.7
Internal temp	> 0 deg C, < 40 deg C
Power amp temp	> 0 deg C, < 45 deg C
Tx disabled	Off (grey) or red for a unit on standby, e.g. White Corries.
Poor VSWR	Off (grey)
Tx protection active	Off (grey)

Table 2 – Radio Overview

8.5 Check that radio is de-keyed (idle).

8.6 Repeat for the remaining radios.

9. Radio Tests – Tx Output Power

Test the output power of each radio fitted on the frame as follows:

9.1 For the first active radio, e.g. a Cell radio, disconnect the antenna feeder at the bulkhead connector at the top of the frame and connect the RF Power Meter to the connector.

9.2 Key the radio using the 'Tx Key' button. Note and record the output power indicated by the meter. This should be within +/-1.5 dB of the 'Tx Power' setting. Record the result for use during Antenna Systems Testing.

9.3 With the radio De-keyed, change the RF Power Meter element for a lower power rated one and using the TX Button, measure reverse power. Record the result for use during Antenna Systems Testing.

9.4 Disconnect the power meter and re-connect the antenna feeder. Check the connector is finger tight.

9.5 Repeat for the remaining radios.

10. Radio Tests – Received Signal Strength

<u>Sites with a main coverage Cell radio</u>

10.1 Check the received signal strength due to the neighbouring Link site(s) as follows:

a) Select the Cell radio tab (Port 1).

b) Select the Port 1 > 'History' tab.

c) Click the 'Rx Signal strength' link in the left hand pane to check that the graph is plotting received signal strength.

d) Click 'Clear graph'.

e) Select the Port 1 > 'RSS testing' tab.

f) Set the 'Neighbour remote key network ID' to the ID of one of the neighbouring Link radio sites.

g) Click 'Tx 5 sec silence' and immediately jump back to the 'History' tab.

h) Observe that the 'Receive' LED lights green and note the Rx signal strength on the graph whilst the Link site is keyed up. Compare the figure with the historical data recorded in the site documentation.

10.2 Repeat this for the neighbouring Link radio site in the opposite direction (where applicable).

Sites with Link radios

10.3 Check the received signal strength due to the Link's neighbouring Cell site as follows:

a) Select a Link radio tab (Ports 2, 3 or 4).

b) Select the 'History' tab.

c) Click the 'Rx Signal strength' link in the left hand pane to check that the graph is plotting received signal strength.

d) Click 'Clear graph'.

e) Select the 'RSS testing' tab.

f) Set the 'Neighbour remote key network ID' to the ID of the neighbouring Cell radio site.

g) Click 'Tx 5 sec silence' and immediately jump back to the 'History' tab.

h) Observe that the 'Receive' LED lights green and note the Rx signal strength on the graph whilst the Cell site is keyed up. Compare the figure with the historical data recorded in the site documentation.

10.4 Repeat this for the remaining Link radios and their neighbouring Cell, where applicable.

11. Radio Tests – Received Signal Strength at Neighbour Sites

Sites with a main coverage Cell radio

11.1 Check the received signal strength at the neighbouring Link site(s) as follows:

a) Select the Cell radio tab (Port 1).

b) Select the Port 1 > 'RSS testing' tab.

c) Set the 'Target network ID' to the ID of one of the neighbouring Link radio sites.

d) Click 'Get Rx signal strength'.

A signal strength response (e.g. -83 dBm) should be received from the Link with the Target ID.

11.2 Compare the figure with the historical data recorded in the site documentation.

11.3 Repeat this for the neighbouring Link radio site in the opposite direction (where applicable).

Sites with Link radios

11.4 Check the received signal strength at the Link's neighbouring Cell site as follows:

a) Select a Link radio tab (Ports 2, 3 or 4).

b) Select the 'RSS testing' tab.

c) Set the 'Target network ID' to the ID of the neighbouring Cell radio site.

d) Click 'Get Rx signal strength'.

A signal strength response should be received from the Cell with the Target ID. Compare the figure with the historical data recorded in the site documentation.

11.5 Repeat this for the remaining Link radios and their neighbouring Cell, where applicable.

END

Includes:	SELC SET 45 -18 Timer (Level Crossing) and SELC 850 AWCU
Excludes:	All other timers

Equipment Identification Image

Figure 1 - SELC SET Digital Timer

Figure 2 - SELC 850 AWCU

1. SELC SET Digital Timer - Set up Process

NOTE: *These style time clocks restrict the output to the yodels when ON, therefore the times need to reflect this, so the ON & OFF times are the opposite to the older mechanical style time clocks.*

1.1 Press PRG button. “SET” appears with first zero flashing.

1.2 Keep pressing OK button until you set the first security code digit which is 4.

1.3 Press PRG button again.

1.4 Enter second security digit which is 7.

1.5 Press PRG again. Timer can now be set up or checked.

1.6 To check what times are inputted without altering; keep pressing PRG which scrolls through each time for ON & OFF. Dashes (--:--) indicate no time is set and timer ignores the setting, so ALL times are to be set.

1.7 To adjust any times; from step 1.5, press PRG until hour or minute flashes and use the OK button (keep pressing or hold down) to adjust each time.

1.8 Set each time (to local instruction, or to standard time which is ON at 2330 and OFF at 0700).

1.9 Keep pressing the PRG button and set ALL times. Note: the days all flash at the bottom, however these do not change as the programmed times are the same for all days of the week. These timers are factory set for specific railway use.

1.10 After each time has been set, press PRG and the following appears; YEAR > MONTH > DAY> TIME.

1.11 Use the OK button to set any of these if wrong.

1.12 Pressing PRG again shows BST/GMT auto change function by either b 1 (ON) or b 0 (OFF). This shall be set to b 1 to enable automatic BST/GMT yearly changes.

1.13 Note: the timer has built in auto leap-year compensation.

1.14 Press PRG to return to main screen.

1.15 Check the main time is correct; the day is correct and according to the time of the day the ON / OFF icon is showing the correct setting.

1.16 Check all the settings again, especially if any have been changed, paying particular attention to the ON and OFF icon making sure the times are correctly matched.

Additional Notes

a) Pressing PRG and OK buttons together results in the timer being reset and clearing all pre-programmed times and settings, and sets the time and date to 00:00 01/01/12, and BST/GMT setting to b 1 (ON).

b) If no buttons are pressed, the screen times out after 30 seconds.

c) Use the MAN button to change the ON / OFF icon over so the yodal's are louder/quieter to test output or to quieten them during engineering work (during the daytime), remember to change back before leaving site if altered.

d) Battery back-up to keep programmed settings is by a lithium cell and lasts up to five years from date of manufacture. It provides up to 12 months back-up if the mains fail. It is NOT user-changeable, so the timer shall be replaced. If exposed to temperatures of +100 degrees Celsius, the cell is liable to explosion. If no LED's lit on buttons, this signifies mains failure.

2. SELC 850 AWCU – Set up process

2.1 Start Set up process (Figure 3).

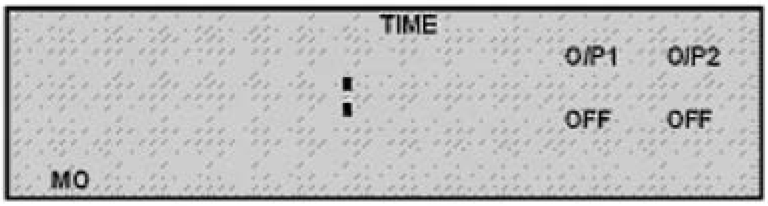


Figure 3 – Start Point

2.2 Output 1 (O/P1) is not used for this application so to move to the Output 2 setup press the MODE button repeatedly until (O/P2) is displayed see (Figure 4).

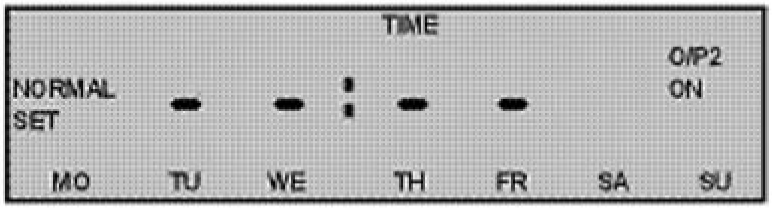


Figure 4 – Output 2 setup

2.3 The hours start to flash (Figure 5)

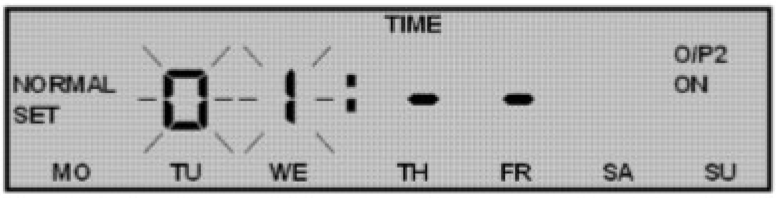


Figure 5 – Hours flashing (Loud)

2.4 Set time for the clock to switch to the loud setting (ON).

2.5 Increase the hours by pressing SET button, once the correct hour is displayed press MODE button once to move to set the minutes (Figure 6).

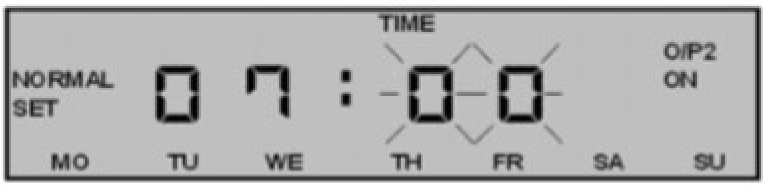


Figure 6 – Minutes flashing (Loud)

2.6 Increase the minutes by pressing the SET button, once the correct minutes are displayed press the MODE button. This causes Monday - Sunday to flash (Figure 7).

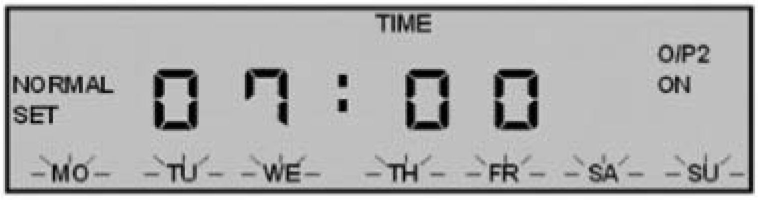


Figure 7 – Days of the week (Loud)

2.7 Press the SET button once, the Monday to Sunday continues to flash now press the SET button again (Figure 8).

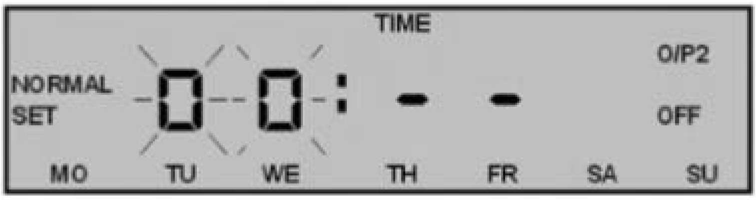


Figure 8 - Set

2.8 Set time for the clock to switch to the quite setting (OFF).

2.9 Increase the hours by pressing the SET button, once the correct hour is displayed press the MODE button once to move to set the minutes.

2.10 Increase the minutes by pressing SET button, once the correct minutes are displayed press MODE button. This causes Monday - Sunday to flash (Figure 9).

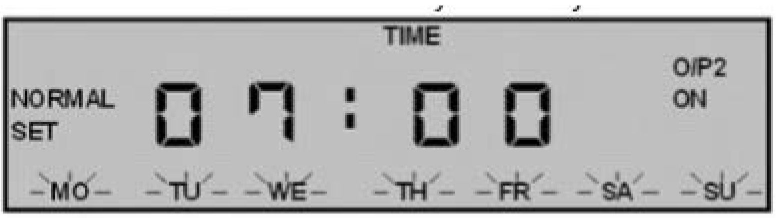


Figure 9 –

2.11 Press SET button once, the Monday to Sunday continues to flash now press SET again.

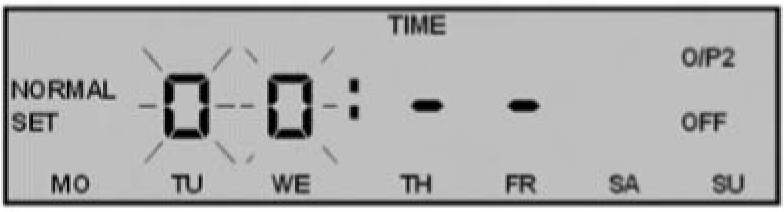


Figure 10

2.12 Set time for the clock to switch to the quite setting

2.13 Increase the hours by pressing SET button, once the correct hour is displayed press MODE button once to move to set the minutes (Figure 10)

2.14 Press the MODE button until Year is displayed (takes several presses)

Figure 11

2.15 Press the SET to increase the (Tens) for the year, once the Tens are correct press the MODE button to move to the (Units). (Figure 11)

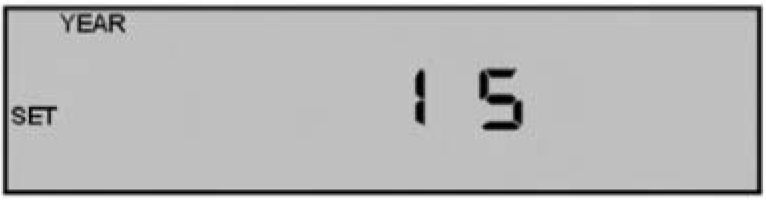


Figure 12

2.16 Press the SET button to increase the (Units) for the year, once the Units are correct press the MODE button to move to Month (Figure 12)

2.17 Press the SET button to increase month (Figure 13)

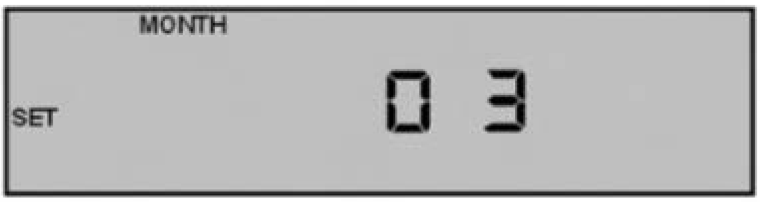


Figure 13

2.18 Once the correct month is displayed press the MODE button to move to the day setup. Press the SET button to increase the day. (Figure 14)

Figure 14

2.19 Once the correct day is displayed press the MODE button to move to the day of the week setup.

2.20 The day of the week flashes (Figure 15)

Figure 15

2.21 Press the SET button once, the day of the week continues to flash. Press the MODE button to move to the next day of the week. Once the current day of the week is displayed press the SET button once.

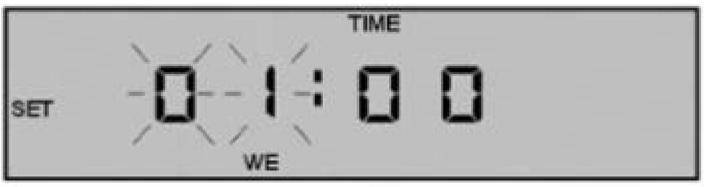


Figure 16

2.22 Press the SET button to increase the hours to display the current hour, then press the MODE button. (Figure 16)

2.23 The minutes now flash

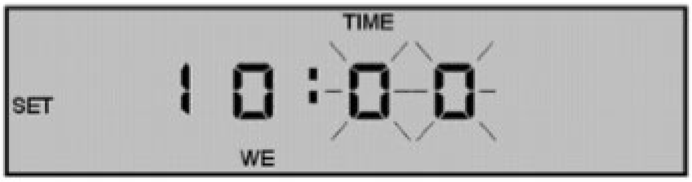


Figure 17

2.24 Press the SET button to increase the minutes to display the current time, then press the MODE button. (Figure 17)

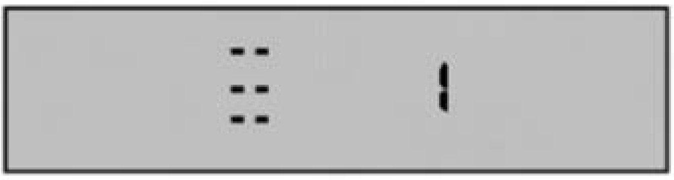


Figure 18

2.25 The screen as displayed above is the setup for BST/GMT changeover and should be left at 1. Press MODE to move to next screen. (Figure 18)

2.26 The next screen is the latitude which should be set at 52. (Figure 19)

Figure 19

2.27 Press the MODE button once which completes the setup and the screen should look something similar to that displayed in Figure 20. (It moves to this screen automatically after a few seconds).

Figure 20

2.28 The state of O/P1 & 2 and the current time is normally displayed.

END

Includes:	All types of Automatic Half Barrier Crossing (AHBC)
Excludes:	All other crossing types

General

Liaise with the Signaller before any tests are carried out.

Check in the crossing control tables for any special controls that affect the automatic control sequence.

On early designs of crossings ATC and Strike in treadle reverse proving is required in the automatic sequence and the crossing sequence starts as soon as the strike in treadles are operated. Check the diagrams.

Where the word EXIT occurs the strike out treadle shall be operated.

On single lines or where bi-directional controls exist, the leaving track circuit shall also be operated.

Where directional proving controls exists the bi-directional strike out treadle shall also be operated in the correct sequence.

Service A - Tests

1. Local Control Sequence

1.1 Operate the LCU to the LOWER position, observe road lights illuminate, audible warnings operate, boom lamps illuminate and the barriers lower.

1.2 Confirm that no trains are approaching.

a) Operate the LCU to the RAISE position.

b) Observe the barriers rise, the road lights extinguish and audible warnings, where designed to sound when barriers are lowered, cease (check diagrams).

1.3 Operate the LCU to the LOWER position, allow the lowering sequence to take place and then operate the LCU switch to the AUTO position.

a) Observe the barriers rise, the road lights extinguish and audible warnings where designed to sound when barriers are lowered cease (check diagrams).

1.4 Close and lock the LCU door.

a) Check the door cannot be locked unless the switch is in the AUTO position.

On BR standard Mk1&2 units (penguin).

b) Check the door cannot be locked unless the AUTO operating lever is in the vertical position and has fully engaged the AUTO button.

2. Automatic Control Sequence

2.1 Simulate an approaching train by shunting a controlling track circuit and/or treadle operation. Observe the following:

a) On double lines 10 seconds elapse before the crossing sequence commences. On single lines the sequence starts immediately.

b) All the amber road signals illuminate, and the audible warnings commence concurrently (Yodel alarms at normal warbling rate).

c) After 3 seconds (5 seconds at older installations) all the amber signals extinguish, and all the red road signals and any pedestrian lights start to flash.

d) After approximately a further 4 seconds (8 seconds at older installations) the barriers commence to lower and the boom lamps illuminate.

e) Check sighting of boom lamps.

f) The barriers take 6 to 8 seconds to reach the fully lowered position.

g) Red road lights and any pedestrian lights continue to be illuminated and flash alternately with the road lights.

h) Audible warnings can continue to sound depending on design (check diagrams).

i) When lowering the final 10 to 15 degrees is damped.

j) Check booms are horizontal when completely lowered.

2.2 Operate the exit function and remove the train simulation if controlling track circuit shunted. Observe the following:

a) The barriers begin to rise.

b) The red road lights extinguish and the audible warnings (depending on design check diagrams) cease before the barriers have reached 45° from the horizontal.

c) The boom lights extinguish when the barriers have reached approximately 81° from the horizontal.

d) The barriers do not take more than 7 seconds to reach the fully raised position of between 81° and 85° from the horizontal.

2.3 Repeat 2.1 and 2.2 for the opposite direction on a single line and the other direction on double lines.

3. Double Lines Second Train Approaching Sequence

3.1 Simulate a train striking in on line one as per 2.1.

3.2 Simulate a second train striking in on line two.

Observe the following:

a) The barriers remain lowered.

b) The road lights and any pedestrian lights continue to flash.

c) The audible warning rate where designed to sound when barriers are lowered continues at the normal rate (check diagrams).

3.3 Operate the exit function and remove the simulation for the first train if controlling track circuit shunted. Observe the following:

a) The barriers remain lowered.

b) The road lights and any pedestrian lights continue to flash.

c) The audible warning rate where designed to sound when barriers are lowered changes to the increased rate (check diagrams).

3.4 Operate the exit function and remove the simulation for the second train. Observe that the sequence is the same as described in 2.2.

3.5 Repeat steps 3.1 to 3.4 for a train striking in on line two first and a second train striking in on line one.

3.6 Where possible, observe the correct crossing sequence during passage of a train(s).

4. Indications

4.1 Check that the correct indications are received in the monitoring signal box throughout a local control and automatic sequence.

Situation	Indication
Automatic control, no train approaching or no train	Barriers Raised
Crossing on Local Control or any barrier proving contact	Barriers Working Barriers
Automatic control, train approaching or train simulation	Barriers Working

Indications can be by needle instrument or lamp depending on the age of the crossing.

*: Check the diagrams for the contacts in the barrier proving circuit ((Xing)KR).
**: The barriers failed indication occur after 180 seconds on a single line or 240 seconds on a double line along with an audible warning.

Service B – Tests

These tests are for the full annual test of the crossing. NR/SMS/PartD/Index lists the indexes and references to the A4 format (with tick boxes) of this test for the use of the person testing the crossing.

END

Includes:	All types of Automatic Barrier Crossing Controlled Locally (ABCL)
Excludes:	All other types of Level Crossing

Liaise with the Signaller before any tests are carried out. Check in the crossing control tables for any special controls that affect the automatic control sequence. Where the word EXIT occurs, operate the strike out treadle.

On single lines or where bi-directional controls exist, operate the leaving track circuit.

Where directional proving controls exists operate the bi-directional strike out treadle in the correct sequence.

The following abbreviations are used in this service:

- DRL: Driver's Red Light.
- DWL: Driver's White Light.

SERVICE A TESTS

1. Local Control Sequence

1.1 Operate the LCU to the lower position:

a) Observe road lights illuminate, audible warnings operate, crossing headlights illuminate and the barriers lower.

b) Check the DWLs do not illuminate.

1.2 Confirm that no trains are approaching. Operate the LCU to the raise position:

- Observe the barriers rise, the road lights extinguish, the crossing headlights extinguish, and audible warnings cease.

1.3 Operate the LCU to the lower position, allow the lowering sequence to take place and then operate the LCU switch to the auto position:

a) Observe the barriers rise, the road lights extinguish and audible warnings cease.

b) Check that all DRL are flashing.

1.4 Close and lock the LCU door. Check the door cannot be locked unless the switch is in the auto position.

1.5 Check that the DRL is flashing for all signalled directions.

2. Automatic Control Sequence

2.1 Observe, with no train approaching, all DRLs are flashing.

2.2 Simulate an approaching train by shunting a controlling track circuit. Observe the following:

a) On double lines 10 seconds elapse before the crossing sequence commences. On single lines the sequence starts immediately.

b) All the amber road signals illuminate, and the audible warnings begin at the same time (Yodalarms at normal warbling rate).

c) After 3 seconds all the amber signals extinguish and all the red road signals and any pedestrian lights start to flash.

d) The crossing headlights illuminate the crossing at the same time the red road lights commence to flash.

e) After approximately a further 4 seconds the barriers commence to lower and the boom lamps illuminate.

f) Check the sighting of the boom lamps.

g) As the barriers commence to lower, the driver's red light extinguishes and the DWL commences to flash for the direction where the train simulation was applied. The DRL continues for the opposing directions.

h) The barriers take 6 to 8 seconds to reach the fully lowered position.

i) The crossing headlights, red road lights and any pedestrian lights continue to be illuminated and audible warnings continue to sound.

2.3 Operate the exit function and remove the train simulation. Observe the following:

a) The barriers begin to rise.

b) The DWL for the direction where the simulation was applied extinguishes and the DRL (if provided) commences to flash.

c) The red road lights and crossing headlights extinguish and the audible warnings cease when the barriers have reached approximately 45° from the horizontal.

d) The boom lights extinguish when the barriers have reached approximately 81° from the horizontal.

e) The barriers do not take more than 7 seconds to reach the fully raised position of between 81° and 85° from the horizontal.

2.4 Repeat steps 2.2 and 2.3 for the opposite direction on a single line and the other direction on double lines.

3. Double Lines Second Train Approaching Sequence

3.1 Simulate a train striking in on line one as per 2.2.

3.2 Simulate a second train striking in on line two. Observe the following:

a) The barriers remain lowered.

b) The road lights and any pedestrian lights continue to flash.

c) The audible warning rate continues at the normal rate.

d) The crossing headlights continue to illuminate.

3.3 Operate the exit function and remove the simulation on line one. Observe the following:

a) The barriers remain lowered.

b) The road lights and any pedestrian lights continue to flash.

c) The audible warning rate changes to the increased rate.

d) The crossing headlights continue to illuminate.

e) The DWL for the direction of the simulation on line one extinguishes and the DRL commences to flash.

f) The DRL for the simulation on line two extinguishes and the DWL commences to flash.

3.4 Operate the exit function and remove the simulation on line two. Observe that the sequence is the same as described in 2.3.

3.5 Repeat steps 3.1 to 3.4 for a train striking in on line two first and a second train striking in on line one.

3.6 Where possible, Observe the correct crossing sequence during passage of a train(s).

SERVICE B TESTS

These tests are for the full annual test of the crossing. NR/SMS/PartD/Index lists the indexes and references to the A4 format (with tick boxes) of these tests for the use of the person testing the crossing.

APPENDIX A - Indications

Table 1 lists the driver indications displayed throughout a local control and automatic sequence.

<table>
<tr><th>Situation</th><th>Indication</th></tr>
<tr><td>Automatic control, no train approaching, or no train simulation applied</td><td rowspan="2">DRL Flashing DWL Extinguished</td></tr>
<tr><td>Crossing on operating on Local Control</td></tr>
<tr><td>Automatic control, train approaching or train simulation applied, barriers started to lower</td><td>DRL Extinguished DWL Flashing</td></tr>
<tr><td>Barriers lowered by train simulation, DWL operating, any DWL proving contact broken, power off *</td><td>DRL Flashing DWL Extinguished</td></tr>
</table>

Table 1 – Driver Indications Table

Notes:

The DWL should only operate for the direction in which the train is approaching or the train simulation has been applied. The DRL should be operating for all other directions.

* Check the diagrams for the contacts in the DWL control circuit (this includes the (PO)PR function).

END

Includes:	All types of Automatic Open Crossing Locally Monitored (AOCL).
Excludes:	All other types of Crossing

General

Liaise with the signaller before any tests are carried out.
Check in the crossing control tables for any special controls that affect the automatic control sequence.

On early designs of crossings ATC and Strike in treadle reverse proving is required in the automatic sequence and the crossing sequence starts as soon as the strike in treadles are operated. Check the diagrams.

Where the word EXIT occurs, the strike out treadle shall be operated.
On single lines or where, bi-directional controls exists, the leaving track circuit shall also be operated.

Where directional proving controls exists the bi-directional strike out treadle shall also be operated in the correct sequence.

The following abbreviations are used in this service:

- DRL: driver's red light.
- DWL: driver's white light.

Service A

Tests

1. Local Control Sequence (If Provided)

1.1 Operate the LCU to the On position and Observe the road lights and audible warnings operate.

1.2 Check that the DWLs do not illuminate.

1.3 Confirm that no trains are approaching

1.4 Operate the LCU to the Off position and Observe the road lights extinguish and audible warnings cease.

1.5 Operate the LCU to On position, allow the sequence to complete then switch to the Auto position. Observe the road lights extinguish and audible warnings cease.

On modern installations the switch can be put straight to the auto position and the door locked.

1.6 Close and lock the LCU door. Check the door cannot be locked unless the switch is in the Auto position.

1.7 Check (if applicable) that the DRL is flashing for all signalled directions.

2. Automatic Control Sequence

2.1 Observe, with no train approaching, all DRLs (if applicable) are flashing.

2.2 Simulate an approaching train by shunting a controlling track circuit. Observe the following:

a) On double lines 10 seconds elapse before the crossing sequence commences. On single lines the sequence starts immediately.

b) All the amber road signals illuminate and the audible warnings commence concurrently (Yodel alarms at normal warbling rate).

c) After 3 seconds (5 seconds at older installations), all the amber signals extinguish and all the red road signals and any pedestrian lights start to flash.

d) The crossing headlights illuminate the crossing at the time the red road lights commence to flash.

e) The DRL (if applicable) extinguishes and the DWL commences to flash for the direction where the train simulation was applied. The DRL (if applicable) continues for the opposing directions.

2.3 Operate the exit function and remove the train simulation. Observe the following:

a) The road lights, any pedestrian lights and audible warnings cease immediately.

b) The DWL for the direction where the simulation was applied extinguishes.

c) The DRL (if applicable) commences to flash.

d) Repeat steps 2.2 and 2.3 for the opposite direction on a single line and the other direction on double lines.

3. Double Lines Second Train Approaching Sequence

3.1 Simulate a train striking in on line one as per 2.2.

3.2 Simulate a second train striking in on line two. Observe the following:

a) The road lights and any pedestrian lights continue to flash.

b) The audible warning rate continues at the normal rate.

c) The crossing headlights continue to illuminate.

3.3 Operate the exit function and remove the simulation for the first train. Observe the following:

a) The road lights and any pedestrian lights continue to flash.

b) The audible warning rate changes to the increased rate.

c) The ATC signs (if Illuminating) illuminate, flash and the words are correct.

d) The crossing headlights continue to illuminate.

e) The DWL for the direction of the simulation on line one extinguishes and the DRL (if applicable) commences to flash.

f) The DRL (if applicable) for the simulation on line two extinguishes and the DWL commences to flash.

3.4 Operate the exit function and remove the simulation on line two. Observe that the sequence is the same as described in 2.4.

3.5 Repeat steps 3.1 to 3.4 for a train striking in on line two first and a second train striking in on line one.

3.6 Where possible, observe the correct crossing sequence during passage of a train(s).

Service B

Tests

These tasks are for the full annual test of the crossing. NR/SMS/Part/D lists the indexes and references to the A4 format (with tick boxes) of these tasks for the use of the person testing the crossing.

APPENDIX A-INDICATIONS

The following table lists the driver indications displayed throughout a local control and automatic sequence.

Situation	Indication
Automatic control, no train approaching or no train simulation applied	DRL Flashing* DWL Extinguished
Crossing on operating on Local Control	
Automatic control, train approaching or train simulation applied, road lights operating	DRL Extinguished* DWL Flashing
Crossing operated by train simulation, DWL operating, any DWL proving contact broken, power off**	DRL Flashing* DWL Extinguished

Table 1 – Driver indications

The DWL should only operate for the direction in which the train is approaching or the train simulation has been applied. The DRL should be operating for all other directions.

*: The DRL indications are applicable to installations that are fitted with DRL/DWL units

**: Check the diagrams for the contacts in the DWL control circuit (this includes the (PO)PR function).

End

Includes:	All types of Automatic Open Crossing Remotely Monitored (AOCR).
Excludes:	All other types of Crossing

General

Liaise with the signaller before any tests are carried out Check in the crossing control tables for any special controls that affect the automatic control sequence.

Where the word EXIT occurs the strike out treadle shall be operated.

On single lines or where bi-directional controls exist, the leaving track circuit shall also be operated.

Where directional proving controls exists the bi-directional strike out treadle shall also be operated in the correct sequence.

Service A

Tests

1. Local Control Sequence

1.1 Operate the LCU to the on position:

1.2 Observe road lights and audible warnings operate.

1.3 Confirm that no trains are approaching

1.4 Operate the LCU to the off position and Observe the road lights extinguish and audible warnings cease.

1.5 Operate the LCU to the on position, allow the sequence to complete then switch to the auto position.

1.6 Observe the road lights extinguish and audible warnings cease.

1.7 Close and lock the LCU door. *Check* the door cannot be locked unless the switch is in the auto position.

2. Automatic Control Sequence

2.1 Simulate an approaching train by shunting a controlling track circuit. *Observe* the following:

a) On double lines 10 seconds elapse before the crossing sequence commences. On single lines the sequence starts immediately.

b) All the amber road signals illuminate and the audible warnings commence concurrently (Yodel alarms at normal warbling rate).

c) After 3 seconds all the amber signals extinguish and all the red road signals and any pedestrian lights start to flash.

2.2 Operate the exit function and remove the train simulation and *observe* the road lights, any pedestrian lights and audible warnings cease immediately.

2.3 Repeat steps 2.1 and 2.2 for the opposite direction on a single line and the other direction on double lines.

3. Double Lines Second Train Approaching Sequence

3.1 Simulate a train striking in on line one as per 2.1

3.2 Simulate a second train striking in on line two. *Observe* the following:

a) The road lights and any pedestrian lights continue to flash.

b) The audible warning rate continues at the normal rate.

3.3 Operate the exit function and remove the simulation on line one. *Observe* the following:

a) The road lights and any pedestrian lights continue to flash.

b) The audible warning rate changes to the increased rate.

3.4 Operate the exit function and remove the simulation on line two. *Observe* the road lights, any pedestrian lights, and audible warnings cease immediately.

3.5 Repeat steps 3.1 to 3.4 for a train striking in on line two first and a second train striking in on line one.

3.6 Where possible, *observe* the crossing sequence during passage of a train.

4. Indications

4.1 Check that the correct indications are received in the monitoring signal box throughout a local control and automatic sequence.

Situation	Indication
Automatic control, no train approaching or no train simulation applied	In Order* In Order**
Crossing on Local Control or any crossing proving contact broken #2	No Illumination* No Legend** Failed/Local Control* #1 No Legend** #1
Automatic control, train approaching or train simulation applied	No Illumination* No Legend**

Table 1 – Signal box indications

Indications can be by needle instrument or lamp depending on the age of the crossing.

* : Indications given by a lamp type indicator.

** : Indications given by a needle type indicator.

#1: The crossing failed indication occurs after 180 seconds on a single line or 240 seconds on a double line along with an audible warning.

#2: Check the diagrams for the contacts in the crossing proving circuit.

SERVICE B TESTS

These tests are for the full annual test of the crossing. NR/SMS/Part/D lists the indexes and references to the A4 format (with tick boxes) of these tests for the use of the person testing the crossing.

End

Includes:	All types of Miniature Stop Light Crossing (MSL)
Excludes:	All other types of Crossing

General

Check in the crossing control tables for any special controls that affect the automatic control sequence. Where the word EXIT occurs the strike out treadle (where provided) shall be operated.

If gates or barriers are found open, close to roadway and inform your SM(S).

Tests

1. Sequence Test

1.1 Simulate an approaching train by shunting a controlling track circuit. Observe the following:

a) The green lamps on all light units extinguish and the red lamps illuminate.

b) The audible warnings (if provided) sound.

1.2 Operate the exit function and remove the train simulation. Observe the following:

a) The red lamps on all light units extinguish and the green lamps illuminate.

b) The audible warnings (if provided) cease.

1.3 Repeat steps 1.1 and 1.2 for all other directions where controls are provided.

2. Double Lines Second Train Approaching Sequence

2.1 Simulate an approaching train as in 1.1 on line one.

2.2 Simulate a second train striking in on line two.

2.3 Operate the exit function for the train simulation on line one, observe the following:

- The green lamps on all light units stay extinguished and the red lamps stay illuminated.
- The audible warnings (if provided) changes to the increased rate.

2.4 Operate the exit function for the train simulation on line two and observe that the sequence is as 1.2.

2.5 Repeat steps 2.1 to 2.4 for a train striking in on line two first and a second train striking in on line one.

2.6 Where possible, observe the correct crossing sequence during passage of a train(s).

These tests are for the full annual test of the crossing. NR/SMS/Part/D lists the indexes and references to the A4 format (with tick boxes) of these tests for the use of the person testing the crossing.

End

Includes:	Manually Controlled Barriers (MCB) & all Derivatives including MCB-CCTV, MCB- OD, MCB-RB, Traincrew Operated Barriers (TOB)
Excludes:	CCTV equipment (see NR/SMS/PartC/TV01 & TV02)

GENERAL

For Signaller's controls at newer installations that have a STOP button on the control unit, one press of the LOWER or RAISE button commences the requested sequence. However some installations have been modified so that the LOWER button has to be kept pressed to continue the sequence. If you are in doubt, check the diagrams or ask your SM(S).

At older installations without a STOP button the LOWER button has to be kept pressed to continue the sequence, but only one press of the RAISE button is required for the raise sequence.

Older MCB crossings do not have local control units. At these sites, the tasks against the LCU do not apply.

At MCB-CCTV installations, the sequence cannot be initiated unless a picture on the monitor is called.

Some MCB-CCTV installations have an auto lower facility (these usually have additional Signaller audible warnings) and/or an auto raise facility.

SERVICE A TESTS

1. Barrier Operation Sequence Signallers Controls

At MCB, MCB-CCTV and MCB-RB crossings the following sequence may be performed by yourself, with permission of the Signaller, or observed whilst the Signaller operates/auto lower initiates the barrier sequence for the passage of a train.

At MCB-CCTV installations, observation can be via the crossing monitor (with on-site assistance for the audible warnings.)

At MCB-OD the tests shall be carried out at site.

1.1 Observe the following sequence as the barriers are lowered:

a) All the Amber lights illuminate and show a steady light.

b) The audible warnings (if fitted) sound when the amber lights illuminate and continue until all the barriers have fully lowered.

c) After approximately 3 to 5 seconds the amber lights extinguish, and all the red lights begin to flash.

d) After approximately 4 to 6 seconds after the red lights have started to flash the barriers begin to lower. At installations with four barriers, check that the nearside barriers (YN& ZN) lower first and are completely lowered before the offside barriers (YO & ZO) begin to lower.

e) The boom lights on each barrier illuminate when the barrier is approximately 80° from the horizontal.

f) Each barrier takes between 6 to 10 seconds to completely lower. Confirm barrier damping (if fitted) is effective when the barrier is approximately 10° from the fully lowered position.

g) The audible warnings (if fitted) cease to sound when all the barriers have fully lowered.

1.2 At MCB, MCB-CCTV and MCB-RB, check that protecting signals cannot be cleared until the ‘crossing clear’ function is operated.

1.3 At MCB-OD crossings, check that, if the crossing is clear, the obstacle detector allows protecting signals to clear approximately 4 seconds after all barriers are detected down (check the DOWN indication in signal box goes from flashing to steady white).

Check that an obstruction on the crossing prevents crossing clear being given (DOWN indication remains flashing, does NOT go steady).

After the barrier management sequence has completed (exit barriers raise and stay raised if crossing is occupied). The Signaller receives an alarm approximately 30 seconds after the exit barriers have raised (by AUTO indication flashing plus an audible alarm).

1.4 Check at MCB-CCTV installations that have auto raise, if this is selected the monitor picture is extinguished when the crossing clear function is operated.

1.5 Observe the following sequence as the barriers are raised:

a) The raise sequence cannot be initiated unless protecting signals are at red.

b) All the barriers begin to rise simultaneously and take 4 to 10 seconds to reach the fully raised position at between 83° and 85° from the horizontal.

c) The flashing red lights continue to show until the barriers have reached approximately 45° from the horizontal.

d) The boom lights extinguish when all the barriers have passed 80° from the horizontal.

2. Additional Checks for MCB-CCTV installations with Auto Lower Facilities

2.1 Check (if provided) an audible warning is given, and a picture is called on the monitor when the crossing sequence is initiated.

2.2 Check (if provided) an audible warning is given when all barriers are fully lowered.

3. Barrier Sequence Operation (Local Control)

These tests are 'If Provided'. At installations that have Auto Lower and/or Auto Raise.

3.1 Check that the manual position is selected for these tests.

3.2 In liaison with the Signaller open the LCU door and switch to local control.

If door proving is fitted, the Signaller receives a failed indication when the door is opened, otherwise it fails when local control is taken.

3.3 Carry out steps and observations as per 1.1 and 1.5.

NOTE: *Because the crossing is now in LCU mode, it will also be failed and so it is not possible for Crossing Clear to be registered or for the protecting signals to clear.*

3.4 Return the crossing control back to the Signaller.

At newer installations when giving local control back, the barriers shall be in the lowered position, then close and lock the LCU door.

The Signaller shall first select LOWER/DOWN (to correspond their controls to the actual barrier position) and can then operate the barriers to the raised position which proves that they have regained control.

4. Barrier Sequence Operation (TMOB)

4.1 Check that the barrier sequence is initiated when the controlling TC is occupied, and the driver's plunger are operated.

4.2 Check that the lowering sequence is as step 1.1.

4.3 Check the DCI (white light) operates only when all barriers are fully lowed for the direction of the applied simulation.

4.4 With the controlling TCs clear, check the raising sequence is as 1.3.

4.5 Check the DCI (white light) is extinguished.

5. Indications (Signallers Controls)

5.1 Check that the correct indications (Table 1) are received on the Signaller's panel throughout a lowering and raising sequence.

SITUATION	INDICATION
Barriers Raised	Barriers Raised
Lower button operated, red road lights operating, barriers raised	Barriers Raised Y Road Lights Z Road Lights
Lower button operated, red road lights operating, barriers lowering	Y Road Lights Z Road Lights
Barriers Lowered	Barriers Lowered Y Road Lights Z Road Lights Crossing Clear*
Barriers Rising	None till all barriers raised; then Barriers Raised
Local Control (if provided)	Barriers Failed

Table 1 – Signallers Indications

* If provided, this will be flashing until the function is operated.

6. Local Control Indications (if provided)

6.1 Check that the correct indications (Table 2) are received on the local control unit throughout a lowering and raising sequence.

Situation	Indication
Signaller Control	No Indication
Local Control	Barriers Raised
Barriers Lowering	No Indication
Barriers Lowered	Barriers Lowered
Barriers Rising	No Indication
Barriers Raised	Barriers Raised

Table 2 – Local Control Indications

SERVICE B TESTS

These tests are for the full annual test of the crossing.

NR/SMS/Part/D lists the indexes and references to the A4 format (with tick boxes) of these tests for the use of the person testing the crossing.

END

Includes:	All types of On Call Barriers (OCB)
Excludes:	All other types of Barrier

General

Check that the signaller receives the correct indications throughout the barrier operation sequence.

Service A

Tests

1. Barrier Operation Sequence

The following sequence can be performed by the technician with permission of the signaller or observed whilst the signaller operates the barriers for the passage of a train.

1.1 Operate the lower switch/button and *Observe* the following:

a) The audible warnings sound.

b) The Barriers commence to fall 8 to10 seconds after the audible warnings commence and are fully lowered in a further 8 to15 seconds.

c) The booms lights illuminate when the barriers are approximately 80° from the horizontal.

d) The audible warnings continue to sound until both barriers are fully lowered.

1.2 Operate the raise switch/button and *Observe* the following:

a) The barriers commence to rise.

b) The boom lights extinguish when the barriers have passed 80° from the horizontal.

c) The barrier cut-off is effective when the barriers reach the fully raised position of between 83° and 85° from the horizontal.

d) The barriers take 8 to 15 seconds to reach the fully raised position.

Service B

Tests

These tests are for the full annual test of the crossing. NR/SMS/Part/D lists the indexes and references to the A4 format (with tick boxes) of these tests for the use of the person testing the crossing.

End

Includes:	Single white light units.
Excludes:	All other types of Crossing

Service A

1. Sequence Test

1.1 Train shunt the controlling track circuits and Observe that the lamps extinguish. Remove the train shunt and observe that the lamps illuminate.

Directional and/or route setting controls can affect the operation of these lights. If in doubt, ask your SM(S).

End

Includes:	Mechanically Operated Gates, Locked Gates, Keylock Operated Gates, Hand Operated Gates
Excludes:	All other Gates

SERVICE A TESTS

1. Mechanically Operated Gates

The sequence in 1.2 may be performed by yourself with permission of the Signaller or observed whilst the Signaller operates the gates for the passage of a train.

1.1 With the gates closed to rail traffic and open to road traffic, check that the gate stops are effective in holding the gates.

1.2 Operate the gates so that they are open to rail traffic and closed to road traffic. Check the following:

a) Audible warnings (if provided) operate correctly.

b) The release and gate stop levers operate without excessive force being required.

c) The gate stops fall and rise correctly in the correct sequence.

d) The gates operate without excessive force required on the operating mechanism.

e) The gates do not catch on the road surface during any part of their movement.

f) On completion on their movement the gates are held effectively in the gate stops.

g) The gate stop levers are correctly locked in the frame.

1.3 Repeat 1.2 operating the gate so that they are closed to rail traffic and open to road traffic.

1.4 Check that any locked wickets gates are effective when the locking lever is reversed in the frame. When locked, the gate should not be able to be opened sufficiently to allow a person to pass.

2. Locked Gates (Black's Locks & Bottle Locks)

These tests shall be carried out in liaison with the Signaller or crossing keeper.

2.1 With the gates closed to rail traffic and open to road traffic. Check the following:

a) The gate lock is effective in holding the gates.

b) The frame release lever is locked in the frame.

2.2 Operate the gates so that they are open to rail traffic and closed to road traffic. Check the following:

a) The gates swing without excessive force being required.

b) The gates do not catch on the road surface during any part of their movement.

2.3 When the gates are closed to road traffic, check the following:

a) The bolt enters the locking mechanism smoothly and can be turned without excessive force being required.

b) When both gate bolts are fully engaged in the locking mechanism, the frame release lever can be reversed.

c) When the frame release lever is fully reversed, the gate bolts are locked in the locking mechanism.

2.4 Place the release lever normal in the frame and check the gate bolts can be turned and withdrawn from the locking mechanism smoothly and without excessive force being required.

3. Keylock Gates (not Fortress style)

These tests shall be carried out in liaison with the Signaller or crossing keeper:

3.1 Check that with the gates open for road traffic, the keys are locked in the gate lock units.

3.2 Check the following in the signal box or gate box:

a) Mechanical Signal Boxes - The frame release lever is locked.

b) Panel Signal Boxes - The protecting signals cannot be cleared.

c) Gate Boxes - A release to the controlling signal box cannot be given.

3.3 Close the gates to road traffic and check the following:

a) The gates swing without excessive force being required.

b) The gates do not catch on the road surface during any part of their movement.

3.4 Check that the keys are not released from the lock units until the gate bolt is fully home.

3.5 Check with the keys removed, the gate bolts cannot be withdrawn.

3.6 Place the first key into the release unit in the signal/gate box and turn. Check the conditions remain as in 3.2.

3.7 Place the second key into the release unit and turn. Check that the first key is locked.

3.8 With both keys turned in the release unit check:

a) Mechanical Signal Boxes - The frame release lever is unlocked and can be reversed.

b) Panel Signal Boxes - The protecting signals can be cleared.

c) Gate Boxes - A release to the controlling signal box can be given.

3.9 Check that the keys are locked in the release unit until:

a) Mechanical Signal Boxes - The frame release lever is returned to the normal position.

b) Panel Signal Boxes - The protecting signals are returned to their most restrictive aspect.

c) Gate Boxes - The release from the controlling signal box is given back.

3.10 Remove the keys (in the correct order) from the release unit and check the conditions return to as described in 3.2.

3.11 Replace the keys in the gates and check the gate bolt can be withdrawn.

4. Fortress Key Locks

4.1 For each gate in turn:

a) Close the gate: Operate the bolt and lock to release the key.

b) Check that the key cannot be withdrawn until the bolt is in the unit and that once the key is withdrawn, the bolt cannot be released from the lock.

c) Return the key to the lock and open the gate.

4.2 For each lever fitted with a lock:

a) Check that the lever cannot be released until the key/s is/are put into the lock and turned.

b) Check that the key/s cannot be removed once the lever is moved out of the lock position.

4.3 For each solenoid lock:

a) Check that signals cannot be cleared until the key is put into the lock and turned.

b) If appropriate, check that the key/s cannot be removed once signals have been cleared for a train to approach.

5. Hand Operated Gates

Manned hand gates open across the rails, user operated hand gates open away from the rails.

5.1 Check the following on hand gate operation:

a) If provided, any equipment for calling the gatekeeper operates correctly.

b) The gates swing without excessive force being required.

c) Gates on bridleways have latches that can be operated by mounted horse riders.

d) The gates do not catch on the road surface during any part of their movement.

e) Any gate self-closing mechanism (if provided) is effective.

f) When open to road traffic, (if provided) any gate securing mechanism is effective.

END

Includes:	SD cards in a PLC unit used in EBI Gate 200 Crossing System
Excludes:	All other SD cards

GENERAL

Before any data collection is carried out, power down the EBI Gate 200 System.

The system can be irreparably damaged if the SD Card is removed whilst the system is powered up and working.

Only a SIEMENS SIMATIC memory card can be used.

Downloading the Daylog Data

1. SD Card Removal

1.1 Power down the Panel Fuse on TB2 at the top rear of the lower enclosure.

1.2 Open the SD Card Cover on PLC by pulling gently on the tab on the top right-hand corner of the cover (See Figure 1). This clicks as the cover releases.

Figure 1 – Lower Enclosure

1.3 Remove the SD Card by gently pressing the SD Card inwards and releasing it (See Figure 2). The SD Card slot is sprung-loaded, and the SD Card releases.

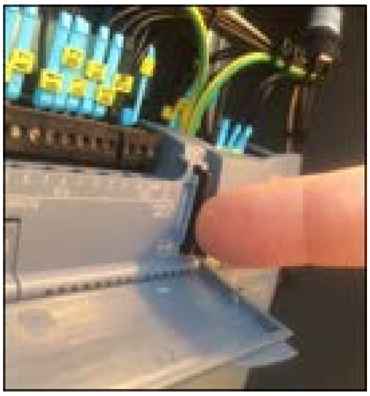


Figure 2 – Press the SD Card inwards

1.4 Downloaded the data to a laptop as described within Section 2.

NOTE: *a replacement SD card of the correct type can be inserted to allow the removed SD Card to be downloaded off site.*

1.5 Re-insert the SD Card back into the PLC. Push gently until you hear the SD Card "click" into place.

2. Copy DayLog Data

2.1 The SD Card (Figure 3) is a standard size and fits into standard SD Card readers/Slots on PC's/Laptops.

Figure 3 – SD Card

2.2 Plug the SD Card into the PC/Laptop SD Slot (Figure 4).

Figure 4 - SD Card into the PC/Laptop SD Slot

2.3 The SIMATIC MC symbol (Figure 5) appears on the desktop.

Click the icon to open.

Figure 5 – SIMATIC MC Symbol

DO NOT Delete or alter the Data or the files on the SD Card. Only copy the data.

2.4 When the SD Card is opened, there are 3 objects in the SD Card Folder (Figure 6).

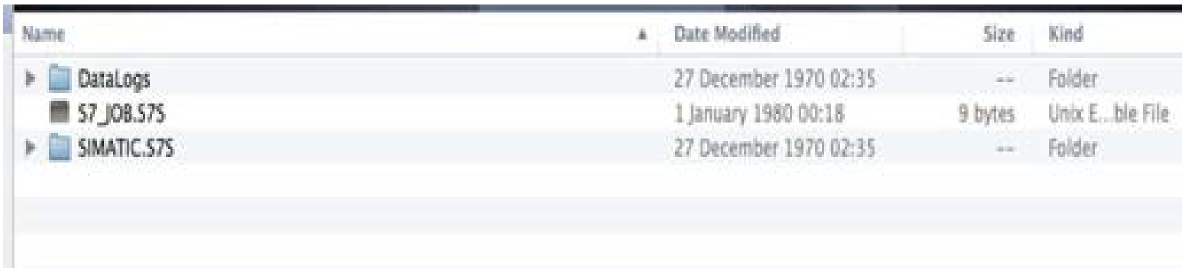


Figure 6 – SD Card Folder

2.5 Open the DataLogs folder, DO NOT open the other files or folders, the DayLog files appear (Figure 7).

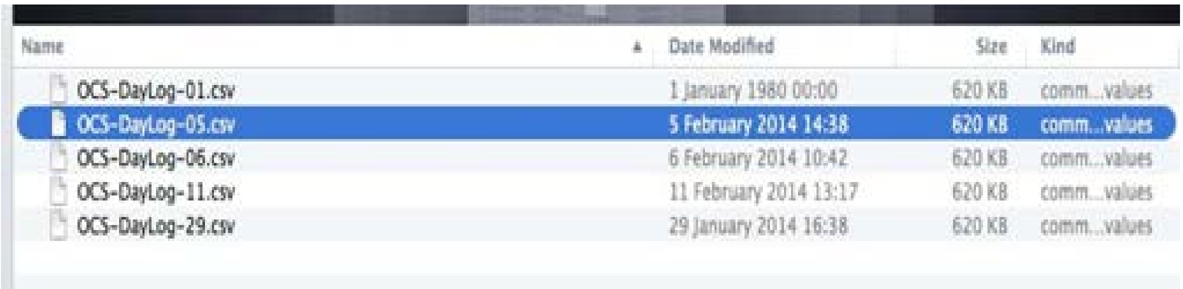


Figure 7 – DayLog Files

The DayLog files are date stamped to the day they were generated. These files are saved in a .csv format and open with Excel software.

2.6 When you open the DayLog files, they look like this (Figure 8).

NOTE: *Information on the Interpretation of the Datalog Files is covered in [NR/SMS/Appendix 09]() - General information on EBI Gate 200 Level Crossing System.*

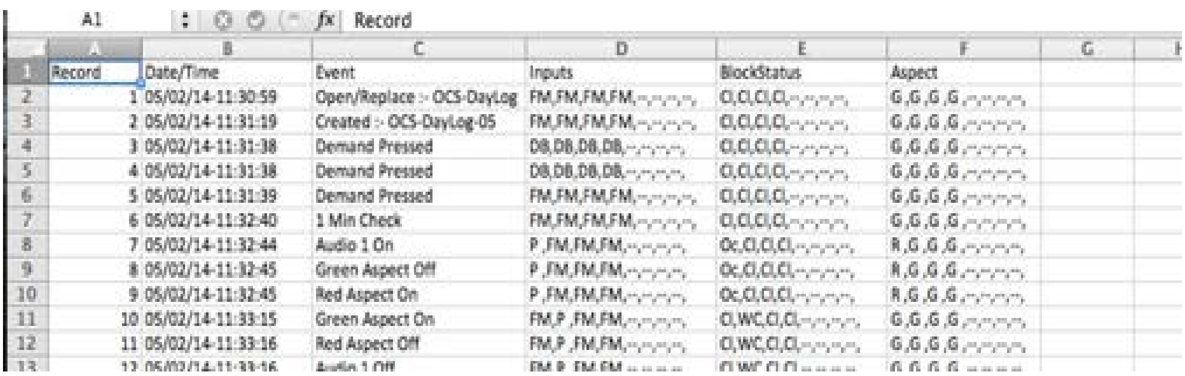


Figure 8 – Open DayLog Files

2.7 Save the file to the PC/Laptop for future reference.

2.8 Eject the SD Card from the PC/Laptop. DO NOT just pull it out of the slot, this might damage the data stored on the SD Card.

2.9 If an SD card has not already been inserted, re-insert the SD Card back into the PLC. Push gently until you hear the SD Card “click” into place.

DO NOT power up the system before replacing the SD card.

2.10 Only after the SD Card has been replaced, power up the UPS isolation fuse.

END

Includes:	AHBC controlled by a level crossing predictor
Excludes:	Any other type of AHBC, or other automatic crossing

Service A

Tests

1. **Physical Inspections**

Any obstructions or conditions likely to prove detrimental to the reliability of the level crossing system shall be dealt with immediately (if practicable) or brought to the notice of the SM(S) and dealt with as soon as possible.

The objective of this examination is to find and remove potential causes of failure and check that, as far as possible, the level crossing can function satisfactorily until the next examination.

This test requires the use of a frequency meter.

1.1 Walk through all approaches and the Island Circuit, and Check the following:

- The integrity of all tail cables and that they are securely attached to the rails as shown on the site set-up sheet.
- The integrity of all fixed and variable shunts and that they are securely attached to the rails.
- The integrity of all bonding within the Predictor approach areas.
- The integrity of cable fasteners on rails and sleepers.
- The integrity of Wideband Joint Couplers and connections.
- That there is at least two turns per foot on twisted pair wiring.
- The frequency of track voltages against the site set-up sheet in the circuit diagrams.
- For insulation deterioration and rail end burring over insulated rail joints.
- Where appropriate, the scorched earth policy is being complied with.
- For metallic or other contaminations on the surface of the rails.
- Check for rust and other contamination on the surface of the rails.
- Check the integrity of rail and clip insulations on the track with concrete or metal sleepers.
- Check the condition of the ballast and report any build-up of ballast against the rails, wet beds in the vicinity or insulated rails joints, and significant

patches of wet ballast.

2. Local Control Sequence

If the frequency of timetabled train services during the test period is such that an extended gap exists between trains on both lines, arrangements should be made for the completion of crossing sequence observations to be carried out on a subsequent visit.

2.1 Operate the LCU to the LOWER position, observe that the road lights illuminate, audible warnings operate, boom lamps illuminate, and the booms lower.

2.2 Confirm that no trains are approaching

2.3 Operate the LCU to the RAISE position, observe that the booms rise, the road lights extinguish and the audible warnings cease.

2.4 Operate the LCU to the LOWER position, allow the lowering sequence to take place and then operate the LCU to the AUTO position. Observe the booms rise, the road lights extinguish, and the audible warnings cease.

2.5 Close and lock the LCU door. Check the door cannot be locked unless the switch is in the AUTO position.

3. Automatic Control Sequence.

During the Automatic Control Sequence tests, Check that trains never reach the level crossing in less than 27 seconds from initiation of the warning sequence.

Any such occurrence should be immediately reported to your SM(S).

As trains approach, check that the loop impedance (EZ – WRSL, RX – GETS) decreases in a steady manner.

3.1 With a train approaching the crossing, Observe that the following sequence takes place:

a) If applicable on double lines that with no other train in section, all amber lights illuminate, and all audible warnings sound at the normal rate.

b) The output of the Level Crossing Predictor is not energised, and that any associated indication is not illuminated.

c) After 3 seconds the amber lights extinguish and all the red flashing road traffic light signals and any pedestrian signals commence to flash, audible warnings continue to sound.

d) After approximately 4 seconds the booms commence to lower and the boom lamps illuminate when the booms are at approximately 80° from the horizontal.

e) The booms take 6 to 8 seconds to reach the lowered position and are horizontal when fully lowered.

f) When the train arrives at the level crossing the associated Island Circuit is de- energised and that any associated indication is not illuminated.

g) The red flashing road traffic light signals and any pedestrian signals are continue to flash and the audible warnings continue to sound.

3.2 When the train has passed over the crossing, Observe the following:

a) The booms begin to rise without significant delayAfter the train has left the crossing the output of the Level Crossing Predictor is restored and that any associated indication is illuminated and the appropriate Island Circuit is restored and that any associated indication is illuminated.

b) Before the booms have reached 45° above the horizontal the red flashing road traffic lights extinguish, and the audible warning ceases.

c) After the booms have reached approximately 81° above the horizontal, the boom lights extinguish.

d) After commencing to rise, the booms reach their final position in no more than 7.5 seconds.

e) When raised, the booms are between 81° and 85° from the horizontal.

3.3 Check that the level crossing operates in accordance with the sequence in 3.1 and 3.2 when repeating these observations for a train approaching from any other direction.

4. Double Line Second Train Approaching Sequence.

4.1 With a train entering the crossing control area on line one, Observe that the sequence is the same as that detailed in 3.1

4.2 When a second train enters the crossing control area on line 2, Observe the following:

a. The booms remain lowered.

b. The road traffic lights and any pedestrian lights continue to flash and the audible warning continues at the normal rate.

4.3 When the leading end of either train passes over the crossing Check that the audible warning rate changes to the increased rate.

4.4 When the train in 4.3 has passed completely over the crossing, Observe the following:

a. The booms remain lowered.

b. The road traffic lights and any pedestrian lights continue to be flash and the audible warning continues at the increased rate.

4.5 When the second train has passed completely over the crossing Observe that the sequence is the same as that detailed in 3.2.

4.6 Where there is a suitable frequency of trains, repeat 4.1 to 4.5 for other combinations of approaching trains.

5. Indications.

5.1 Check that the correct indications are received in the monitoring signal box throughout the local control and automatic sequence tests.

Situation	Indication
Automatic control, no train approaching, or no train simulation applied	Barriers Raised
Crossing on Local Control or in failure #1	Barriers Working Barriers Failed #2
Automatic control, train approaching or train simulation applied	Barriers Working
Power Removed from LCP	Standby In Use

Table 1 – Indications

#1 Check the circuit diagrams for the contacts in the barrier proving circuit.

#2 The Barriers Failed indication occurs no more than 180 seconds after the Barriers Working indication is displayed on a single line, and no more than 240 seconds after the Barriers Working indication is displayed on a double line. The Barriers

Failed indication is accompanied by an audible warning.

Service B

Tests

These tests are for the full annual test of the crossing. NR/SMS/Part/D lists the indexes and references to the A4 format (with tick boxes) of this test for the use of the person testing the crossing

End

Includes:	MSL crossing controlled by a Level Crossing Predictor
Excludes:	Any other type of MSL, or automatic crossing

Service A

Tests

1. Physical Inspections

The objective of this examination is to find and remove potential causes of failure and check that, as far as possible, the level crossing will function satisfactorily until the next examination.

Any obstructions or conditions likely to prove detrimental to the reliability of the level crossing system shall be dealt with immediately (if practicable) or brought to the notice of the SM(S) and dealt with as soon as possible.

This test requires the use of a frequency meter.

1.1 Walk through all approaches and the Island Circuit, and Check the following:

a) The integrity of all tail cables and that they are securely attached to the rails as shown on the site set-up sheet.

b) The integrity of all fixed and variable shunts and that they are securely attached to the rails.

c) The integrity of all bonding within the Predictor approach areas.

d) The integrity of cable fasteners on rails and sleepers.

e) The integrity of Wideband Joint Couplers and connections.

f) That there is at least two turns per foot on twisted pair wiring.

g) The frequency of track voltages against the site set-up sheet in the circuit diagrams.

h) For insulation deterioration and rail end burring over insulated rail joints.

i) Where appropriate, the scorched earth policy is being complied with.

j) For metallic or other contaminations on the surface of the rails.

k) For rust and other contamination on the surface of the rails.

l) The integrity of rail and clip insulations on the track with concrete or metal sleepers.

m) The condition of the ballast and report any build up of ballast against the rails, wet beds in the vicinity or insulated rails joints, and significant patches of wet ballast.

2. Automatic Control Sequence.

2.1 During the Automatic Control Sequence tests, Check that trains never reach the level crossing in less than:

a) 20 seconds from initiation of the warning sequence on a Footpath Crossing,

b) And not less than 40 seconds on a Bridleway or User Worked Crossing.

Any such occurrence shall be immediately reported to your SM(S).

2.2 As trains approach, check that the loop impedance (EZ – WRSL, RX – GETS) decreases in a steady manner.

2.3 With a train approaching the crossing, Observe that the following sequence takes place:

a) If applicable on double lines that with no other train in section, all green lights are extinguished, all red lights illuminate and, where provided, all audible warnings sound.

b) The output of the Level Crossing Predictor is not energised, and that any associated indication is not illuminated.

c) When the train arrives at the level crossing the associated Island Circuit is de-energised and that any associated indication is not illuminated.

d) The red lights signals are illuminated and that, where provided, the audible warnings continue to sound.

2.4 After the train has passed completely over the crossing, observe that the red lights are extinguished, all green lights are illuminated and, where provided the audible warning ceases without significant delay.

2.5 Check that after the train has left the crossing the output of the Level Crossing Predictor is restored and that any associated indication is illuminated.

2.6 Check that the appropriate Island Circuit is restored and that any associated indication is illuminated.

2.7 Check that the level crossing operates in accordance with the sequence in 2.2 to 2.6 when repeating these observations for a train approaching from any other direction.

3. Double Line Second Train Approaching Sequence.

3.1 With a train entering the crossing control area on line one, observe that the sequence is the same as that detailed in 2.1

3.2 When a second train enters the crossing control area on the line 2, Observe the following:

a) The red lights remain illuminated.

b) Where provided, the audible warning continues at the normal rate

3.3 When the leading end of either train passes over the crossing Check where provided that the audible warning rate changes to the increased rate.

3.4 When the train in 3.3 has passed completely over the crossing, Observe the following:

a) The red lights continue to be illuminated.

b) Where provided, the audible warning continues at the increased rate.

3.5 Observe the second train passing completely over the crossing and observe that the sequence is the same as that detailed in 2.2 to 2.6.

3.6 Where there is a suitable frequency of trains, repeat steps 3.1 to 3.4 for other combinations of approaching trains.

Service B

Tests

These tests are for the full annual test of the crossing. NR/SMS/Part/D lists the indexes and references to the A4 format (with tick boxes) of this test for the use of the person testing the crossing.

End

Includes:	Systems fitted with **"both"** IMC & ACB Boards
Excludes:	Systems fitted with **"only"** IMC Boards

General

Before work is undertaken that affects the normal operation of the level crossing system the Signaller shall be informed. Normally a possession of the equipment or a no train period is required.

The tests in sections 1 to 3 are required when wheel sensors are replaced or removed and re-fitted.

1. Frauscher RSR123 Wheel Sensor Test (System Adjustment)

1.1 Before starting work the system shall be powered down by the removal of the main supply fuse in the master post.

1.2 Disconnect the wheel sensor cable in the trackside connection box (GAK unit).

1.3 Connect a multimeter set on 0-1V DC to the AMB001 test box socket (See Figure 1). Press the toggle switch on AMB001 to the battery symbol. The multimeter reading shall be > 0.75 V, if not the battery of the test box AMB001 needs replacing.

Figure 1 – AMB001 Test Box

1.4 Sensor System 1. Connect wire 1 (brown) to the red connector and wire 2 (yellow) to the black connector (See Figure 2). The adjustment procedure starts automatically. After approximately 10 seconds the multimeter shall show a value between 0.49 V and 0.515 V.

Figure 2 - AMB001 Test Box Connected

1.5 If the measurements are outside of this range then try re-aligning the head to the centre of the tolerances, reference NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) - Period Task 3. If this is unsuccessful then the wheel sensor shall be replaced.

1.6 Within 50 seconds of test step 1.3 place the testing plate PB200 over sensor system 1 (see Figure 3) and check that the multimeter value is between 330mV and 375mV.

Figure 3 – PB200 Over Sys1

1.7 If the measurements are outside of this range then try re-aligning the head to the centre of the tolerances, reference NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) - Periodic Task 3. If this is unsuccessful then the wheel sensor shall be replaced.

1.8 Reconnect the wires to the trackside connection box to wiring diagrams.

1.9 Sensor System 2. Connect wire 3 (green) to the red connector and wire 4 (white) to the black connector. The adjustment procedure starts automatically. After approximately 10 seconds the multimeter shall show a value between 0.49 V and 0.515 V.

1.10 If the measurements are outside of this range then try re-aligning the head to the centre of the tolerances, reference NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) - Periodic Task 3. If this is unsuccessful then the wheel sensor shall be replaced.

1.11 Within 50 seconds of test step 1.8 place the testing plate PB200 over sensor system 2 (see Figure 4) and check that the multimeter value is between 330mV and 375mV.

Figure 4 - PB200 Over Sys2

1.12 If the measurements are outside of this range then try re-aligning the head to the centre of the tolerances, reference NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) - Periodic Task. If this is unsuccessful then the wheel sensor shall be replaced.

1.13 Power up the axle counting system, as described in Section 2 of this document.

1.14 Undertake the wheel sensor detection capability test, as described in Sections 4 & 5 of this document

2. Level Crossing System Power Up

2.1 At the master post replace the main supply fuse to energise the system.

2.2 Check that the Green “DC Okay” LED is illuminated on the 24vDC power supply.

2.3 Check the two 5V LEDs (green) on the ACB board illuminate and observe that the display initially shows LRNO for approximately 5 seconds.

2.4 Observe the ACB display changes to flashing **** for approximately 10 seconds indicating system initialisation. After 10 seconds the ACB display changes to an alternating display of -109 / -209. This indicates that the system is now waiting for the axle counter section to be occupied and cleared.

2.5 Observe the two green PWR LEDs on the IMC evaluator board are illuminated.

2.6 To reset the ACB displays to 0 undertake one of the options, as described in section 3 of this document.

3. Block Section Test and Reset Sequence

3.1 To test and reset the ACB displays to 0, undertake one of the options 3.3 or 3.4.

3.2 To reset all Block Sections simultaneously undertake option 3.5.

3.3 Observe the passage of a train on each line.

a) Observe the number of axles counted in and the ACB Occupied LED (red) is lit.

b) Check all the axles are counted out of the section and the ACB display count shows 0.

c) Check the Occupied LED (red) is extinguished.

3.4 Activate the axle counter heads in sequence using the test plate PB200 over each head for each line.

a) In the normal direction of travel slowly sweep test plate PB200 over a Strike-in wheel sensor. This simulates one axle in block section.

b) check the section ACB display shows 1 and the Occupied LED (red) is lit.

c) In the normal direction of travel slowly sweep the test plate over the section Strike-out head.

d) Check that the ACB for block section 1 shows 0 and the Occupied LED for the section is extinguished.

e) Check the ACB for block section 2 shows 1 and the Occupied LED is lit.

f) In the normal direction of travel slowly sweep the test plate over the Strike-out head for the block section 2.

g) Check that the section ACB display shows 0 and the Occupied LED (red) is extinguished.

3.5 Operate the reset switch.

3.6 The successful completion of either 3.3, 3.4 or 3.5 initialises the system, ready for service.

3.7 Failure of any of the above tests should be reported as corrective maintenance.

4. Wheel Sensor Test for NDI and NDO heads (Detection Capability)

4.1 Identify the Evaluation Board (IMC) related to the axle counter sensor to be tested and check the section is indicating clear. The IMC Board should only have the two green power LEDs lit (Figure 5) and the associated ACB display shows 0 (Figure 6).

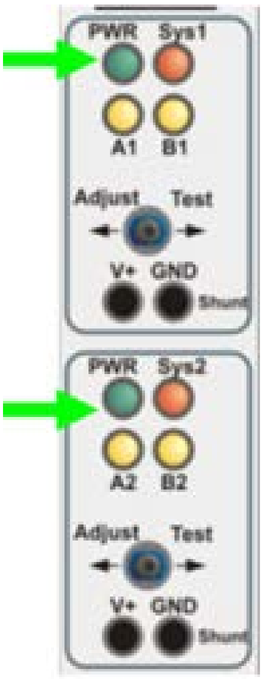


Figure 5 - IMC Board

Figure 6 – ACB Board

4.2 Place the PB200 testing plate on the railhead, on the approach side of the axle counter wheel sensor, for a train moving in the normal direction. This is the start position (Figure 7).

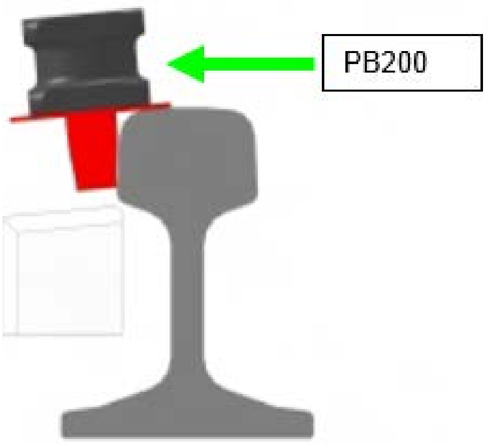


Figure 5 - PB200

4.3 Move (slide) the PB200 slowly in the normal direction of travel and stop over the first wheel sensor (Figure 8).

4.4 Check the LED indications SYS1 and B1 are illuminated (Figure 9) and the ACB display shows <00> (Figure 13). Whilst testing the NDO, BS1/BS3 ACB shows an error code and BS2/BS4 shows as per Figure 10.

Figure 6 – PB200 Over Sys1

Figure 7 – IMC Board

Figure 8 – ACB Board

4.5 Move (slide) the PB200 slowly in normal direction of travel and stop in between the two wheel sensors systems (Figure 11).

4.6 Check the LED indications SYS1, SYS2 and B1, B2 are illuminated (Figure 12).

Figure 11 – PB200 Mid Position

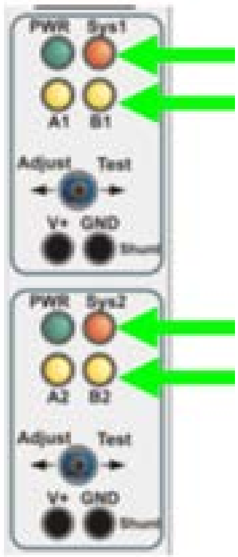


Figure 12 – IMC Board

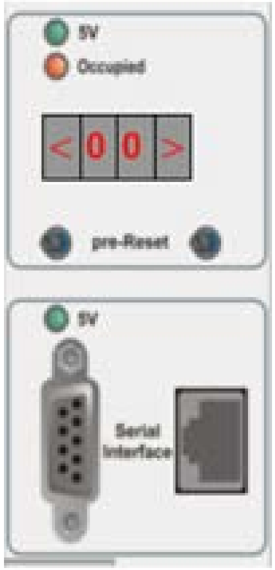


Figure 13 – ABC Board

4.7 Move (slide) the PB200 slowly in normal direction of travel and stop over the second wheel sensor (Figure 14).

4.8 Check the LED indications SYS1 and B1 have extinguished and the LED indications SYS2 and B2 remain illuminated (Figure 15).

Figure 14 – PB200 Over Sys2

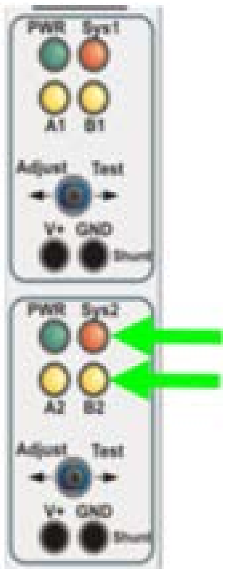


Figure 15 – IMC Board

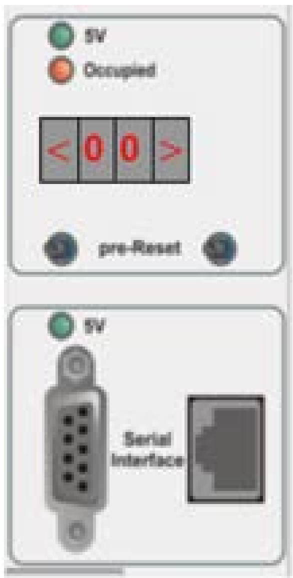


Figure 16 – ACB Board

4.9 At the end of the simulation, when the PB200 testing plate has passed beyond the sensor check the LED indications SYS2 and B2 have extinguished on the IMC Board leaving the two PWR indications illuminated, this indicates that the head/sensor has sensed a complete sweep (Figure 17). Check the ACB Display now indicates a single axle count (Figure 18). Whilst testing the NDO, BS1/BS3 ACB shows an error code and BS2/BS4 ACB displays a count of one.

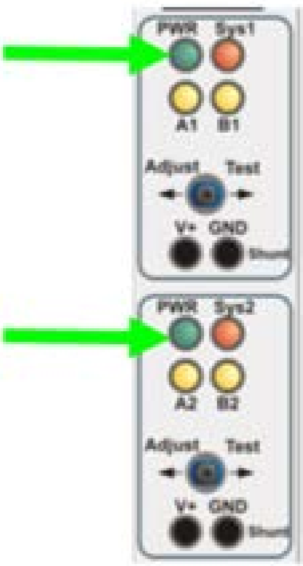


Figure 17 – IMC Board

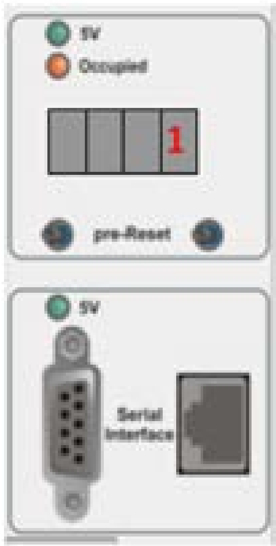


Figure 18 – ACB Board

4.10 The PB200 shall now be traversed over the axle counter sensors in the reverse direction to clear the section / track. When testing the NDO, BS2/BS4 ACB resets to zero and the BS1/BS3 ACB displays an error code.

Figures 8, 11 and 14 illustrate the PB200 moving over a sensor mounted on the cess rail, if the sensor were fitted on the 10ft rail then the direction of travel of the PB200 would be reversed.

4.11 If a wheel sensor detection test is carried out in isolation the on an NDO it is likely to have caused BS1/3 to fail. To clear this issue the system shall be reset.

5. Wheel Sensor Test for XDI heads (Detection Capability)

5.1 Identify the Evaluation Board (IMC) related to the axle counter sensor to be tested and check the section is indicating clear. The IMC Board should only have the two green power LEDs lit (Figure 19) and the associated ACB display shows 0 (Figure20).

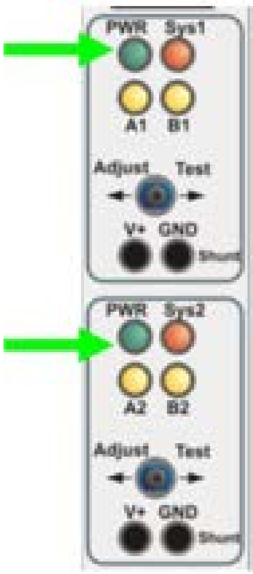


Figure 9 – IMC Board

Figure 10 – ACB Board

5.2 Place the PB200 testing plate on the railhead, on the approach side of the axle counter wheel sensor, for a train moving in the wrong direction. This is the start position (Figure 7).

5.3 Move (slide) the PB200 slowly in wrong direction of travel and stop over the first wheel sensor (Figure 21).

5.4 Check the LED indications SYS2 and B2 are illuminated (Figure 22) and the ACB display shows <00> (Figure 23).

Figure 21 – PB200 Over Sys2

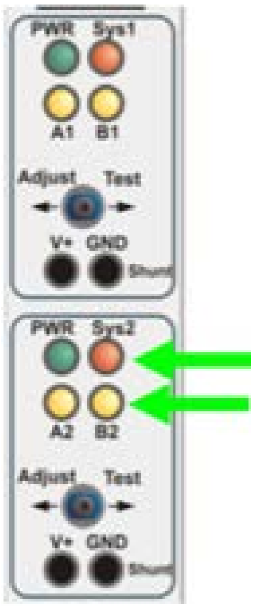


Figure 11 - IMC Board

Figure 23 – ACB Board

5.5 Move (slide) the PB200 slowly in wrong direction of travel and stop in between the two wheel sensors systems (Figure 24).

5.6 Check the LED indications SYS1, SYS2 and B1, B2 are illuminated (Figure 25).

Figure 24 – PB200 Mid Position

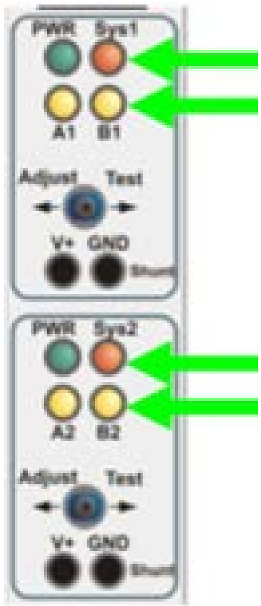


Figure 12 - IMC Board

Figure 26 – ACB Board

5.7 Move (slide) the PB200 slowly in normal direction of travel stop over the second wheel sensor (Figure 27).

5.8 Check the LED indications SYS1 and B1 have extinguished and the LED indications SYS2 and B2 remain illuminated (Figure 28).

Figure 27 – PB200 Over Sys1

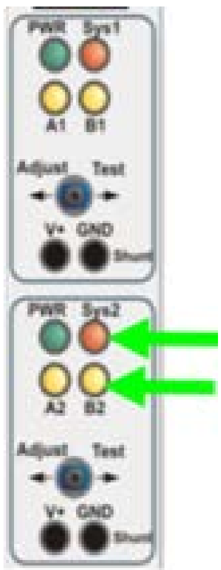


Figure 28 – IMC Board

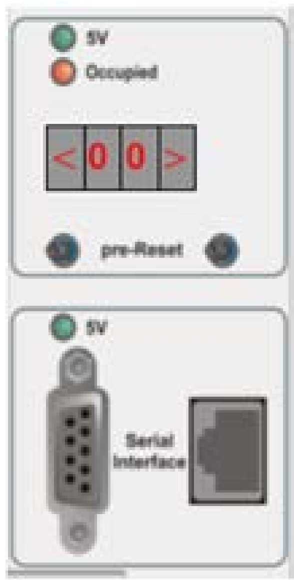


Figure 13 – ACB Board

5.9 At the end of the simulation, when the PB200 testing plate has passed beyond the sensor check the LED indications SYS2 and B2 have extinguished on the IMC Board leaving the two PWR indications illuminated, this indicates that the head/sensor has sensed a complete sweep (Figure 30). Check the ACB Display now indicates a single axle count (Figure 31).

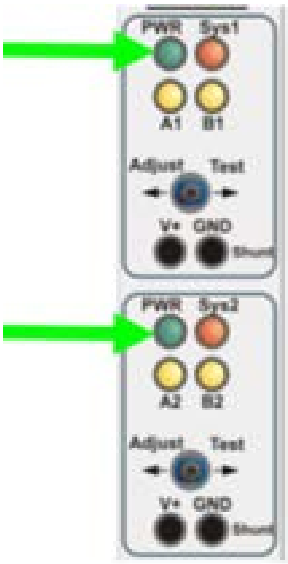


Figure 30 – IMC Board

Figure 31 – ACB Board

5.10 The PB200 shall now be traversed over the axle counter sensors in the reverse direction to clear the section/track.

5.11 If a wheel sensor detection test is carried out in isolation the on a single unit it is likely to have caused the associated block section to fail. To clear this issue the system shall be reset using the Test/Reset facility.

Figures 21, 24 and 27 shows the PB20 moving over a sensor mounted on the cess rail, if the sensor were fitted on the 10ft rail then the direction of travel of the PB200 would be reversed.

6. Functional Task – Operational Sequence Test

6.1 Check no train enters the level crossing strike in area from any direction for the duration of test.

6.2 Push the On-Demand button on one of the units if applicable and observe the green lights illuminate in both units. Commence timing the lights and check that the green lights are extinguished after 5 minutes.

6.3 Press the on demand button (if provided). Simulate a train occupying an entrance section by entering one axle using the test switches on a Strike-in evaluator board (IMC). Observe the green lights in both units are extinguished; the red lights illuminate and check the audible warnings sound. Observe the entrance block section ACB display shows 1 and the ACB Occupied LED (red) is illuminated.

6.4 Simulate a train arriving at the crossing and exiting the entrance section by entering one axle using the test switches on the Strike-out evaluator board (IMC) to clear the axle counter section. Observe the crossing lights change from red to green and Check the audible warning ceases. Observe the entrance section ACB display shows 0 and the ACB Occupied LED (red) is extinguished.

Reference should be made to local documentation as the toggle switch sequence is related to the layout of the sensor heads.

Observe the exit block section ACB display shows 1 and the ACB Occupied LED (red) is illuminated.

6.5 To complete the sequence, simulate the train leaving the exit block section. Observe that the ACB display for the exit block section shows 0 and the ACB Occupied LED (red) is extinguished.

6.6 Repeat 6.3 to 6.5 for all other lines (normal direction strike-in), there is no need to wait for 5 minutes to elapse between tests.

7. Double Lines Second Train Approaching Sequence Test

7.1 Push the On-Demand button (if applicable/fitted) on one of the posts and observe the green lights illuminate in both units.

7.2 Simulate a train occupying an entrance section on line 1. Enter two axles using the test switches on a Strike-in evaluator board (IMC) for line 1. Observe the green lights in both units are extinguished the red lights illuminate and check the audible warnings sound. Observe the entrance section ACB display shows 2.

Reference should be made to local documentation as the toggle switch sequence is related to the layout of the sensor heads.

7.3 Simulate a second train occupying an entrance section on line 2. Enter two axles using the test switches on a Strike-in evaluator board (IMC) for line 2. Check the lights continue to show red. Observe the entrance section ACB display for the second line shows 2 and the ACB Occupied LED (red) is illuminated.

7.4 Simulate the train on line 1 arriving at the crossing by entering one axle using the test switches on the entrance section Strike-out evaluator board (IMC) for line 1. Observe the red lights remain illuminated and check the audible warning changes to the increased ATC rate. Observe the entrance section ACB display shows 1.

7.5 Simulate the train on line 1 exiting the entrance section by entering a second axle using the test switches on the Strike-out evaluator board (IMC) for line 1. Observe that the light units continue to show a red light and check the increased audible warning rate continues. Observe the entrance and exit section ACB displays shows 0 and the ACB Occupied LED (red) is extinguished.

7.6 Simulate the train on line 2 arriving and exiting the entrance section by entering two axles using the test switches on the entrance section Strike-out evaluator board (IMC) for line 2. Observe that the red lights are extinguished; the green lights are illuminated and check the audible warning ceases. Observe the entrance section ACB display for the second line shows 0 and the ACB Occupied LED (red) is extinguished.

7.7 At this stage the exit section in the direction of travel, for both lines are occupied. To complete the sequence, simulate the train leaving the exit block section on both lines. Observe that the ACB display for the exit block section shows 0 and the ACB Occupied LED (red) is extinguished.

7.8 Repeat 7.1 to 7.7 for all other normal direction ATC permutations.

END

Includes:	All types of Automatic Open Crossing Locally Monitored plus Barriers (AOCL+B)
Excludes:	All other types of Crossing

Liaise with the Signaller before any tests are carried out

Check in the crossing control tables for any special controls that affect the automatic control sequence.

Where the word EXIT occurs, the strike out treadle shall be operated.

On single lines or where bi-directional controls exist, the leaving track circuit shall also be operated.

Where directional proving controls exists the bi-directional strike out treadle shall also be operated in the correct sequence.

The following abbreviations are used in this service:

- DRL: Driver's Red Light.
- DWL: Driver's White Light

SERVICE A

1. Local Control Sequence (If Provided)

1.1 Operate the Local Control Unit (LCU) to the on/lower/hand position: Observe road lights illuminate, audible warnings operate, crossing headlights illuminate and the barriers lower. Check the DWLs do not illuminate

1.2 Confirm that no trains are approaching before proceeding.

1.3 Operate the LCU to the off position. Observe the barriers rise, the road lights extinguish, the crossing headlights extinguish and audible warnings cease.

1.4 Operate the LCU to the on/lower/hand position, allow the lowering sequence to take place and then operate the LCU switch to the auto position, close and lock the LCU door.

1.5 Observe the barriers rise, the road lights extinguish, and audible warnings cease.

1.6 Check that all DRL are flashing.

1.7 Check the LCU door cannot be locked unless the switch is in the auto position.

1.8 Check that the DRL is flashing for all signalled directions.

2. Automatic Control Sequence

2.1 Observe, with no train approaching, all DRLs are flashing.

2.2 Simulate an approaching train by shunting a controlling track circuit. Observe the following:

a) On double lines 10 seconds elapse before the crossing sequence commences. On single lines the sequence starts immediately.

b) All the amber road signals illuminate, and the audible warnings commence concurrently (Yodalarms at normal warbling rate).

c) After 3 seconds all the amber signals extinguish, and all the red road signals and any pedestrian lights start to flash.

d) The crossing headlights illuminate the crossing at the same time the red road lights commence to flash.

e) After approximately a further 4 seconds the barriers commence to lower and the boom lamps illuminate. Check the sighting of the boom lamps.

f) As the barriers commence to lower the driver's red light extinguishes and the DWL commences to flash for the direction where the train simulation was applied. The DRL continues for the opposing directions.

g) The barriers take 6 to 8 seconds to reach the fully lowered position.

h) The crossing headlights, red road lights and any pedestrian lights continue to be illuminated and audible warnings continue to sound.

2.3 Operate the exit function and remove the train simulation. Observe the following:

a) The barriers begin to rise.

b) The DWL for the direction where the simulation was applied extinguishes and the DRL (if provided) commences to flash.

c) The red road lights and crossing headlights extinguish and the audible warnings cease when the barriers have reached approximately 45° from the horizontal.

d) The boom lights extinguish when the barriers have reached approximately 81° from the horizontal.

e) The barriers do not take more than 7 seconds to reach the fully raised position of between 81° and 85° from the horizontal.

2.4 Repeat steps 2.2 and 2.3 for the opposite direction on a single line and the other direction on double lines.

3. Double Lines Second Train Approaching Sequence

3.1 Simulate a train striking in on line one as per 2.2

3.2 Simulate a second train striking in on line two. Observe the following:

a) The barriers remain lowered.

b) The road lights and any pedestrian lights continue to flash.

c) The audible warning rate continues at the normal rate.

d) The crossing headlights continue to illuminate.

3.3 Operate the exit function and remove the simulation on line one. Observe the following:

a) The barriers remain lowered.

b) The road lights and any pedestrian lights continue to flash.

c) The audible warning rate changes to the increased rate.

d) The crossing headlights continue to illuminate.

e) The DWL for the direction of the simulation on line one extinguishes and the DRL commences to flash.

f) The DWL for the simulation on line two continues to flash.

3.4 Operate the exit function and remove the simulation on line two. Observe that the sequence is the same as described in 2.3.

3.5 Repeat steps 3.1 to 3.4 for a train striking in on line two first and a second train striking in on line one.

3.6 Where possible, observe the correct crossing sequence during passage of a train(s).

SERVICE B

These tests are for the full annual test of the crossing. NR/SMS/PartD/Index lists the indexes and references to the A4 format (with tick boxes) of these tests for the use of the person testing the crossing.

APPENDIX A - Indications

Table 1 lists the driver indications displayed throughout a local control and automatic sequence:

<table>
<tr><th>Situation</th><th>Indication</th></tr>
<tr><td>Automatic control, no train approaching, or no train simulation applied</td><td rowspan="2">DRL Flashing
DWL Extinguished</td></tr>
<tr><td>Crossing on operating on Local Control</td></tr>
<tr><td>Automatic control, train approaching, or train simulation applied, barriers started to lower</td><td>DRL Extinguished
DWL Flashing</td></tr>
<tr><td>Barriers lowered by train simulation, DWL operating, any DWL proving contact broken, power off. ✱</td><td>DRL Flashing
DWL Extinguished</td></tr>
</table>

Table 1 – Driver Indications

The DWL should only operate for the direction in which the train is approaching, or the train simulation has been applied.

The DRL should be operating for all other directions

✱ Check the diagrams for the contacts in the DWL control circuit (this includes the (PO)PR function).

END

Do not enter the potential entrapment zone whilst the gate is in operation.

This includes the space between the gate, when open, and any obstruction such as fences, wall and landscaping.

1. Before commencing any adjustment

1.1 Check the gate is properly installed and all nuts are tight.

1.2 Check the top gate rail is horizontal.

1.3 Check the gate swings feely in both directions.

1.4 Check the gate engages and the solenoids lock without binding.

1.5 Check the solenoids sit in the centre of the gate latch jaws.

2. Limit Switch Adjustment

The open and closed limits of the actuator arm may need to be adjusted to guarantee flush fitting of the gate into the solenoid locks when the gate is fully open and fully closed.

The limit switches set the point at which the actuator stops driving.

For testing / adjustment purposes you may find it easier to release the actuator and turn it upside down to access the limit switch adjustment screws which are located on the underside of the actuator unit.

Once adjustments are completed flip the actuator back to the correct final installation position.

2.1 The limit switch adjustments are located on the bottom of the actuator (See Figures 1 and 2):

Figure 1 - Location of limit switches

Figure 2 - Close up

2.2 Remove the dust plug to make adjustments. Only use a small flat blade manual screwdriver.

2.3 Each gate should be tested individually. Disable gate 2 (See Figure 3) by turning to dipswitch SW 4 to the off position.

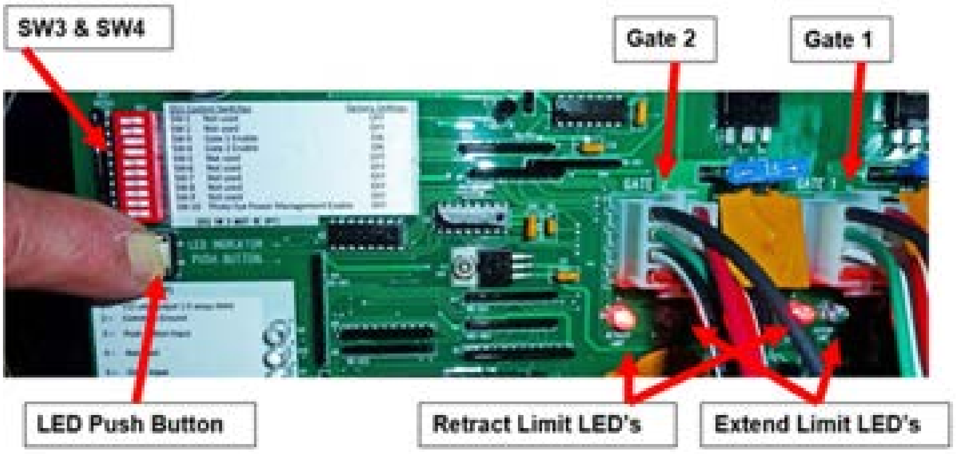


Figure 3 – NR Control Board

Closed Gate Adjustment

2.4 Operate gate 1 to the fully closed position and check it is latched. Press the LED indicator button. This should cause the extend limit LED under gate 1 to illuminate. (if the LED illuminates move to 2.9).

2.5 If the LED fails to illuminate or illuminates before travel is completed, adjust the limit switch to extend or reduce length of the actuators travel.

2.6 To extend (increase) gate travel towards the closure position turn the extend length adjustment screw clockwise. As indicated in red in Figure 4.

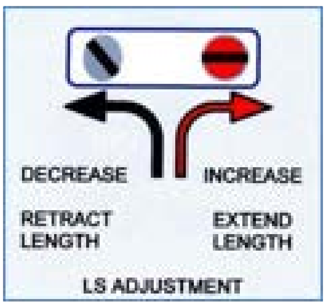


Figure 4 – Extend

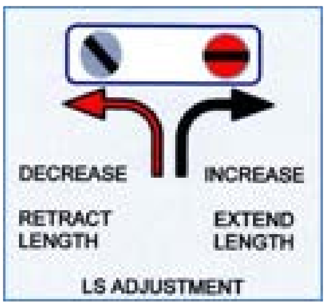


Figure 5 - Retrack

2.7 To reduce (decrease) gate travel towards the closure position turn the extend length adjustment screw counter clockwise. As indicated in red in Figure 5.

2.8 When the actuator is correctly adjusted the extend limit LED illuminates.

Open Gate Adjustment

2.9 Operate gate 1 to the open position and press the LED indicator button this should cause the retract limit LED under gate 1 to illuminate. (if the LED illuminates move to 2.14)

2.10 If the LED fails to illuminate or illuminates before travel is completed, the limit switch requires adjusting to extend or reduce length of the actuators travel.

2.11 To extend (increase) gate travel towards the open position turn the retract length adjustment screw clockwise. As indicated in red in Figure 6.

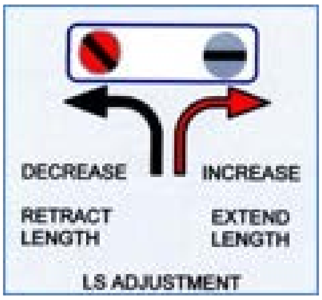


Figure 6 – Extend

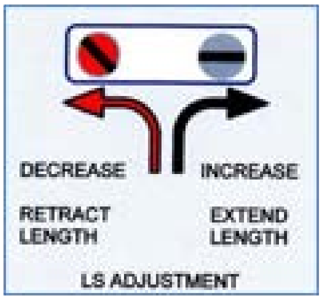


Figure 7 - Retract

2.12 To reduce (decrease) gate travel towards the open position turn the retract length adjustment screw counter clockwise. As indicated in red in Figure 7.

2.13 When the actuator is correctly adjusted the retract limit LED illuminates.

2.14 Replace the dust covers.

Remember to return the actuator to it correct position if you carried out the adjustment with the unit upside down.

3. Gate Reaction Test

3.1 Identify which gate is gate 1 and which is gate 2.

As a rule, gate 1 will be closest to the control panel and is deemed the Master with the gate across the track designated gate 2 and deemed the Slave.

3.2 Attach the 300mm extension spacer to the Closing Force Tester and Check the “ready for measurement” indication is showing (see Figure 8).

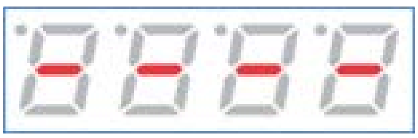


Figure 8 – Ready Indication

3.3 Open the Gate fully using the green button or the open/close button on the Control Board.

3.4 Press the Close gate button.

3.5 As the gate closes place the Closing Force Tester between the gate and the “Closed” post so the closing gate applies force to the pressure plate (See Figure 9).

Care should be taken to avoid crushing injuries and the correct PPE should be worn including gloves.

Figure 9 - Force tester in position

3.6 Check and record the reaction time recording the results on approved record card

If you are unsure of how to interpret the indications displayed on the “Closing Force Tester” then you should refer to Appendix A.

The reaction time of the gate shall be less than 0.75 seconds. If the response time exceeds this than the current sensor should be adjusted to lower the reaction time to below 0.75 seconds.

3.7 Report any failure to meet the required standard to your SM(S).

4. Current Sensor Adjustment

If any adjustment is made to a Current Sensor it is a requirement that you carry out a Gate Reaction Test before returning the gate into service. Check you have a serviceable tester before commencing any adjustment.

4.1 To carry out the adjustment you shall identify the correct current sensor potentiometer. These are found on the top edge of the Control Board and are marked as Gate 1 and Gate 2 (circled in Figure 10), one for each gate.

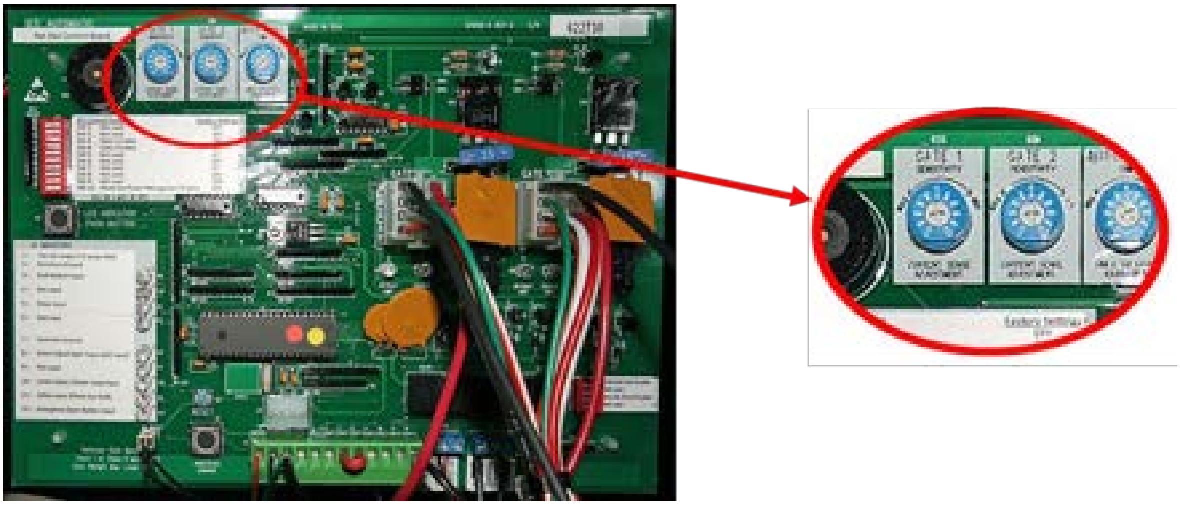


Figure 10 – NR Control Board

4.2 Using a small electrical screwdriver gently adjust the Current Sensor Potentiometer:

- To increase the Force pushing the gate you should adjust anticlockwise.
- To decrease the Force pushing the gate you should adjust clockwise.

4.3 After each adjustment the gate action time shall be rechecked using clauses 3.2 to 3.6.

The gate shall not be left to operate in automatic mode in the event of non-compliance with reaction time test.

APPENDIX A - Closing Force Tester

<u>Interpreting the outputs from the Closing Force Tester</u>

The Closing force Tester produces a series of five readings for completeness. All five are explained below. However only the second and fifth readings are recorded on the record card as explained in Clause's 2 and 5.

1. **The first indication:** This shows the closing force in Nm and is shown as a full number. This can be read directly from the unit when the force has been released.

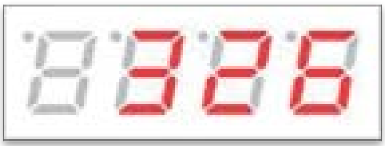


Figure 11 – Closing Force

The example in Figure 11 shows 326 N.

2. **The second indication:** In addition to the closing force reading. When the second display segment from the left flashes this indicates the dynamic time exceeded 0.75ms.

Figure 12 – Display Segment 2

3. **The third indication:** In addition to the closing force reading. When the third display segment from the left is flashing this indicates the force value exceeded 25 N at the end of the 5 second measurement period.

Figure 13 – Closing Force < 25Nm

4. **The fourth indication:** In addition to the closing force reading. When the third and fourth display segments from the left are both flashing this indicates the force value exceeded 80 N at the end of the 5 second measurement period.

Figure 14 – Closing Force < 80Nm

5. **The fifth indication:** If clause 2 has indicated a measurement in excess of 0.75 seconds then the control button on the Force Tester should be pressed once. The display shows actual dynamic time in milliseconds and this should be entered on to the record card.

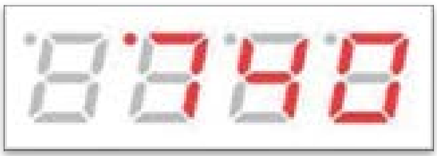


Figure 15 – Dynamic Time

The example in Figure 15 shows 740ms.

6. **The sixth Indication:** If clause 3 has indicated a measurement in excess of 25 Newtons then the control button on the Force Tester can be pressed twice. The display shows actual force value in Newton's.

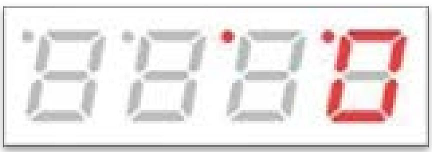


Figure 16 – Actual Force in Newton

The example in Figure 16 shows Zero Newtons.

Pressing the control button returns the user to the initial readings. The tester can be turned off by pressing and holding the button in for 2 seconds. After 5 minutes of inactivity the device powers down.

END

Includes:	Servosafe 7788, 7788R, 7789, 7789R, 8889, 8889R
Excludes:	Servotrim 9909

The tasks in these tests can be carried out by other teams or equipment specialists.

SERVOSAFE SERIES

Previously the alarm levels were checked by using the servo pen recorder. This is no longer possible due to no spares available to enable repair. Also, the pen recorder paper is now obsolete.

To check that the DPU is sending out alarms at the correct level the system has to be fully powered and the transmission link to the Signal Box disconnected (prevents alarms being transmitted whilst the unit is set up).

Connect telephone 'ear piece' with connections to R1 & R2 alarm transmitters whilst the alarm levels are being set.

Once alarms are triggered they should be heard as 'beeps'.

Once the alarm levels are set, the transmission can be turned off, links reconnected, and signaller informed prior to when transmission switched back on.

1. Locator Tests

Inform the Signaller that routine tests are being carried out. Carry out test between trains.

These tests refer to the signal box end of the equipment.

1.1 Switch OFF the 110Vac power supply and check that the system failure alarm operates (15 to 40 seconds). Restore the 110Vac power supply.

1.2 Operate Normal/Failure switch to Failure and check system failure alarm operates. Restore the Normal/Failure switch to Normal.

1.3 Certain Ex BR-WR sites only

a) Remove signal input plug and check system failure alarm operates.

b) Cancel system failure alarm by operating Normal/Failure switch to Failure.

c) Replace signal input plug and check system failure alarm operates.

d) Cancel system failure alarm by operating Normal/Failure switch to Normal.

1.4 Operate the locator reset button and observe that total alarms and axle number displays show zero.

NOTE: *For the following tasks, use the test buttons on the back of the locator:*

- TEST RL 2 (R/H alarm)
- TEST RL 1 (L/H Alarm)
- TEST WHEEL COUNT

1.5 Operate test wheel count push button twelve times.

1.6 Check that 12 is displayed in the axle number counter.

1.7 Check that total alarms remains zero.

1.8 Wait 30 seconds then operate test wheel count button once.

1.9 Observe that the axle number counter resets to 001.

1.10 Enter nine alarms, by using the TEST RL 1 and TEST RL 2 test buttons, interspersed by test wheel counts.

1.11 Check that the hot axle box alarm sounds intermittently.

1.12 Cancel the hot axle box alarm by operating the audible alarms reset button.

1.13 Check that the hot axle box indications appear under the first and last digits in the axle number display.

1.14 Check the results in the total alarms display and axle number display by use of the display selector switch.

1.15 Operate the locator reset button.

2. Calibration Tests

2.1 Make arrangements with the Signaller to enable the apparatus to be disconnected.

2.2 Switch OFF the carrier system and switch the signal box locator to FAILURE.

Calibration Temperature

2.3 Place the thermometer in the shade adjacent to the Scanners.

2.4 Switch the function simulator power and gate switches to the OFF position.

2.5 Connect the function simulator by its cable to the data processing unit and switch the function simulator power switch to the ON position.

Pedestal Pulse

2.6 On the test panel select DIR 1 and RAIL 1 and set the test panel pulse amplitude control to minimum.

NOTE: *The test panel deflection meter should display pedestal pulses of approximately 1.5mm amplitude.*

2.7 Check that the pedestal pulse amplitudes are constant, and no spurious alarms are produced.

2.8 Adjust, if necessary, RAIL 1 Pulse Processor PED ADJ control whilst observing the test panel deflection meter.

2.9 Select RAIL 2 on the test panel and repeat items 2.3 and 2.4. Adjust, if necessary, RAIL 2 pulse processor PED ADJ control.

2.10 Reset the test panel and allow the integrity test to complete.

Absolute Alarm Check (A.M.A. Right Hand Servolarm Unit)

2.11 Remove the fuse on the differential alarm unit. (A.M.D. Left-hand Servolarm Unit).

2.12 On the test panel select DIR 1 and RAIL 1.

2.13 Set the test panel test pulse amplitude control to give 15.5mm reading on the deflection meter.

2.14 On the absolute alarm unit (A.M.A. Right-hand Servolarm Unit), adjust alarm level RAIL 1 potentiometer until the alarm triggers so that there is an intermittent miss in triggering.

2.15 On the test panel increase the test pulse amplitude control to 16mm and check that triggering always occurs. Decrease the test pulse amplitude control to 15mm and check that triggering does not occur.

2.16 On the test panel select RAIL 2 and repeat items 2.9 to 2.12. Adjust the absolute alarm level RAIL 2 potentiometer.

2.17 On the differential alarm unit (A.M.D Left-hand Servolarm unit) restore the fuse.

2.18 Set the test panel pulse amplitude control to minimum.

Differential Alarm Check (A.M.D. Left hand Servolarm Unit).

2.19 On the test panel select RAIL 1.

2.20 Remove the absolute alarm fuse. Set the test pulse amplitude control to give 9.5mm reading on the deflection meter.

2.21 On the differential alarm unit (A.M.D. Left hand Servolarm Unit) adjust alarm level RAIL 1 potentiometer until the alarm triggers so that there is an occasional missing triggering.

2.22 On the test panel increase the test pulse amplitude control to 10mm. Check that triggering always occurs. Decrease the test pulse amplitude control to 9mm. Check that triggering does not occur.

2.23 On the test panel select RAIL 2 and repeat items 2.17 to 2.19. Adjust the Differential Alarm Unit (A.M.D. Left hand Servolarm Unit) Alarm Level RAIL 2 potentiometer. Re-fit the absolute alarm fuse.

2.24 On the test panel set the test pulse amplitude control to minimum. Reset the test panel and allow the integrity test to complete.

Pulse Processor Gain

2.25 Place the function simulator on the step of the RAIL 1 Scanner. For the 7788R system, use the saddle fixture.

2.26 Note the ambient temperature. On the function simulator adjust the coarse and fine temperature controls to indicate a temperature of 130º f above ambient.

2.27 Allow the function simulator about 3 minutes to warm up and then switch the function simulator gate switch to ON.

2.28 On the test panel select RAIL 1.

2.29 Adjust RAIL 1 pulse processor unit GAIN control to give a test panel deflection meter reading of (see Table 1):

<table>
<tr><th>Equipment Type</th><th>Reading</th></tr>
<tr><td>7788</td><td rowspan="2">6mm</td></tr>
<tr><td>7789</td></tr>
<tr><td>7788R</td><td>12.5mm</td></tr>
<tr><td>8889</td><td rowspan="2">12mm</td></tr>
<tr><td>8889R</td></tr>
</table>

Table 1 – Deflection Readings

2.30 Check that the deflection meter reading is steady, any variations should not exceed + 0.5mm.

2.31 Move the function simulator to RAIL 2 and select RAIL 2 on the test panel.

2.32 Repeat items 2.26 to 2.27 and adjust RAIL 2 pulse processor unit GAIN control.

2.33 Remove the function simulator from the scanner.

2.34 Switch the function simulator gate switch off and switch the power switch off.

2.35 Disconnect the function simulator from the data processing unit.

SERVOTRIM SERIES

Includes:	Servotrim 9909
Excludes:	Servosafe 7788, 7788R, 7789, 7789R, 8889, 8889R

SERVICE A TESTS

3. DPU Keypad Tests

3.1 Press * to enable the keypad. Then check the date and time:

a) Press D/ENT/2/ENT/

b) Check that time and date are correct. Press * to clear.

If not correct:

c) Press D/ENT/ - followed by: Month/ENT/Day/ENT/Year/ENT/Hour/ENT/ Minute/ENT/ENT/

d) Check again and press * to clear.

Should the readings have been more than a few minutes out, report it as corrective maintenance.

3.2 Check the alarm level:

a) Press E/ENT/1/ENT

b) Check that alarm level E1 is set to 14.

If wrong, enter the correct value and press:

c) ENT

d) Press /ENT/ again and E2 will be displayed. Continue in this way and check/correct values:

e) E1=14; E2=14; E3=08; E4=08; E5=08; E6=08.

If any values are found to be incorrect, report it as corrective maintenance

3.3 Run the processor and integrity tests:

a) Press C/ENT/3/ENT

b) Check that A1 is displayed.

c) Press * to clear.

3.4 Place thermometer outside in the shade near to the temperature probe and allow to stabilise.

a) Press C/ENT/5/ENT

b) Check that the display corresponds to the thermometer ±2° F. Press * to clear.

3.5 Shut down the keypad:

a) Press F/ENT

3.6 Where practicable, count the number of axles on two trains and check with the Signaller that the signal box received the same.

SERVICE B TESTS

4. Signal Box Display Equipment

4.1 Unplug the transmission line from the back of the modem and check that a ‘Comms Alarm’ is received.

4.2 Replace plug and check that the alarm is cancelled correctly.

4.3 Where the readout is computer based, switch the power off, leave for 10 seconds and power up.

4.4 Check that the computer boots up correctly and, where possible, that the next train is correctly reported.

5. Keyboard

5.1 Check that the system responds to a keyboard command by typing:

S/RETURN

NOTE: *This performs a self-test, and the ensuing report should be examined on the printer (i.e., "system test: passed + date and time).*

6. System Functions

NOTE: *Each time the sensor is adjusted, it is necessary to refresh the display by entering: C/ENT/5/ENT*

6.1 Plug the function simulator cable into the back of the DPU and the function simulator.

6.2 Set the function simulator to 130º F above ambient temperature, turn on the gate switch and power switch, and allow to warm up.

6.3 When the neon indicator is seen to be cycling on/off, place the saddle on the trailing end of rail 1 scanner and place the function simulator onto the saddle.

6.4 On the DPU Keypad press:

a) C/ENT/2/ENT

b) Check that the lowest cycling point on the display is 12.0. If it's not, adjust R58A on the front edge of board 2 of DPU.

6.5 Using a digital voltmeter, measure the voltage between TP61A (+) and TP78A (-)

- 2VDC (±0.05V). If it is outside these limits, adjust R13A to correct.

6.6 Move saddle and function simulator across to rail 2 scanner.

6.7 Check that the lowest cycling point on the display is 12.0. If it's not, adjust using R48A on the front edge of board 2 of the DPU.

6.8 Using a digital voltmeter, Measure the voltage between TP52A (+) and TP78A (-)

- 2VDC (±0.05V). If it is outside these limits, adjust R17A to correct.

NOTE: *It should be borne in mind that the values in 6.4/6.5 and 6.7/6.8 are interrelated and should be rechecked if either pair are adjusted.*

6.9 Switch the function simulator “gate” off and remove the function simulator from the scanner.

6.10 If any adjustments have been made in 6.5; 6.6; 6.7 or 6.8, benchmark the equipment by pressing C/ENT/2/ENT/*

Holding the * in until the function simulator LED on the front panel goes out. Then (within 5 secs) Press C/ENT/1/ENT

This initiate an integrity test.

Record the integrity values displayed. Press * to clear the display and exit.

6.11 Recover the function simulator, saddle, and cable from the track.

CYBERSCAN 2000 (TRIM II)

7. DPU Tests

Use a laptop or desktop PC to carry out these tests via the DPU interface terminal.

Report as corrective maintenance if any of the tests fail.

7.1 Check and Record the DPU time by typing:

NOW/ENT

7.2 Check and Record the system parameters and software installed by typing:

VER/ENT

7.3 Check and Record the system integrity by typing:

I or INTEG/ENT

END

Caution: 7788 HABD Equip is fragile, primarily due to its age. Care shall be taken when working on this equipment.

NOTE: *Excessive power down & up cause component failure.*

Inform the Signaller that routine tests are being carried out.

Carry out test between trains.

These tests refer to the signal box end of the equipment. Before starting the full alignment test check the scanners are aligned to each other.

This confirms that, once all checks have been carried out, the scanners should be looking at the same area, each side of the same axle of the passing train. Until this is achieved the tests will not be effective.

Check the alignment jig to confirm it is not bent, as it is easily mis-shaped due to bad storage or misuse.

Scanner & bolometer lens covers need to be removed. The centre of bolometer lens can now be obtained, and a straight line drawn across rail top. This can be done by using a large T square or the servo alignment jig by looking vertically down at the lens until the edge of the horizontal 'bar' is square to the running rail and aligns with the centre of the bolometer lens. R1 & R2 bolometer rail top marks should align.

Adjust scanner metal base plate to align scanners. Check that the scanner base has not moved backward or forward after this alignment or has been moved up/down or in/out to the rail.

If unable to initially align scanners inform your SM(S).

1. Alignment of transducers and optical alignment of scanners ballast mounted scanners

1.1 Check that the system is either powered down as per notes in the general section of each equipment type or the system is disconnected from the Signal Box.

NOTE: *Appendix A shows the details for Servosafe (Figure 2) rail mounded scanners, Servotrim systems (Figure 3), and Trim II systems (Figure 4). The transducers are marked as A, B & C.*

1.2 Fit the alignment jig & target mirror (Appendix C).

a) Establish the centre of the scanner lid aperture, square to the running rail.

b) Mark across the rail top for this position, complete for both scanners.

c) Check both R1 & R2 rail top marks align.

d) Move scanners to achieve alignment. If unable to align scanners report it as corrective maintenance.

e) Check that the positions of the transducers.

f) Measure ‘Z’ distance from the centre of each bolometer lens, mark on rail top towards ‘A’ & ‘B’ transducers.

g) Mark each rail at this point.

h) Note the measurement (via alignment jig) at which the centre of the fixture post sits, compare this measurement with the fixture bar setting table (Appendix B).

1.3 Report as corrective maintenance if the fixture bar measurements is outside those given in the setting table.

1.4 By use of a ferrous object, establish and mark the magnetic centres of the transducers A and B.

- If Servotrim transducers are used the magnetic centre can be found by use of an Allen key held in the hand.
- If Servopole transducers are used mark the ‘physical’ centre manually.

1.5 The scanner to transducer rail top mark now becomes the datum mark for A & B transducers.

a) Measure from this datum, distance ‘X’, marking the rail top. Then distance ‘Y’ and again mark the rail top. Marks first made on the transducers, in 1.2 should align to the marks on the rail top - distance ‘X’ & ‘Y’.

b) Adjust transducers to confirm alignment.

c) If unable to align, inform SM (S).

1.6 Check the alignment for ‘C’ Transducer. If unable to align, inform SM (S).

1.7 Check that the scanner mounting metal base plate is level by using a spirit level.

a) View the mirror through the hole in the target plate.

b) Check that the red spot appears within the black circle. Section 3 lists actions to be taken if the red spot is outside the black circle.

c) Report as corrective maintenance if any of these actions fail to solve the problem.

1.8 Remove alignment jig & target mirror and refit the lens cover and scanner housing.

1.9 Repeat as per 1.2 to 1.5 for the second scanner (rail top marking only required for the transducer rail).

1.10 Check external anti-vibration mounts are not excessively loose. Visually check, where possible, for deterioration.

1.11 Refit the lens cover and scanner housing.

1.12 Restore the power to the equipment as per notes in the general section of each equipment type or reconnect the system to the Signal Box.

Remember to allow the system to stabilise after being powered down as per the notes in the general section of each equipment type before handing back to the Signaller.

2. Alignment of transducers and optical alignment of scanners rail mounted scanners

2.1 Check that the system is either powered down as per notes in the general section of each equipment type or the system is disconnected from the Signal Box.

NOTE: *Appendix A shows the details for Servosafe rail mounded scanners, Servotrim systems, and Trim II systems. The transducers are marked as A, B & C.*

2.2 Check that the cant nuts are all set to the same number. For 113lb flat bottom vertically inclined rail the lowest number on the cant nut is used (positioned at the top).

2.3 Fit the alignment jig & target mirror (Appendix C).

a) To obtain the scanner to transducer datum mark, position the assembled alignment jig on the scanner/transducer rail.

b) Move the alignment jig towards A & B transducers until the target mirror red dot is within the black circle of the target plate.

c) Check that the alignment jig sits correctly on the rail and the fixture post and target plate are secure when aligned with target.

d) Mark the rail top with the centre of the alignment jig position at this point.

e) Note the measurement (via alignment jig) at which the centre of the fixture post sits and compare this measurement with the fixture bar setting table (Appendix B – Figure 6).

2.4 Report as corrective maintenance if the fixture bar measurements is outside those given in the setting table.

2.5 By use of a ferrous object, establish and mark the magnetic centres of the transducers A and B.

- If Servotrim transducers are used the magnetic centre can be found by use of an Allen key held in the hand.
- If Servopole transducers are used mark the 'physical' centre manually.

2.6 The scanner to transducer rail top mark now becomes the datum mark for A & B transducers.

a) Measure from this datum, distance 'X', marking the rail top.

b) Then distance 'Y' and again mark the rail top. Marks first made on the transducers, in 2.3, should align to the marks on the rail top - distance 'X' & 'Y'.

c) Adjust transducers to confirm alignment.

d) If unable to align, inform SM (S).

2.7 Check the alignment for 'C' Transducer. If unable to align, inform SM (S).

2.8 Check that the scanner mounting metal base plate is level by using a spirit level.

a) View the mirror through the hole in the target plate.

b) Check that the red spot appears within the black circle. Section 4 lists actions to be taken if the red spot is outside the black circle.

c) Report as corrective maintenance if any of these actions fail to solve the problem.

2.9 Remove alignment jig & target mirror and refit the lens cover and scanner housing.

2.10 Repeat as per 2.2 to 2.9. for the second scanner (rail top marking only required for the transducer rail).

2.11 Check external anti-vibration mounts are not excessively loose. Visually check, where possible, for deterioration.

2.12 Restore the power to the equipment as per notes in the general section of each equipment type or reconnect the system to the Signal Box.

Remember to allow the system to stabilise after being powered down as per the notes in the general section of each equipment type before handing back to the Signaller.

3. Suggested action to be taken if alignment is incorrect for ballast mounted scanners

This is a list of suggested actions to be taken to correct alignment; they are not mandated actions to be taken in all cases.

3.1 Check the scanner unit mounting base/plates are not obstructed by ballast or other objects preventing adjustment.

3.2 Check that the scanners are still aligned to each other if any additional adjustment is carried out i.e. A combination of adjusting the scanner metal base plate up or down, in or out to the rail, along with the bolometer mounting base, should enable compliance with 1.2.

After adjustment, check that the metal base plate is level by using a spirit level.

3.3 Check the scanner unit mounting base/plates have adjustment available.

Inform your SM(S) if no adjustment available to comply with 1.9.

3.4 Check for damage to the scanner metal base plate i.e. bent, mis-shaped.

Usually after being driven over by RRVs or hit by Tamper's.

Inform your SM(S) if plate is damaged.

3.5 Check for damage to the metal base plate mountings.

Inform your SM(S) if mountings are damaged and or preventing compliance with 1.9.

3.6 Check bolometer anti-vibration mounts are not deteriorated or have been damaged. Replace if necessary.

3.7 Check alignment bar is in correct position i.e. middle of bar aligns with the Z distance (Appendix B) rail top mark.

a) Check fixture post set to correct setting.

b) Check the alignment bar is flush/pushed down onto the rail top.

Alignment checks should be combined with an onsite 'system check'. Other than 'fault conditions' or equipment replacement after track work, is usually undertaken every 12 months'.

4. Suggested action to be taken if alignment is incorrect for rail mounted scanners

4.1 Check the scanner is secure and correctly fitted. Loose fixing bolts or dirt/debris behind the clamps.

4.2 Check that the scanner and is not damaged (e.g. hit by an object hanging from a train). Correctly secure or replace as necessary.

4.3 Check that the correct alignment can be obtained within the tolerances given in Appendix B.

4.4 Check that the railhead does not have a layer of swarf/rust or has burrs. Clean or Rectify as required.

4.5 Check that the scanner mountings are not deteriorated, replace if necessary.

4.6 Check that the internal anti-vibration mounts are not deteriorated or have been damaged. Replace if necessary.

4.7 Check if provided, the scanner cant clamp nut (or cant cam).

On 113lb flat bottom vertically inclined rail this should be at the lowest number, positioned at the top.

If the fixture bar measurements cannot be obtained (with cant nuts correct) and no spare scanner is available, additional special packing pieces (fit between the anti-vibration pads and scanner body) are available to adjust scanner alignment, if required.

Advise your SM(s) if packings are required.

Note that this may have been adjusted previously to obtain correct alignment.

4.8 If none of the previous steps solve the problem, replace the scanner with a known 'good' unit and recheck the alignment.

APPENDIX A - Equipment Positions

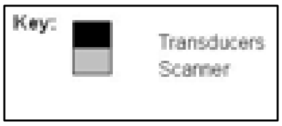


Figure 1 - Positioning of transducers and scanner (not to scale)

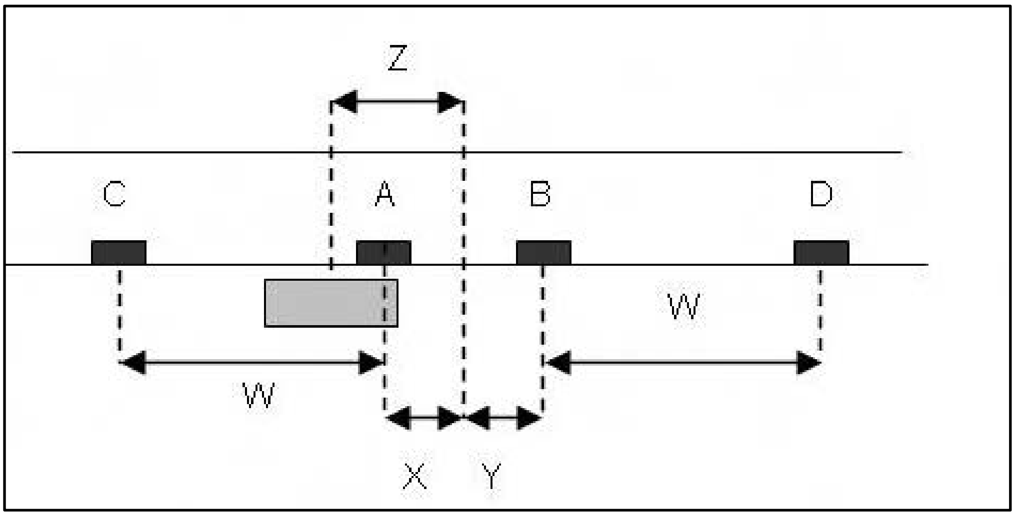


Figure 2 – Servo Safe Series

NOTE: *The Servosafe diagram shows rail mounted scanners*

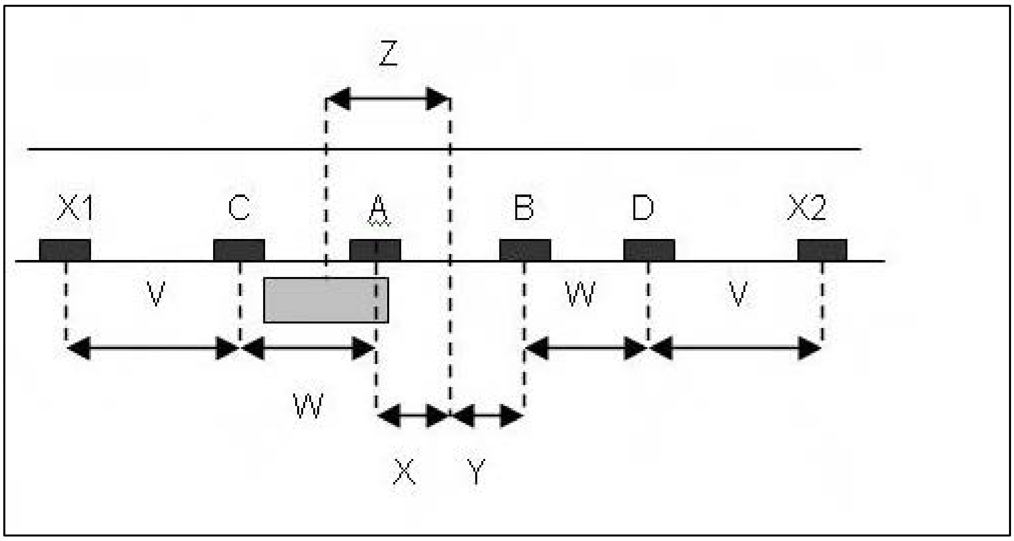


Figure 3 – Servotrim Series

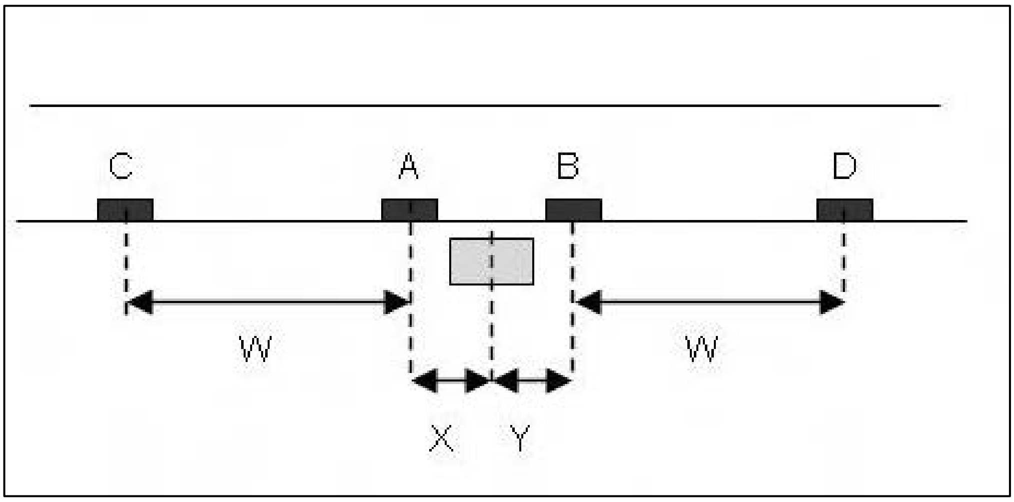


Figure 4 – Trim II Series

APPENDIX B - Setting Tables

Equip. Type	Distance (Inches)				
	W	X	Y	X+Y	Z
7788	433 ±6	10	10	20	35¾
7788R	433 ±6	12	12	24	19½
7789	433 ±6	10	10	20	35¾
8889	433 ±6	12	12	24	19⅓
8889R	433 ±6	12	12	24	20⅔
9909	864 ±6	13½	13½	27	20⅔
Trim II	480 ±6	13½	13½	27	0

Table 1 – Distance Setting Table

NOTE: *Distant Z can vary on older systems, it is important that the scanners are aligned to each other. See the general section.*

Distance Z is between the centre points of X/Y and the centre of the scanner mirror/aperture.

Distance 'V' (X1/2 to C/D transducers) is applicable only to the Servotrim 9909 series (transducers X1/2 are on this system only) and is a distance of 500 feet (±10 inches).

Distances V, W, X and Y are between the magnetic centres not the physical centres

Equipment Type	Fixture Bar Setting (inches)
7788 and 7789 rail mounted scanners	14.5
7788 ballast mounted scanners	13.5
7788R	6.75 (+¼ / - ½)
8889	13.125
8889R	6.75 (+¼ / - ½)
9909	6.75 (+¼ / - ½)

Table 2 – Fixture Bar Setting Table

APPENDIX C - Scanner Alignment

NOTE: *The diagrams shows rail mounted scanners:*

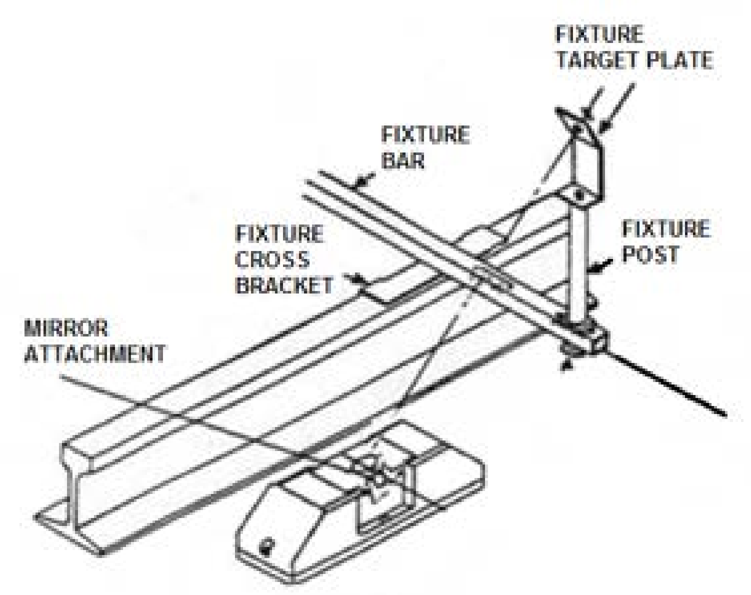


Figure 5 – Scanner Alignment

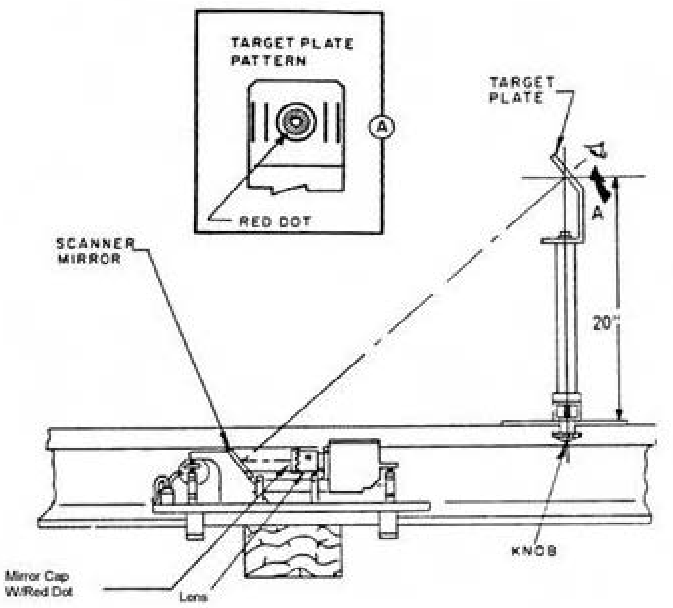


Figure 6 – Scanner Alignment 2

END

Advise the Signaller a functions test is to be performed on the system.

1. Test HOAL

1.1 Set the heat source to 110C + Nom Temp (i.e. 10 degrees higher than the alarm threshold).

Warning: Do not touch the black surface of the heat source.

1.2 Place the heat source above the shutter opening with the heated surface pointing to the shutter opening.

1.3 Use the train simulator unit to simulate the passage of a train with speed set to slow and number of axles set to 32.

1.4 Remove the heat source after 7 seconds and await the unit to finish processing the data.

1.5 Use the Terminal / Menu X / B-last trains / X Showax menu to check the charts of each sensor element is displaying the correct temperature.

1.6 Check the data for the last train (i.e. the simulated train) confirming each axle raised an alarm.

1.7 Check with the Signaller that an alarm has been raised for the correct temperature and number of axles.

1.8 Where necessary undertake any corrective action. This may include re-aligning the sensor elements using the alignment matrix (see NR/SMS/PartE/HO11 – HABD Equipment GETS FUES - Appendix B).

2. Test HOAR

2.1 Repeat steps 1.2 to 1.8.

3. Test FBOA

3.1 Set the heat source to 410C + Nom Temp (ie. 10 degrees higher than the alarm threshold).

3.2 Repeat steps 1.2 to 1.8.

END

Includes:	SSI Datalink
Excludes:	All other types of datalink

GENERAL

Records shall be kept for a minimum of five years.

Health Check Tests

Sections 1 and 2 require the use of a datalink analysis device capable of counting blips and incomplete, damaged, or incorrect telegrams on an SSI datalink. Any unit with this functionality can be used, provided that it has been accepted by Network Rail for attachment to SSI datalink test points for the purpose of datalink monitoring.

Accepted datalink analysis devices available at the time of writing are the PTERTS, the SLA. REMIT detect and REMOSdl.

Section 3 requires use of an SSI datalink interrogator and a digital storage oscilloscope. More details on these appear in the 'DLM Tests' text preceding Section 3.

This monitoring equipment shall only be fitted by an 'Instrumentation Engineer' (Oscilloscope) or a 'Special User' (PTERTS, SLA, REMIT and REMOS) who has been trained in its use.

Before fitment, the engineer shall specifically consider power supply arrangements, connections to the datalinks and any address changing necessary.

In electrified areas, the following tests shall be carried out while a representative electric service is being run (or at least two electric trains shall pass through the testing area during the period of testing).

The SLA does blip detection and telegram error detection simultaneously, thus Clauses 2.1 - 2.3 below are not required.

REMITdetect has been specifically designed to cover the maintenance requirements for data links and hence many of the steps herein are automated by the use of this tool.

The SLA also has an internal logging feature which should be enabled during the testing; the internal log should be provided to your SM(S) if either the blip count or telegram error rate is exceeded.

SERVICE B TESTS

1. Blip Detection

1.1 Follow the manufacturer's operating manual to set up the datalink analysis device. The correct power supply connection is required for both PTERTS and the SLA, dependant on the monitoring time.

1.2 For the PTERTS only, set the unit to count blips.

1.3 Observe that the unit is detecting blips (on the PTERTS an LED indication pulses when a blip is encountered, the SLA shows activity on the display screen and blip and other counts at the top) and leave the unit to obtain a representative count.

1.4 Observe that the unit is detecting blips (the LED indication pulses when blips are detected) and leave the unit to obtain a representative count.

On busy lines, an hour during daytime should be adequate; on lightly used lines, a full day is more appropriate.

1.5 Record the times and count obtained.

If the blip count is greater than 5/hr, further investigation shall be undertaken to determine the cause of the level of errors and corrective actions taken.

2. Telegram Error Detection

If using the SLA or other device that automates the telegram selection; proceed to step 2.3 using the data obtained from Section 1.

2.1 Connect a correct power supply to the datalink analysis device. Set the unit to the local datalink address.

2.2 Connect the datalink analysis device input leads to the system test points (usually at the interlocking but can be at any location on the system).

2.3 Observe that the unit is detecting valid telegrams (the LED indication illuminates when valid telegrams are detected) and leave the unit to obtain a representative count.

On busy lines an hour during daytime should be adequate; on lightly used lines a full day is more appropriate.

2.4 Record the times and count obtained.

A desirable error rate is 0 in a 24-hour period. If the rate is greater than 120 in a 24-hour period, further investigation shall be carried out to explain the rate and remedial action carried out as necessary.

NOTE: *That where separate counts are provided for coding, parity, and corruption errors; check that the test for desirable error rate is carried out using the total telegram error rate.*

3. DLM Baseband Datalink Tests

The following tests are to find damage within the DLMs.

The transmitted signals can appear as asymmetric or a higher output than normal.

In addition, damage to the lines can show as an abnormal attenuation.

Since a ‘back-to- back’ repeater site can correct any asymmetry and amplitude problems during re-transmission (as can an LDT in the line) it is necessary to test each baseband section of the datalink between repeaters or LDTs separately.

The datalink schematic can be used to decide on a suitable base site for each baseband section (the interlocking should be one site as it does not involve LDTs).

The chosen sites should be used for all subsequent testing as this maintains a useful reference for the readings.

The SSI datalink interrogator and a digital storage or other suitable automated test equipment should be used for the tests.

Where the datalink interrogator method is used this shall be configured to trigger the oscilloscope at the correct time and the equipment shall be connected as per Appendix A.

Refer to the manufacturer’s instructions for connection of other automated test equipment.

The planning shall specifically consider the power supply arrangements, earthing and where to connect the datalinks before starting work.

3.1 Select the base site on a metallic link, connect the test equipment in a relevant manner for the equipment being used.

Where applicable for the test equipment, set the interrogator for interlocking (outgoing) telegrams and monitor the address for the base site.

3.2 Measure the amplitude of the telegram transmission or select the relevant test from an automated test tool such as REMOSdl.

While the system can operate with a waveform between 0.5v and 6 v peak to peak readings below 1v and above 5v peak to peak shall be highlighted for further investigation.

3.3 Measure the symmetry of the telegram transmissions. Check they are not distorted.

NOTE: *Up to 50mV peak asymmetry is acceptable.*

Where asymmetric telegrams are found, the DLM associated with this telegram shall be changed.

3.4 Measure the telegram transmissions for pronounced overshoot in the offset waveform after the last edge of the transmission.

- Up to 150mV peak is acceptable.

3.5 Check that there is no line noise between telegrams

- Up to 100mV peak to peak is acceptable.

3.6 Check that the telegram amplitude does not vary within each message.

- Up to 10% of the peak amplitude is acceptable.

3.7 Repeat 3.1 to 3.4 for every DLM on the baseband link (this can be done automatically when using a tool such as REMOSdl, (Appendix B).

As well as review of the reply telegram amplitude against the expected norm for a data link of the relevant length, the readings shall be reviewed against previous actual measurements for the data link concerned. Any discrepancy with either review shall be recorded and investigated further.

3.8 For each section of baseband data link bounded by a DLIT or Back to Back repeater, carry out the Non-Intrusive Earth Leakage Test detailed in section 11.5.4 of NR/GN/SIG/19054-11.

For any cable section where this test method indicates a reading below 10Mohm, further investigation is required to find the cause.

There are many reasons for poor earth readings which include cable damage and surge protection failure. Carry out necessary checks on relevant items and repair or replace as required to achieve a reading of >10Mohm.

3.9 Where readings remain above 10Mohm, the latest measurements shall be compared with previous test results to determine the rate of degradation.

If any increase or sudden change is identified, further investigation shall be planned to address the situation, before the readings fall to levels which might affect stability.

4. LDT Tests

Testing on a system with LDTs is carried out in a manner very similar to baseband links.

4.1 The base site shall be after the LDT link on the metallic section of the system which normally rules out the signal box as the base site.

4.2 It shall be remembered that on systems using LDTs replies are returned to the interlocking in the reply period of the minor cycle subsequent to that in which the initiating outgoing telegram was sent.

4.3 LDTs are treated as for back-to-back repeaters and a single address of a TFM beyond an LDT shall be included in the list compiled from the datalink schematic.

4.4 The same procedure detailed in Section 3 ‘DLM Baseband Datalink Tests’ shall be used for testing a system with LDTs, taking into account the comments in this section.

APPENDIX A - SSI BASEBAND DATALINK TESTING INSTRUMENTATION SET UP

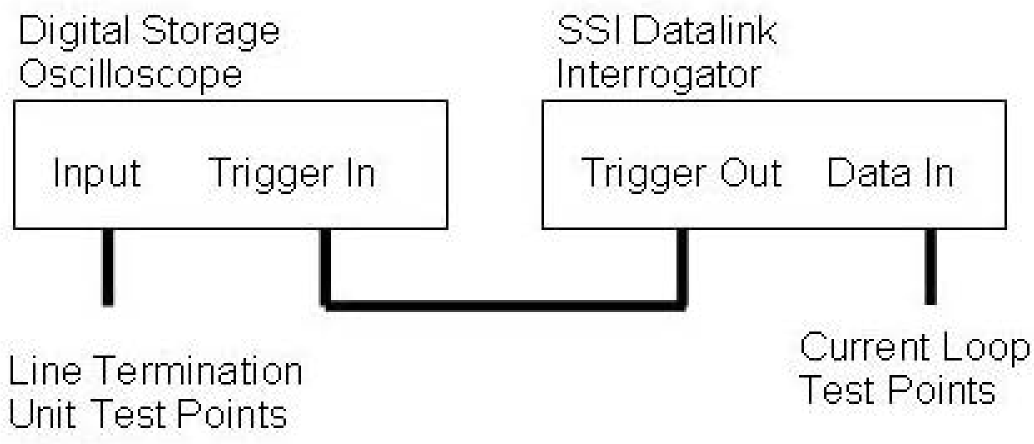


Figure 1 – SSI Baseband Datalink Testing Instrumentation Set Up

APPENDIX B - DLM Baseband Datalink Testing

When an automated test tool is not available, it is required to repeat the test in Section 3 to monitor and record in turn every DLM on the baseband link and hence the requirements of this appendix apply.

1. The datalink schematic should be consulted to produce a list of DLM and TFM addresses. The rules of compiling this list are as follows:

   a) Review the datalink schematic to identify each dlm and then choose one tfm address serviced by it (some dlms service more than one tfm, it is only necessary to see replies from one of those tfms).

   b) If the base site is not the signal box or the origin of the datalink it is necessary to see a reply from a tfm at the base site. This should be added to the list.

   c) Where back-to-back repeaters are provided, it is necessary (to prove the operation of the repeater dlm itself) to select a single address somewhere in the section beyond the repeater. This should be added to the list.

   d) Work through the list setting the datalink interrogator for trackside (incoming) telegrams and its address to each of the tfms on the list taking measurements in turn.

   e) Review the results for the datalink, there should be a gradual decline in the signal levels in line with the distance away from the transmitting tfm. Any measurements outside the specified limits require remedial action.

END

Includes:	GEC Over-Ride System
Excludes:	All other Ove-Ride Systems

General

This test makes sure that the remote control 'over-ride' system works when it is required to.

Because it affects the available signalling routes, you shall make arrangements with the signaller before attempting this test.

The signaller is responsible for the safety of trains and shall give you permission to start.

1. Over-Ride Test

1.1 Check that the remote control normal white indication is showing on the control panel.

1.2 When the signaller gives you permission to do so, turn the emergency route setting switch from 'Normal Working' to 'Auto-Working'.

1.3 Check that:

a) The system sets the defined routes.

b) The routes are correctly indicated, and

c) The signals are shown to clear on the signal box panel.

1.4 Turn the emergency route setting switch from 'Auto- Working' to 'Signals On'.

1.5 Check that:

a) All controlled signals return to danger.

b) The signals are correctly indicated on the signal box panel.

1.6 If facilities are provided for selective defined routes, repeat 1.2 to 1.5 for each set of routes.

1.7 Turn the emergency route setting switch to 'Normal Working'.

1.8 With the signaller's permission, set the defined routes on the panel buttons.

1.9 Turn the emergency route setting switch to 'Auto- Working' and Check that the aspects do not drop back by watching the indications on the signal box panel.

1.10 If facilities are provided for selective defined routes, repeat 1.7 – 1.8 for each set of routes.

1.11 Turn the emergency route setting switch to ‘Normal Working’ and Check the remote control normal indication is showing.

1.12 Check that routes can be set and cancelled via the normal method of remote control.

End

Includes:	BR Electronic Route Selection Equipment (ERSE) Mk2A and 2B
Excludes:	BR Electronic Route Selection Equipment (ERSE) Mk1

General

Due to operating conditions, not all of these tests may be possible to achieve.

Testing shall be carried out of those allowed by the Signaller with the others noted for testing at a low traffic period or when under a system possession.

1. Signal Box

1.1 Observe that the ERSE alarm indication on the Signaller's panel is extinguished.

Ask the Signaller if they are aware of any faults on the system.

1.2 Press and release an entrance button and observe that the button indication flashes.

Pull and release the button and observe that the button indication extinguishes.

Repeat for all entrance buttons.

1.3 Press and release an entrance button then press and hold a valid exit button for the entrance selected.

Check that after 5 to 30 seconds an audible alarm sounds with a visual indication. Operate the 'Alarm Acknowledge' button or switch and check that the alarm is silenced.

Release the exit button and cancel the route.

1.4 Repeat 1.3 but do not operate the 'Alarm Acknowledge' button or switch.

Release the exit button and check that the alarm cancels 1 second after the button is released.

Cancel the route.

1.5 Operate the Signaller's ERSE by-pass control and check that routes can still be set.

When in ERSE by-pass mode the points in the route must be operated manually via the point keys to the required position before pressing the entrance button only.

Extreme caution shall be observed that all the points in the route are set correctly, the route entrance signal shall clear when the entrance button is pressed irrespective of the lie of the points when in ERSE by-pass.

2. Equipment Room

2.1 Observe the LED and lamp indications on cards and power supply units in the equipment cubicle, check they indicate as follows:

Item	Colour	State
Monitor Units 2/2 or 2/3	Green	Illuminated
	Red TL	Illuminate only during route setting
	Red RP	
Route Cards	Red L1	Illuminate only during route setting
	Red L2	
	Red L3	
	Green L4	Illuminated
	Red L5#	Illuminated only when route is available
Input Cards	Green	Illuminated
PSUs	Red 110V	Illuminated
	Green 15V	

Table 1 - Indications

#: L5 LED is not provided on early versions of route cards.

2.2 Measure using a meter or oscilloscope the following DC output voltages and AC ripple from each power supply:

Supply	Limits	Ripple
15V	14.4V to 15.6V	<15mV
24V	24V to 30V	<3V

Table 2 - Output Voltages

3. Monitor Unit

3.1 On each monitor unit (2/2 or 2/3) press the test reset button.

This will apply a reset to all the route cards.

3.2 Connect a meter between the 0V and TL/RP test points in turn. Check that the following voltages are obtained:

Operation	Test Point	Voltage
Push Button Ring Free	TL	12V to 15V
	RP	
Push Button Ring In Use	TL	0V
	RP	

Table 3 - Test Point Voltages

4. Power Supplies

4.1 Switch all 15V PSUs off line. Observe that all the indication LEDs on the monitor, route and input cards are extinguished.

4.2 Switch off the 110V supplies. Remove the 15V PSUs from their housing. Visually check the electrolytic capacitors for any signs of leakage, swelling or general deterioration. If any is found, renew the PSU.

Electrolyte from capacitors is hazardous to heath, PPE (e.g. gloves) shall be worn when handing leaking capacitors.

4.3 Visually check the buffer relay 24V PSU electrolytic capacitors as in 4.2.

4.4 Replace the PSU's into their housing and restore the 110V AC supply.

Switch the PSUs on line and check that all alarms and indications normalise.

Measure the PSU outputs as listed in 2.2.

4.5 Check with the Signaller that route setting is working to their satisfaction.

END

1. Physical Checks

1.1 Check that markers are in place at 90%, 75%, and 50% of the approach length.

2. Detection Linearity Check and Lumped Impedance Adjustment

When carrying out this test, RX should only be expected to change when the termination shunts in use at the crossing are either narrow band shunts (NBS) or frequency selectable shunts (FSS).

No change in RX shunt shall be seen in cases where wide band shunts (WBS) are in use.

If such a change is noted, inform your SM(S) as it may indicate that the WBS in question is faulty.

Where narrow band compensation is in use, disable this for the duration of this test and re-enabled it once the test is complete.

Detection Linearity Check

2.1 With a clear track, set the RX to 100.

2.2 Connect a hard wire shunt at the HXP-3's approach termination and note the RX value; this should reduce to between 85 and 100.

2.3 If RX does not change, or increases with the shunt connection at the termination, move the hard wire shunt to 10% of the approach length inside the termination. RX should now be between 88 and 92.

2.4 Calculate what the expected RX should be at the 50% point. This is half of the RX value in step 2.3.

2.5 Move the hard wire shunt to 50% of the approach length and note the RX value again. If this figure for RX is more than 2 units away from the calculated figure, adjustment is required as described overleaf.

Lumped Impedance Adjustment

2.6 With the shunt at the 50% of the approach, advance to the LIA section of the IDK display by pressing the ADJUST SEL key until the present value for LIA begins to flash. On the "ADJUST" screen.

2.7 Press the ENTER button once so that the LIA prompt begins to flash and the value stops flashing.

2.8 While viewing the RX on the display, press the 2 (up arrow) button to count up, or the 3 (down arrow) button to count down until RX reads within 2 units of the calculated RX derived in step 1.5.

2.9 Press and hold the ENTER button until the LIA stops flashing.

2.10 Remove the test shunt at the 50% point.

2.11 For bi-directional HXP-3s, repeat this process for the opposite approach. When carrying out step 1.8, only make an adjustment when the RX is above the value calculated in step 2.5. Do not raise RX if the value is lower than that calculated for the second approach.

2.12 Repeat steps 2.1 to 2.11 for track 2 where present.

3. Island Check

3.1 Place a hard wire shunt on track 1 somewhere within the island.

3.2 Check that the island relay drive is de-energised and the (red) LOW LED located on the RSI module is on.

3.3 Move the shunt 5m outside the island and check that the (green) HIGH LED is on.

3.4 Check the island relay drive is energised. Remove the shunt.

3.5 If the island does not check out correctly, perform the island adjustment procedure.

END

1. Voltage Test

To check that accurate results are obtained, the following tasks shall always be carried out in the order that they appear in this document.

1.1. Measure and record the battery voltage on the +5V DC Power Supply Module at the + and – terminals of TB1.

If the result obtained is not between 4.5V – 5.5V DC, adjust the 12 volt feed by varying potentiometer R16.

In the event that is unsuccessful, inform your SM(S) such that arrangements can be made for the 5V DC Power Supply Module to be replaced.

1.2. Measure and record the output of the +5V DC Power Supply Module across TPI and TP2 of the Module.

1.3. Measure and record the voltage across TP1 and TP2 on the VLP module, which should be between 4.95V and 5.05V DC.

If the result obtained in task 1.3 is within the specified parameters, subtract the value obtained in task 1.2 from the value obtained in task 1.3 and record this on the record card before moving to clause 1.5.

If the result obtained in task 1.3 is not within the specified parameters, adjust the +5V DC Power Supply Module output voltage.

In the event that this is unsuccessful inform your SM(S) such that arrangements can be made for the +5V DC Power Supply Module to be replaced.

1.4. Operate the Power Supply Switch S1, located on the +5Vdc Power Supply Module, to the “OFF” position.

Measure and record and record the Lithium Battery voltage across TP1 and TP2 on the ACP Module and verify that this is between 3.25V and 3.75 V DC.

Operate the Power Switch S1, located on the +5V DC Power Supply Module, to the “ON” position.

If the result obtained is not within the specified parameters, inform your SM(S) such that arrangements can be made for the ACP module to be replaced.

For Interlocking only

1.5. On the NVIO module measure and record the following voltages:

a) Between TP1 and Com (10 to 38V)

b) Between TP2 and Com (10 to 38V)

END

Caution: where the records show that linearisation adjustment has been previously required, linearisation shall always be performed following calibration.

Calibration and Linearisation

Before proceeding with calibration, check the following:

a) All track bonding is good, and all termination shunts, insulated joint couplers, and track isolation devices (battery chokes etc) are installed in accordance with the design.

b) Due note is taken of the ballast conditions. If the level crossing predictor is calibrated under poor ballast conditions, it may require recalibration when the ballast conditions improve.

c) Enhanced detection is switched off.

d) There are no trains on the approach.

Calibration is required when:

a) Application programming is changed *

b) Modules are changed *

c) There are changes to the track infrastructure

* These tasks should be performed by technical support personnel following application programming change.

Calibration and linearisation should be performed as required by Table 1 in Appendix A.

All keys to be pressed during calibration and linearisation are on the level crossing predictor keypad (LCPK). All references to displays refer to the level crossing predictor display (LCPD).

1. Physical Checks

1.1 Check that markers are in place at 70% and 50% of the approach measured from the crossing.

2. Calibration

2.1 Check in the design details if enhanced detection (ED) is switched on. If ED is not switched on, proceed to Step 2.7

2.2 Press the TRACK 1 key.

2.3 Press the FUNCTION key.

2.4 Press the DOWN ARROW key until 'ENHANCED DETECTION' appears for the appropriate track.

2.5 Press the NEW DATA key.

2.6 Observe that 'ENHANCED DETECTION: OFF' is displayed for the appropriate track.

2.7 Press and hold the SETUP key.

2.8 Observe that 'SETUP T1 for Calibration is displayed.

2.9 Release the SETUP key.

2.10 Press the ENTER key.

2.11 Observe that 'SETUP T1 IN PROGRESS' is displayed.

2.12 After approximately 60 seconds Observe that 'SETUP T1 COMPLETE' is displayed.

2.13 Observe that calibrated values of EZ and EX are displayed.

2.14 Record the values of EZ and EX on the record card.

2.15 If the value of EX is 40 or lower, or the value of EZ is 115 or higher, inform your SM(S) immediately.

2.16 Measure and record the voltage between the Z1 and COM terminals on the appropriate 80012 track transceiver module.

2.17 Measure and record the voltage between the Z2 and COM terminals on the appropriate 80012 track transceiver module.

2.18 If the value of Z1 – COM or Z2 – COM is outside the range 7.5V to 10.0V DC, or the difference between the two values is greater than 0.5V DC, inform your SM(S) immediately.

2.19 Where Track 2 is present, repeat Steps 2.1 to 2.18 for Track 2.

2.20 If Linearisation is not required for either track, proceed to section 4.

3. Linearisation

Perform this section for each track that requires Linearisation.

3.1 Press the TRACK 1 key.

3.2 Press the SETUP key for approximately 3 seconds and then release.

3.3 Repeatedly press the DOWN ARROW key until 'SETUP T1 FOR LINEARISATION' is displayed.

3.4 Press the ENTER key.

3.5 Observe that 'LINEARISATION T1 VALUE:?? EZ:??' is displayed.

3.6 Press the NEW DATA key.

3.7 Press the UP ARROW key or the DOWN ARROW key until 'LINEARISATION T1 VALUE:+0 EZ:??' is displayed.

3.8 Press the ENTER key.

3.9 Place a short circuit across the termination shunt on the normal approach.

3.10 Observe and record the EZ value.

3.11 Calculate and record what the expected EZ should be at the 50% point. This is half of the EZ value in step 3.10.

3.12 Move the short circuit to the marker at 50% of the approach length and record.

3.13 If the level crossing predictor is configured as a unidirectional (or simulated bidirectional) crossing (see the design details) proceed to step 3.18.

3.14 Place a short circuit across the termination shunt on the other approach.

3.15 Observe and record the EZ value.

3.16 Calculate and record what the expected EZ should be at the 50% point. This is half of the EZ value in step 3.15.

3.17 Move the short circuit to 50% of the approach length and record the EZ value.

3.18 Press the SETUP key for approximately 3 seconds and then release.

3.19 Repeatedly press the DOWN ARROW key until 'SETUP T1 FOR APPROACH LENGTH`' is displayed.

3.20 Press the ENTER key.

3.21 Observe that 'TERMINATE T1 APPROACH EZ:??' is displayed.

3.22 Press the NEW DATA key.

3.23 If there is no simulated track inductor on the crossing, enter the smallest EZ number recorded in Steps 3.10 and 3.15. Otherwise enter the EZ value from the approach without the simulated track inductor.

3.24 Press the ENTER key.

3.25 Observe that the display alternates between 'PROGRAM T1 APPROACH: ????' and 'PROGRAM T1 COMPUTED: ????'.

3.26 Record the values computed.

3.27 Note the highest 'NO LINEARISATION' EZ value recorded at the 50% points in Steps 3.12 and 3.17.

3.28 Note the Calculated EZ/2 value for the appropriate approach recorded in Step 2.31 or 2.36.

3.29 Compare the value noted in Step 3.7 with the value noted in Step 3.28. If the two values are within +/- 1 of each other, proceed to section 4.

3.30 Subtract the value noted in Step 3.27 from the value obtained in Step 3.28. Multiply this value by 2. If the value is greater than +/-25 inform your SM(S) immediately.

3.31 Press the SETUP key for approximately 3 seconds and then release.

3.32 Repeatedly press the DOWN ARROW key until 'SETUP T1 FOR LINEARISATION' is displayed.

3.33 Press the ENTER key.

3.34 Observe that 'LINEARISATION T1 VALUE:?? EZ:??' is displayed.

3.35 Press the NEW DATA key.

3.36 Press the UP ARROW key or the DOWN ARROW key until the displayed 'LINEARISATION T1 VALUE:?? EZ:??' value matches the amount noted in Step 3.30 (taking note of the sign of the number).

3.37 Press the ENTER key.

4. Completion

4.1 Check in the design details if enhanced detection (ED) should be switched on. If ED is not required, proceed to Step 4.7.

4.2 Press the TRACK 1 key.

4.3 Press the FUNCTION key.

4.4 Press the DOWN ARROW key until 'ENHANCED DETECTION' appears for the appropriate track.

4.5 Press the NEW DATA key.

4.6 Observe that 'ENHANCED DETECTION: ON' is displayed for the appropriate track.

4.7 Repeat as necessary for the second track.

5. Island Calibration

5.1 Check that the frequency select jumper on the 80211 island module is set in accordance with the wiring details.

5.2 Place a short circuit between the rails at the distance beyond the receiver rail connections specified for the corresponding island frequency in Table 2 in Appendix B.

5.3 Press and hold the island module 'Calibration Select' push button for 2 seconds until 'REL' appears on the module display.

5.4 Release the push button and then press and release it again within 2 seconds.

5.5 Observe that the module display shows 'CAL*'.

5.6 After approximately 6 seconds, observe that the display momentarily shows 'DONE'.

5.7 Observe that the display shows 'BOOT' for approximately 9 seconds.

5.8 Observe that the display alternates between the software version and the pickup delay setting.

5.9 If ‘FAIL’ appears in the display, turn the Island module power off and then on again, and repeat Steps 5.3 to 5.9 again. If ‘FAIL’ appears again, the Island module is faulty.

5.10 Once calibration is complete, check that:

a) The displayed frequency matches the design details.

b) The pickup delay setting matches the design details.

c) The island STATUS indicator on the front panel of the level crossing predictor is extinguished.

d) The island relay drive voltage is 0v DC measured across the island relay terminals on the front of the level crossing predictor.

5.11 Remove the short circuit installed in Step 5.2 and then Check that:

a) The Island STATUS indicator on the front panel of the level crossing predictor is illuminated.

b) The island relay drive voltage is greater than 10V DC measured across the island relay terminals on the front of the level crossing predictor.

5.12 Place a 0.5ohm shunt across the rails between the Island Transmit wires.

5.13 Check that the island relay drive is de-energised, the island STATUS indicator on the front panel of the level crossing predictor is extinguished, and the crossing warning sequence is activated.

5.14 Remove the shunt and wait until the crossing warning sequence is reset.

5.15 Place a 0.5ohm shunt across the rails between the island receive wires.

5.16 Check that the island relay drive is de-energised, the island STATUS indicator on the front panel of the level crossing predictor is extinguished, and the crossing warning sequence is activated.

5.17 Remove the shunt.

5.18 Repeat Steps 5.1 to 5.17 for Track 2 where present.

APPENDIX A - Requirement for Calibration and Linearisation

Program Change	Calibration	Linearisation
Increased number of tracks from 1 to 2	Track 2 Only	Track 2 Only
LCP Frequency	Both Tracks	Both Tracks
Unidirectional to Bidirectional Or Bidirectional to Unidirectional	Changed Track Only	Changed Track Only
Transmit Level Changed from: Medium to Maximum Or Maximum to Medium	Changed Track Only	Not Required
Approach Length	Changed Track Only	Changed Track Only
Ballast Compensation Value	Changed Track Only	Not Required

Table 1 - Requirement for Calibration and Linearisation

NOTE: *In the test all actions are written as applicable to Track 1. Where Steps are to be repeated for Track 2, any displayed messages referring to either 'TRACK 1' or 'T1' can be taken to refer to 'TRACK 2' or 'T2' as appropriate.*

Values shown as '??' depend on the installation.

APPENDIX B - Island Frequency and Shunt Distance

Island Frequency (kHz)	Shunt Distance (Feet/Meters)
2.14	84 (25.6m)
2.63	72 (22m)
3.24	55 (16.8m)
4.0	45 (13.7m)
4.9	39 (11.9m)
5.9	32 (9.8m)
7.1	29 (8.8m)
8.3	25 (7.6m)
10.0	22 (6.7m)
11.5	20 (6.1m)
13.2	17 (5.2m)
15.2	15 (4.6m)
17.5	14 (4.3m)
20.2	14 (4.3m)

Table 2 - Island Frequency and Shunt Distance

END

This test checks that both processor modules (PM) are capable of output and input to/from lineside equipment. Hot standby PMs are installed in modular equipment housings (MEH) or object controllers (OC). Refer to installation documentation to ascertain the provision of these facilities.

The test might affect all outputs and inputs to the PMs, therefore protection should be applied to the working railway in liaison with the Signaller and in accordance with technical instructions.

It is also essential that the Technician's facility monitoring the PMs should be manned for the duration of the test.

1. Installations with hot-standby PMs

Where installations have hot-standby PMs, check the changeover facility as follows:

1.1 Obtain a list of faults from the TF(L) or TF(R).

1.2 Check the standby OK LED is illuminated green.

1.3 Press the red changeover button on the front of the active PM to force a changeover.

1.4 Check the standby OK LED on both PMs show red briefly. The Active LED on the deactivated PM is extinguished and the Active LED on the activated PM is lit.

1.5 Check the activated PM is error free and has not created new faults by relisting and comparing the new fault list with the list generated in 1.1.

1.6 Repeat steps 1.2 to 1.5 to check that the changeover works in both directions.

1.7 If the changeover fails in either direction inform your SM(S)

2. Test as part of periodic maintenance

2.1 If this test was carried out as part of periodic maintenance, then repeat steps 1.2. to 1.5 to leave the PM pair on what was the off-line PM.

END

Includes:	Systems fitted with “only” IMC Boards
Excludes:	Systems fitted with “both” IMC & ACB Boards (see SMS/PartB/Test/082)

General

Before work is undertaken that affects the normal operation of the level crossing system, the Signaller shall be informed. Normally a possession of the equipment or a no train period is required.

1. Frauscher RSR123 Wheel Sensor Test (System Adjustment)

1.1 Before starting work, the system shall be powered down by the removal of the main supply fuse in the equipment case.

1.2 Disconnect the wheel sensor cable in the trackside connection box (GAK unit).

1.3 Connect a multimeter set on 0-1V DC to the AMB001 test box socket (See Figure 1). Press the toggle switch on AMB001 to the battery symbol. The multimeter reading shall be > 0.75 V, if not the battery of the test box AMB001 needs replacing.

Figure 1 – AMB001

1.4 Sensor System 1. Connect wire 1 (brown) to the red connector and wire 2 (yellow) to the black connector (See Figure 2). The adjustment procedure starts automatically. After approximately 10 seconds the multimeter shall show a value between 0.49 V and 0.515 V.

Figure 2 – AMB001 Connected

1.5 If the measurements are outside of this range then try re-aligning the head to the centre of the tolerances, reference NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) - Periodic Task 3. If this is unsuccessful then the wheel sensor shall be replaced.

1.6 Within 50 seconds of test step 1.4, place the testing plate PB200 over sensor system 1 (see Figure 3) and check that the multimeter value is between 330mV and 375mV.

Figure 3 - PB200 Over Sys1

1.7 If the measurements are outside of this range then try re-aligning the head to the centre of the tolerances, reference NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) - Periodic Task 3. If this is unsuccessful then the wheel sensor shall be replaced.

1.8 Reconnect the wires to the trackside connection box to wiring diagrams.

1.9 Sensor System 2. Connect wire 3 (green) to the red connector and wire 4 (white) to the black connector. The adjustment procedure starts automatically. After approximately 10 seconds the multimeter shall show a value between 0.49 V and 0.515 V.

1.10 If the measurements are outside of this range then try re-aligning the head to the centre of the tolerances, reference NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) Periodic Task 3. If this is unsuccessful then the wheel sensor shall be replaced.

1.11 Within 50 seconds of test step 1.9, place the testing plate PB200 over sensor system 2 (see Figure 4) and check that the multimeter value is between 330mV and 375mV.

Figure 4 – PB200 Over Sys2

1.12 If the measurements are outside of this range then try re-aligning the head to the centre of the tolerances, reference NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) - Periodic Task 3. If this is unsuccessful then the wheel sensor shall be replaced.

2. System Power Up

2.1 At the equipment case replace the main supply fuse to energise the system.

2.2 Check that the following LED indications are illuminated:

- 24vDC power supply - Green “DC Okay”.
- Buffer Module - Green “Status”.
- Telemetry module - Green “Power”.
- IMC Board – Green “Power” (for both channels, on all boards).

2.3 Observe both on-demand LEDs are illuminated momentarily and then go out.

2.4 The red indication LEDs illuminate, and the auditable warning device sounds for 60 seconds before the LEDs go out, the audible warning is silenced, and the crossing reverts to dark mode.

3. Wheel Sensor Test (Detection Capability)

3.1 Identify the Evaluation Board (IMC) related to the wheel sensor to be tested and check the section is indicating clear. The IMC Board should only have the two green power LEDs lit (Figure 5).

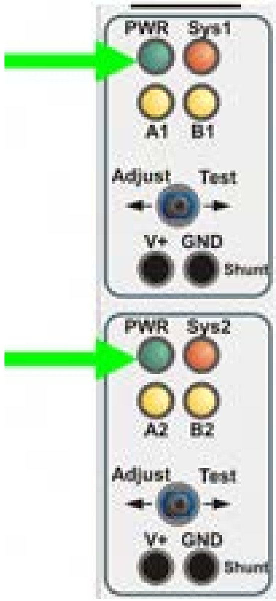


Figure 5 – IMC Board

3.2 Place the PB200 testing plate on the railhead to the left of the axle counter wheel sensor in the start position (Figure 6).

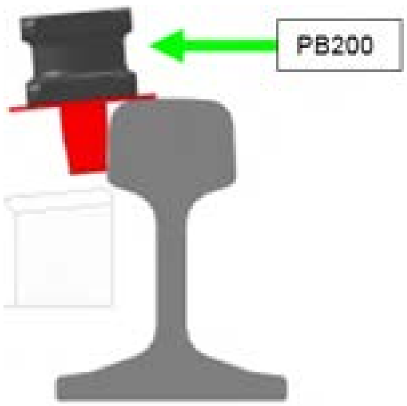


Figure 6 - PB200

3.3 Move (slide) the PB200 slowly in direction of arrow and stop over the first wheel sensor (Figure 7).

In the case of a VAMOS strike-in wheel sensor, Sys1 - Sys2 shall be in the direction of the strike-in.

Figure 7 – PB200 Over Sys1

3.4 Check the LED indications SYS1 and B1 are illuminated (Figure 8).

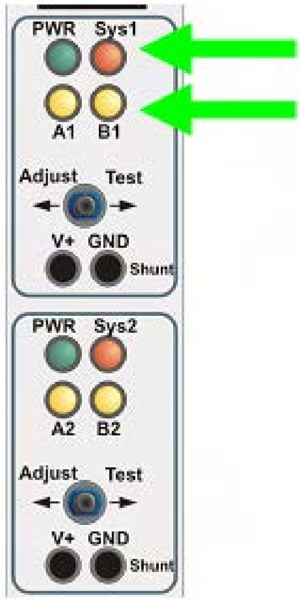


Figure 8 – IMC Board

3.5 Move (slide) the PB200 slowly in direction of arrow and stop at the mid-point between the two wheel sensors systems (Figure 9).

Figure 9 – PB200 over Mid Point

3.6 Check the LED indications SYS1, SYS2 and B1, B2 are illuminated (Figure 10).

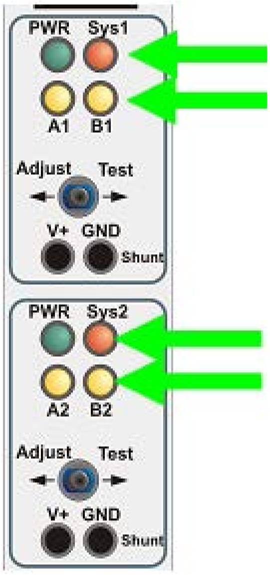


Figure 10 – IMC Board

3.7 Move (slide) the PB200 slowly in direction of arrow and stop over the second wheel sensor (Figure 11).

Figure 11 – PB200 Over Sys2

3.8 Check the LED indications SYS1 and B1 have extinguished and the LED indications SYS2 and B2 remain illuminated (Figure 12).

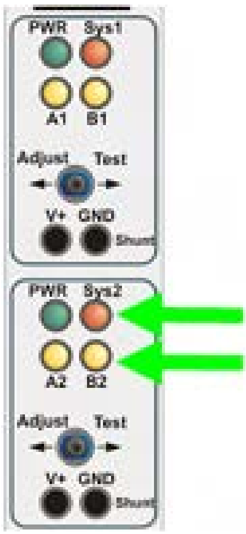


Figure 12 – IMC Board

3.9 At the end of the simulation, when the PB200 testing plate has passed beyond the sensor Check the LED indications SYS2 and B2 have extinguished on the IMC Board leaving the two PWR indications illuminated (Figure 13).

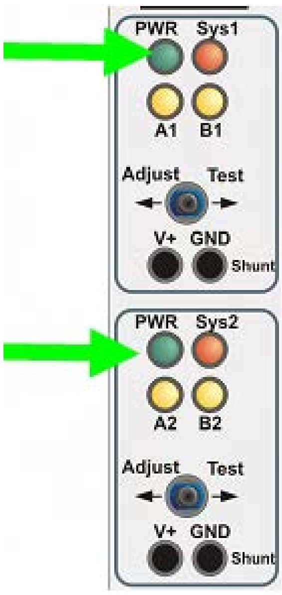


Figure 13 – IMC Board

3.10 There is no requirement to traverse over the wheel sensors in the reverse direction as the occupation times out.

END

Includes:	Vamos Level Crossing System
Excludes:	All other Overlay MSL crossings

GENERAL

The telemetry module has internal storage and writes the data's periodically onto the microSD card. Therefore, it is important to follow this procedure so is not lost.

1. Telemetry Data Logger

1.1 The Vamos System is fitted with a Telemetry Data Logger which both displays and records a number of parameters, making it straight forward to analyse and fault find on the system. (See Figure 1.

The system is fitted with a small screen and navigation buttons, allowing the user to scroll through its 5 screens. Each of the screen is broken into 6 lines each relating to a particular function.

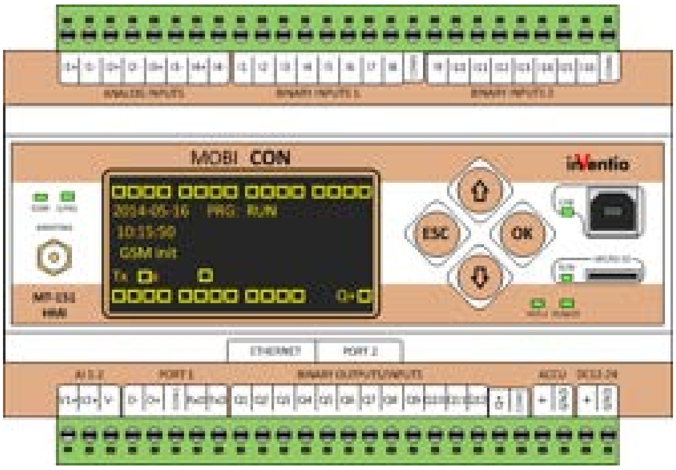


Figure 1 - Telemetry Data Logger

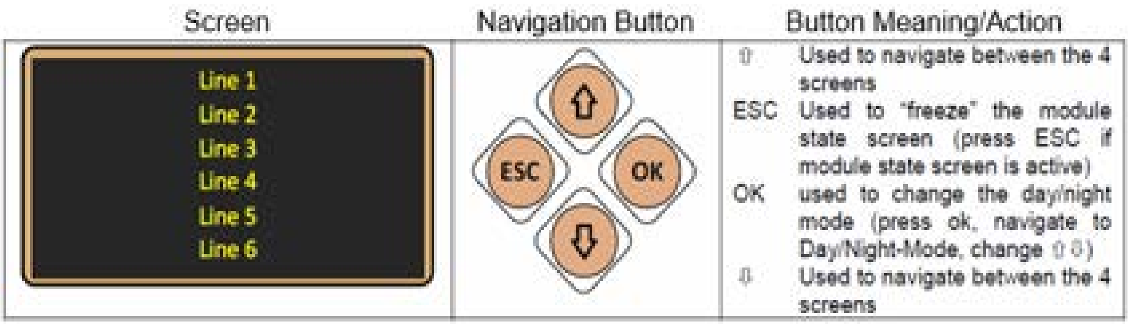


Figure 2 – Navigation Screens

1.2 The five screens are (in order):

a) Module status (Figure 2).

b) System Info.

c) Failure page 1.

d) Failure page 2.

e) Main menu (This is reached via the Module Status screen).

2. Removal of the SD Card

2.1 The main menu is accessed by pressing the “OK” button for 3 seconds when the Module State screen is displayed.

Figure 3 - Module State screen

2.2 By using the up and down arrows move the highlighted bar until “Actions” is highlighted then press the “OK” button. This “Actions” menu allows for the controlled recovery of the data stored on the SD Card.

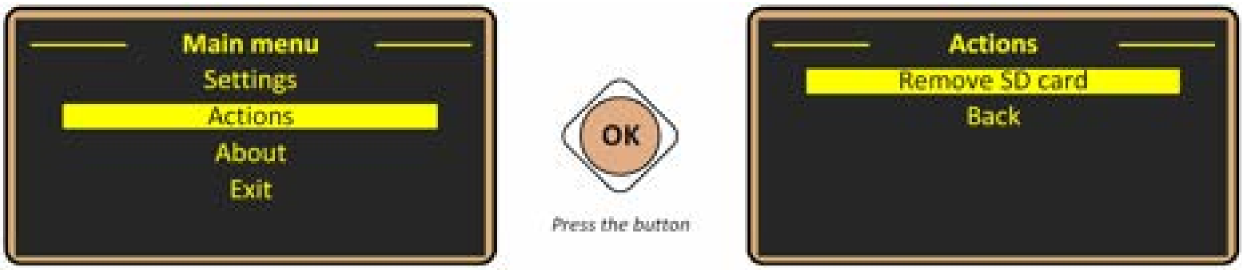


Figure 4 – Main Menu and Actions Screens

2.3 The sequence for the SD Card removal is as follows. Highlight “Remove SD Card” and press “OK”.

If you decide not to remove the card at this point highlight “No” and press “OK” this returns you back to the previous menu.

If you intend the remove the card highlight “Yes” and press “OK” this takes you to a new screen which advises you the data is being written to the SD Card and the green LED marked R/W to the left illuminates during this process.

Figure 5 – SD Card Removal Screens

2.4 Once the data transfer is completed you get a message indicating the card can be removed. Remove the card and store securely. The system continues to record data onto the internal memory.

The SD card needs to be returned to the system within 30 minutes or the data recorded internally is lost. If the card is to be out of the system for longer than 30 minutes a new SD card shall be installed.

Figure 6 – SD Card removal Screen

3. Transferring the Data to a Laptop

3.1 The SD card shall be placed into a micro-SD card adapter

Figure 7 – Micro SD Card and Adapter

3.2 The SD adapter card can now be inserted into a standard Network Rail laptop.

Figure 8 – SD Card Insertion

3.3 Click "open folder to view files using windows explorer", see Figure 9.

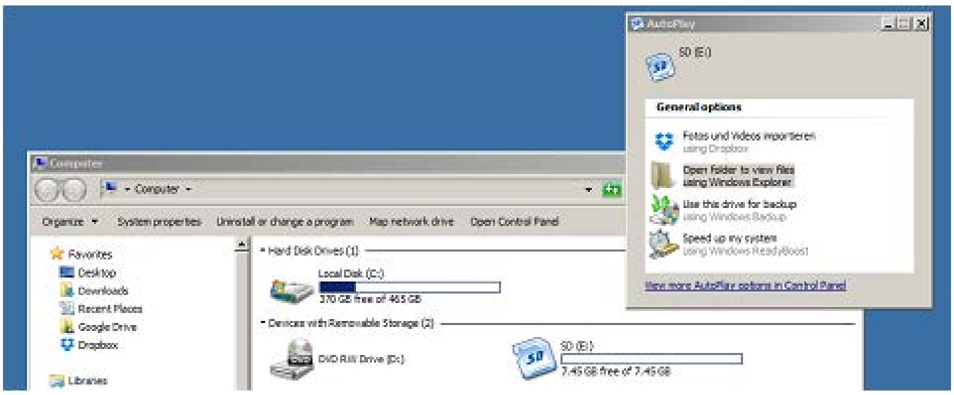


Figure 9 – Windows Explorer View

3.4 With SD card open three folders are displayed. See Figure 10.

3.5 On the laptop create a folder called c:\vamos\backup.

3.6 Copy the Log Converter and LOGFILES folders from the SD Card into the backup folder.

3.7 Safely disconnect and eject the SD card.

3.8 The SD card can now be removed from the SD adaptor and reinserted carefully into the Micro SD card slot of the data-logger. Confirm that the green R/W LED illuminates after you have reinserted the card. It can take up to 2 minutes to recognise the card. The logger can now write to the card again, when the internal memory is full.

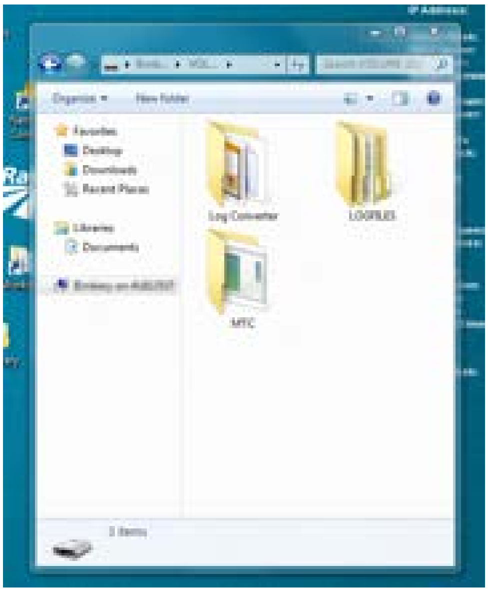


Figure 10 – SD Card Folders

4. Converting the Logger Data.

4.1 Browse to the backup directory and double click the Vamos Logfile Convertor to start it.

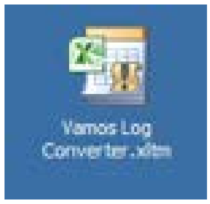


Figure 11 - Vamos Logfile Convertor Icon

4.2 Select "Convert" to convert a logfile.

Figure 12 – Converter Screen

NOTE: *If you select "Help" more information is provided about the convertor and how to use it. The "Admin" button is for people with convertor administrator privileges only.*

4.3 Open the “LOGFILES” folder it contains one file for each day.

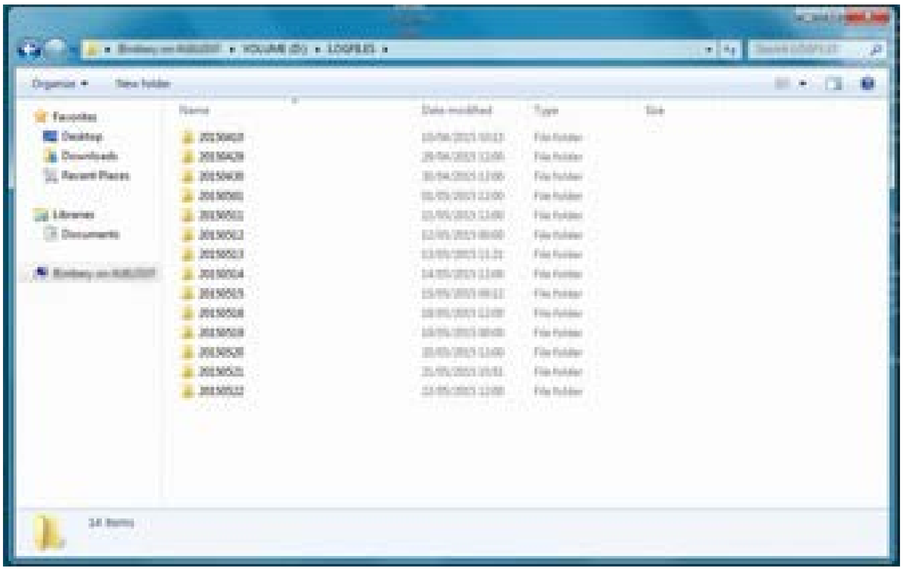


Figure 13 – Log Files Folder

4.4 Double click the file for the day you are interested in.

The file is now converted into a user-friendly spreadsheet, before allowing you to open the file, it shall be saved into the backup folder.

The file appears as shown in Table 1.

Vamos level cross Logfiles:		**Training_unit**		
Date	**Event**	**Time**	**Status**	
12/05/2015	RED aspect FAILURE	12:05:34	ON	
12/05/2015	GREEN aspect FAILURE	12:05:34	OFF	
12/05/2015	Audible Warning FAILURE	12:05:34	OFF	
12/05/2015	System Power	12:05:34	OFF	
12/05/2015	MSL System failure	12:05:34	OFF	
12/05/2015	Track 1 issue	12:05:34	OFF	
12/05/2015	Track 2 issue	12:05:34	OFF	
12/05/2015	OD Parameter fault	12:05:34	OFF	
12/05/2015	Strike-IN Track 1	12:05:34	OFF	
12/05/2015	REVERSE strike-IN Track 1	12:05:34	OFF	
12/05/2015	REVERSE strike-IN Track 2	12:05:34	OFF	
12/05/2015	Strike-IN Track 2	12:05:34	OFF	
12/05/2015	Strike-OUT Track 1	12:05:34	OFF	
12/05/2015	Strike-OUT Track 2	12:05:34	OFF	
12/05/2015	RED aspect	12:05:34	OFF	
12/05/2015	GREEN aspect	12:05:34	OFF	
12/05/2015	RED aspect FAILURE	14:13:29	ON	
12/05/2015	GREEN aspect FAILURE	14:13:29	OFF	

12/05/2015	Audible Warning FAILURE	14:13:29	OFF	
12/05/2015	System Power	14:13:29	OFF	
12/05/2015	MSL System failure	14:13:29	OFF	
12/05/2015	Track 1 issue	14:13:29	OFF	
12/05/2015	Track 2 issue	14:13:29	OFF	
12/05/2015	OD Parameter fault	14:13:29	OFF	
12/05/2015	Strike-IN Track 1	14:13:29	ON	
12/05/2015	REVERSE strike-IN Track 1	14:13:29	OFF	
12/05/2015	REVERSE strike-IN Track 2	14:13:29	OFF	
12/05/2015	Strike-IN Track 2	14:13:29	OFF	
12/05/2015	Strike-OUT Track 1	14:13:29	OFF	
12/05/2015	Strike-OUT Track 2	14:13:29	OFF	
12/05/2015	RED aspect	14:13:29	OFF	
12/05/2015	GREEN aspect	14:13:29	OFF	
12/05/2015	Audible Warning	14:13:29	OFF	

Table 1 – Day File shown in Excel

5. Understanding the Converted Log File

5.1 The top line of each file states that it is a Vamos Level Crossing Logfile and the physical location of the system.

5.2 The Vamos system only records changes of state therefore reducing the need for large amounts of memory.

5.3 The first column contains the **Date** of the entry.

5.4 The second column contains the **Event** (what has changed). Further details are shown in Section 6 - What each “Event” Means.

5.5 The third column contains the **Time** of the entry.

5.6 The fourth column contains **Status**. Either “On” or “Off”.

5.7 The fifth column is only used to indicate that the first 25 lines of data have been transferred from the previous “logfile” to assist with issues that cross the changeover boundaries.

6. What each “Event” Means

6.1 Table 2 provides the NR Rail meaning of each event to assist in the interpretation of the condensed entries found in the LOGFILES. Having a reference copy of each crossing sequence under normal circumstances can be beneficial when investigating any alleged anomalies or incidents.

Logfile event entry	**Network Rail meaning**
Strike-IN Track x (ON)	Normal direction wheel sensor strike-in Track X (wheel detected)
Strike-IN Track x (OFF)	Normal direction wheel sensor strike-in Track X (wheel no longer detected)
Strike-OUT Track x (ON)	Normal direction wheel sensor strike-out Track X (wheel detected)
Strike-OUT Track x (OFF)	Normal direction wheel sensor strike-out Track X (wheel no longer detected)
REVERSE strike-IN Track x (ON)	Reverse direction wheel sensor strike-in Track X (wheel detected)
REVERSE strike-IN Track x (OFF)	Reverse direction wheel sensor strike-in Track X (wheel no longer detected)
RED aspect (ON)	Red aspect illuminated
RED aspect (OFF)	Red aspect extinguished
RED aspect FAILURE (ON)	Red aspect failed
RED aspect FAILURE (OFF)	Red aspect fault cleared
GREEN aspect (ON)	Green aspect illuminated
GREEN aspect (OFF)	Green aspect extinguished
GREEN aspect FAILURE (ON)	Green aspect failed
GREEN aspect FAILURE (OFF)	Green aspect fault cleared
MSL System FAILURE (ON)	Miniature Stop Light System failed
MSL System FAILURE (OFF)	Miniature Stop Light System fault cleared
VaMoS System AVAILABLE	Vamos System available
Audible Warning (ON)	Audible Warning sounding
Audible Warning (OFF)	Audible Warning silenced
Audible Warning FAILURE (ON)	Audible Warning failed
Audible Warning FAILURE (OFF)	Audible Warning fault cleared
Another Train Coming (ON)	Another Train Coming audible warning sounding
Another Train Coming (OFF)	Another Train Coming audible warning silenced
DARK-Mode (ON)	System in Standby mode (Indication Post LED's Out)
DARK-Mode (OFF)	System in Normal mode (Indication Post LED's Lit)
Track x issue (ON)	Track 1 Issue (failed)
Track x issue (OFF)	Track 1 Issue (fault cleared)
On-demand Button y PRESSED (ON)	On-demand Button y pressed
On-demand Button y PRESSED (OFF)	On-demand Button released
On-demand Button FAILURE (ON)	On-demand Button failed
On-demand Button FAILURE (OFF)	On-demand Button failure cleared
System power (ON)	System power available
System INITIALIZED (ON)	System initializing
System INITIALIZED (OFF)	System initialization complete
System power (OFF)	System power off
GSM network (ON)	GSM network restored
GSM network (OFF)	GSM Network failed
RTC battery empty (ON)	RTC battery discharged
RTC battery empty (OFF)	RTC battery charging / charged
OD Parameter fault (ON)	OD Parameter failed
OD Parameter fault (OFF)	OD parameter failure recovered

Table 2 – Event Meanings

Key		
X	=	Track 1 or Track 2 (Track 1 always Up Road / Direction and Track 2 Down Road / Direction)
Y	=	On Demand button 1 or 2

Table 3 – Key to the Events Meanings Table

END

Includes:	Vamos Crossing system
Excludes:	All other Crossing systems

GENERAL

Before work is undertaken that affects the normal operation of the level crossing system, the Signaller shall be informed. Normally a possession of the equipment or a no train period is required.

1. Operational Sequence Test - No Train

1.1 Check no train is expected to enter the level crossing strike in area from any direction for the duration of this test.

1.2 Confirm the system is in “Standby Mode” (No red or green indicator LED lit).

1.3 Using a timing device, Press/touch the “On-Demand” button on one of the indication posts and start timing.

1.4 Observe that the “On-Demand” LED is extinguished, at the same time the green LEDs illuminate in both indication posts.

1.5 Check that the green LEDs are extinguished after 5 minutes.

1.6 Repeat for the other indication post.

1.7 Check the crossing returns to “Standby Mode” and the “On-Demand” red LEDs are illuminated.

2. Operational Sequence Test - One Train

2.1 Check no train is expected to enter the level crossing strike in area from any direction for the duration of tests.

2.2 Where the “On-Demand” option is fitted:

a) Confirm the system is in “Standby Mode” (No red or green indicator LED lit)

b) Press/touch the “On-Demand” button on one of the indication posts.

c) Observe that the “On-Demand” blue LED is extinguished and changes to yellow whilst touching button, at the same time the green LEDs illuminate in both indication posts.

2.3 Simulate a train “striking in” on a strike in sensor head by operating the test switches on a Strike-in evaluator board (IMC).

2.4 Observe the green LEDs on both indicator posts are extinguished and that the red LED's illuminate.

2.5 Confirm that both audible warnings sounders are working correctly.

2.6 Simulate a train "striking out" on a strike out sensor head on the same line as the "Strike in" sensor by operating the test switches on a Strike-out evaluator board (IMC).

2.7 After a short delay (3-6 seconds), Observe the indicator post LED's change from red to green.

2.8 Confirm the audible warning ceases.

2.9 Repeat steps 2.2 to 2.8 for each direction a train could approach from, including wrong direction moves.

3. Operational Sequence Test - Double Lines Second Train Approaching

3.1 Check no train is expected to enter the level crossing strike in area, from any direction for the duration of tests.

a) Confirm the system is in "Standby Mode" (No red or green indicator LED lit).

b) Press/touch the "On-Demand" button on one of the indication posts.

c) Observe that the "On-Demand" LED is extinguished, at the same time the red LEDs illuminate in both indication posts.

3.2 Simulate a train "striking in" on a strike in sensor head by operating the test switches on a Strike-in evaluator board (IMC).

3.3 Simulate a train "striking in" on a strike in sensor head mounted on 2nd line in the "opposite direction" to the first train, by operating the test switches on a Strike-in evaluator board (IMC).

3.4 Confirm that both audible warnings sounders, do not change to the second train approaching warning.

3.5 Check both indication posts continue to display a red LED.

3.6 Simulate a train "striking out" on first sensor by operating the test switches on a Strike-out evaluator board (IMC).

3.7 Confirm that both audible warnings sounders, now change to the second train approaching warning.

3.8 Check both indication posts continue to display a red LED and the warning continue to sound.

3.9 Simulate a train “striking out” on 2nd line by operating the test switches on a Strike-out evaluator board (IMC).

3.10 After a short delay (3-6 seconds), Observe the indicator post LED’s change from red to green.

3.11 Confirm the audible warning ceases.

3.12 The “On-Demand” LED’s remains extinguished until the crossing reverts to “Standby Mode”.

END

Includes:	All types of Automatic Full Barrier Crossing Locally Monitored (AFBCL)
Excludes:	All other types of Crossing

General

Liaise with the Signaller before any tests are carried out.

Check in the crossing control tables for the amber light time, red light time and any special controls that affect the automatic control sequence.

Where the word EXIT occurs, the strike out treadle shall be operated. On single lines or where bi-directional controls exist, the leaving track circuit shall also be operated.

Where directional proving controls exists the bi-directional strike out treadle shall also be operated in the correct sequence.

The following abbreviations are used in this service:

- DRL: Driver's Red Light.
- DWL: Driver's White Light.
- SPOD: Standing Person Obstacle Detector.

SERVICE A TESTS

1. Local Control Sequence

1.1 Operate the LCU to the lower position and check the following items:

a) All the amber road signals illuminate and the audible warnings commence at the same time (at the normal warbling rate).

b) After the amber time all the amber signals extinguish, all the red flashing road signals & any pedestrian lights start to flash and the crossing headlights illuminate.

c) After the red time the entrance barriers commence to lower and all the boom lamps illuminate. The entrance barriers reach their fully lowered position in 6 to 8 seconds.

d) After the entrance barriers are down the exit barriers start to lower. The exit barriers reach their fully lowered position in 6 to 8 seconds.

e) The crossing headlights, red road lights and any pedestrian lights continue to be illuminated and audible warnings continue to sound.

f) Check that all the DRLs continue to flash and the DWLs do not illuminate.

1.2 Confirm that no trains are approaching.

1.3 Operate the LCU to the raise position and check the following items:

a) All barriers start to rise at the same time and the headlights extinguish.

b) The road lights extinguish when all the barriers are above 42° from the horizontal and the audible warnings turn off.

c) The boom lights extinguish when all the barriers reach 81° from the horizontal.

d) All the barriers reach their fully raised position in less than10 seconds.

1.4 Operate the LCU to the auto position. Observe that a full lowering sequence takes place followed by a full raising sequence. Check that all DRL are flashing.

1.5 Close and lock the LCU door. Check the door cannot be locked unless the switch is in the auto position.

1.6 Check that all the DRLs are flashing.

2. Automatic Control Sequence (Crossing Area Clear)

2.1 Observe, with no train approaching, all DRLs are flashing.

2.2 Simulate an approaching train by shunting a controlling track circuit. Observe the following:

a) On double lines 10 seconds elapse before the crossing sequence commences. On single lines the sequence starts immediately.

b) All the amber road signals illuminate and the audible warnings commence at the same time (at the normal warbling rate).

c) After the amber time all the amber signals extinguish, all the red flashing road signals & any pedestrian lights start to flash and the crossing headlights illuminate.

d) After the red time the entrance barriers commence to lower, all the boom lamps illuminate and the SPOD shutters open. The entrance barriers reach their fully lowered position in 6 to 8 seconds.

e) After the entrance barriers are down the exit barriers start to lower and the SPOD shutters close. The exit barriers reach their fully lowered position in 6 to 8 seconds.

f) The crossing headlights, red road lights and any pedestrian lights continue to be illuminated and audible warnings continue to sound.

g) When all the barriers are down the driver's red light extinguishes and the DWL commences to flash for the direction where the train simulation was applied. The DRL continues for all other directions.

h) Check the sighting of the boom lamps.

2.3 Operate the exit function and remove the train simulation. Observe the following:

a) All barriers start to rise at the same time and the headlights extinguish.

b) DWL for the direction where the simulation was applied extinguishes and the DRL (if provided) commences to flash.

c) The road lights extinguish when all the barriers are above 42° from the horizontal and the audible warnings turn off.

d) The boom lights extinguish when all the barriers reach 81° from the horizontal.

e) All the barriers reach their fully raised position in less than10 seconds.

2.4 Repeat steps 2.2 and 2.3 for the opposite direction on a single line and the other direction on double lines.

3. Automatic Control Sequence (Crossing Area Occupied)

3.1 Observe, with no train approaching, all DRLs are flashing.

3.2 Place an obstruction that can be detected by a SPOD on the crossing.

3.3 Simulate an approaching train by shunting a controlling track circuit. Check the following:

a) On double lines 10 seconds elapse before the crossing sequence commences. On single lines the sequence starts immediately.

b) All the amber road signals illuminate and the audible warnings commence at the same time (at the normal warbling rate).

c) After the amber time all the amber signals extinguish, all the red flashing road signals & any pedestrian lights start to flash and the crossing headlights illuminate.

d) After 3 seconds all the amber signals extinguish, and all the red road signals and any pedestrian lights start to flash.

e) After the red time the entrance barriers commence to lower and all the boom lamps illuminate and the SPOD shutters open. The entrance barriers reach their fully lowered position in 6 to 8 seconds.

f) After the entrance barriers are down the exit barriers stay raised.

g) Remove the obstruction. Observe that the exit barriers commence to lower and the SPOD shutters close.

h) The exit barriers reach their fully lowered position in 6 to 8 seconds.

i) When all the barriers are down the driver's red light extinguishes and the DWL commences to flash for the direction where the train simulation was applied. The DRL continues for all other directions.

j) The crossing headlights, red road lights and any pedestrian lights continue to be illuminated and audible warnings continue to sound.

3.4 Operate the exit function and remove the train simulation. Observe the following:

a) All barriers start to rise at the same time and the headlights extinguish.

b) DWL for the direction where the simulation was applied extinguishes and the DRL (if provided) commences to flash.

c) The road lights extinguish when all the barriers are above 42° from the horizontal and the audible warnings turn off.

d) The boom lights extinguish when all the barriers reach 81° from the horizontal.

e) All the barriers reach their fully raised position in less than10 seconds.

4. Double Lines Second Train Approaching Sequence

4.1 Simulate a train striking in on line one as per 2.2.

4.2 Simulate a second train striking in on line two. Observe the following:

a) The barriers remain lowered.

b) The road lights and any pedestrian lights continue to flash.

c) The audible warning rate continues at the normal rate.

d) The crossing headlights continue to illuminate.

4.3 Operate the exit function and remove the simulation on line one. Observe the following:

a) The barriers remain lowered.

b) The road lights and any pedestrian lights continue to flash.

c) The audible warning rate changes to the increased rate.

d) The crossing headlights continue to illuminate.

e) The DWL for the direction of the simulation on line one extinguishes and the DRL commences to flash.

f) The DRL for the simulation on line two extinguishes and the DWL commences to flash.

4.4 Operate the exit function and remove the simulation on line two. Observe that the sequence is the same as described in 2.3.

4.5 Repeat steps 3.1 to 3.4 for a train striking in on line two first and a second train striking in on line one.

4.6 Where possible, observe the correct crossing sequence during passage of a train(s).

SERVICE B

Tests

These tests are for the full annual test of the crossing. NR/SMS/Part/D lists the indexes and references to the A4 format (with tick boxes) of these tests for the use of the person testing the crossing.

APPENDIX A - Indications

The following table lists the driver indications displayed throughout a local control and automatic sequence.

Situation	Indication
Automatic control, no train approaching, or no train simulation applied.	DRL Flashing DWL Extinguished
Crossing on operating on Local Control.	
Automatic control, train approaching or train simulation applied, all barriers down.	DRL Extinguished DWL Flashing
Barriers lowered by train simulation, DWL operating, any DWL proving contact broken, power off #	DRL Flashing DWL Extinguished

NOTES: *The DWL should only operate for the direction in which the train is approaching or the train simulation has been applied. The DRL should be operating for all other directions.*

#: Check the diagrams for the contacts in the DWL control circuit (this includes the (PO)PR function).

END

Includes:	Flex Crossing system
Excludes:	All other Crossing systems

GENERAL

Before work is undertaken that affects the normal operation of the level crossing system the Signaller shall be informed.

1. Operational Sequence Test - One Train (With Interface Signal Off)

1.1 Check no train is expected to enter the level crossing strike in area from any direction for the duration of the test.

1.2 Confirm any interface signals are showing “proceed”.

1.3 Simulate a train “striking in” on a strike in sensor head by operating the test switches on a Strike-in evaluator board (IMC). Confirm the section shows a count of 1.

1.4 Observe the green LEDs on both indicator posts are extinguished and that the red LED’s illuminate.

1.5 Check both audible warnings sounders are working correctly.

1.6 Simulate a train “striking out” on a strike out sensor head on the same line as the “strike in” sensor by operating the test switches on a strike-out evaluator board (IMC). Confirm the first section shows a count of 1.

1.7 After a short delay (3-6 seconds), observe the indicator post LED’s change from red to green.

1.8 Confirm the audible warning ceases.

1.9 Simulate a train “striking out” on a strike out sensor head of the second section on the same line as the “strike in” sensor by operating the test switches on a strike-out evaluator board (IMC). Confirm the first section shows a count of 0 and second section a count of 0.

1.10 Clauses 1.2 to 1.9 shall be repeated for each direction a train could approach from, including wrong direction moves.

2. Operational Sequence Test - Double Lines Second Train Approaching (With Interface Signal Off)

2.1 Check no train is expected to enter the level crossing strike in area from any direction for duration of test.

2.2 Confirm any interface signals are showing “proceed”.

2.3 Simulate a train “striking in” on a strike in sensor head by operating the test switches on a strike-in evaluator board (IMC).

2.4 Observe that the red LEDs illuminate in both indication posts. Check both audible warnings sounders sound.

2.5 Simulate a train “striking in” on a strike in sensor head mounted on 2nd line in the “opposite direction” to the first train by operating the test switches on a strike-in evaluator board (IMC).

2.6 Confirm that both audible warning sounders do not change to the second train approaching warning.

2.7 Check both indication posts continue to display a red LED.

2.8 Simulate a train “striking out” on first sensor by operating the test switches on a Strike out evaluator board (IMC).

2.9 Check both audible warning sounders, now change to the second train approaching warning.

2.10 Check both indication posts continue to display a red LED and the warning continues to sound.

2.11 Simulate a train “striking out” on 2nd line by operating the test switches on a strike out evaluator board (IMC).

2.12 After a short delay (3-6 seconds), observe the indicator post LED’s change from red to green.

2.13 Confirm the audible warning ceases.

3. Operational Sequence Test – One Train (With Interface Signal On)

3.1 Check no train is expected to enter the level crossing strike in area from any direction for the duration of the test.

3.2 Confirm the interface signal is at red, and has been at red, for greater than 2 minutes.

3.3 Simulate a train “striking in” on a strike in sensor head by operating the test switches on a strike-in evaluator board (IMC).

3.4 Observe the green LEDs on both indicator posts remain lit.

3.5 Clear the interface signal.

3.6 Observe the green LEDS on both indicator posts are extinguished, and the red LEDS are illuminated.

3.7 Check both the audible warning sounds are working correctly.

3.8 Observe the interface signal clears to proceed aspect, after signal regulation time (if applied, check in the control tables). Refer to record card for timer setting.

3.9 Simulate a train “striking out” on a strike out sensor head on the same line as the “strike in” sensor by operating the test switches on a strike-out evaluator board (IMC).

3.10 After a short delay (3-6 seconds), observe the indicator post LED’s change from red to green.

3.11 Confirm the audible warning ceases.

3.12 Clauses 3.1 to 3.11 shall be repeated for each interfaced signal.

END

1. Test

1.1 Using a meter, check that there is a voltage (110V AC) across terminals 23 and 24 in the T72 point machine.

If none is present:

1.2 Check the power supply to the heater:

- T2 links 1 and 2 in the Junction Box.

If a voltage is present:

1.3 Isolate the heater power supply.

1.4 Fit a strap across terminals 23 and 25 in the T72 point machine.

This bypasses the thermostat.

1.5 Reinstate the heater power supply and using a meter check that there is a voltage across the heater terminals 24 and 25 in the T72 point machine.

If the heater fails to operate, the heater is faulty. Replace this as part of corrective maintenance.

1.6 Remove the strap fitted across terminals 23 and 25 in the T72 point machine.

END

High voltages can be present. The appropriate precautions for working on high voltage equipment shall be implemented and observed (see NR/SMS/PartC/EL00 (Electrical Equipment General).

This test shall not be performed if there is an active earth fault at the PL/DPL. Inform your SM(S) and arrange remedial work.

The test shall be performed on at least one output on each (FIU) Field Isolation Unit in each subrack.

Removing the back plate of the subrack provides access to the 'U-Links' which are used for this test.

Each 'U-Link' is provided with a 'test hole' in its insulation to enable the circuit to be tested without the need to partially withdraw the link thereby risking circuit interruption.

Test Equipment

A calibrated resistance decade box with 'flying' leads (Details are in NR/SMS/Appendix/02).

1. Peripheral Post

Remove the back plates from all the FIU subracks.

1.1 Connect one of the 'flying leads' to the Test Earth.

1.2 Set the decade box to 900kΩ ('less than 1MΩ test').

1.3 Check that the person monitoring the SIM PC and the MOT is in position and is monitoring the correct CNT diagnostic field on the OLD screen.

1.4 Starting from the left, locate the first FIU unit fitted in the subrack.

1.5 Touch the end of the second 'flying lead' on to the test point on any one of the 'U-Links' fitted at the back of the selected FIU unit.

A Critical Alarm shall be registered on the MOT. If not, the system is faulty, and your SM(S) shall be informed immediately, rectification of the problem must be undertaken within 2 days.

1.6 Repeat the test with the decade box set to 90kΩ ('less than 100kΩ test').

1.7 Record the details of the circuits tested and the test results.

1.8 Repeat the above procedure for all of the FIU subracks within the PL/DPL.

END

AC Leakage Test

An AC leakage test shall be carried out on exposed metallic parts after each service.

For further information refer to the GraphXMaster Service Manual - section 2.3 General Guidelines – AC Leakage Test – Cold Check.

Test Equipment

- An Insulation Tester set to 500V DC
- An IEC free test socket with a lead connected to the power and neutral pins.

1. Cold Check

1.1 Check that the projector is switched off and the AC power cable has been removed from the power supply.

1.2 Plug the projector power plug into IEC test socket and connect the lead of IEC test socket into insulation tester.

1.3 Switch the projector AC switch to on.

1.4 Touch other lead of insulation tester on each exposed metallic part. Check that the resistance is >4MΩ

Pay particular attention to any exposed metal part having a return path to the chassis.

If the resistance is below this value, the projector shall be isolated and reported as a corrective maintenance item. The projector shall only be returned to service if the test result is satisfactory.

1.5 Switch the projector off and remove the projector power plug from IEC test socket.

END

There is no provision for a maintenance control to prevent a release being given for the section under test. A safe system of work shall be implemented in liaison with the Signaller.

1. Test

1.1 Obtain the Signaller's permission to test the apparatus.

1.2 Check that the TRAFFIC indicator is illuminated.

1.3 Check that the PATROL push button function is inoperative with the Normal/Operate keyswitch in the NORMAL position.

1.4 Check that the Normal/Operate keyswitch cannot be operated without its unique key.

1.5 Arrange a release with the Signaller and insert the key and turn the Normal/Operate keyswitch to the OPERATE position.

1.6 Check that the key is retained in keyswitch.

1.7 Press the button marked PATROL and Check that the TRAFFIC indicator extinguishes and the PATROL indicator illuminates.

1.8 Confirm with the Signaller that the delimited section is in PATROL mode.

e.g. signal 203 to signal 204.

1.9 Turn the Normal/Operate keyswitch to the NORMAL position and Check that the PATROL indicator remains illuminated.

1.10 Request the Signaller to cancel the release and confirm that the section remains in PATROL mode The PATROL mode indicator remains illuminated.

1.11 Turn the Normal/Operate keyswitch to the OPERATE position and Press the button marked TRAFFIC.

1.12 Check that the PATROL indicator extinguishes and the TRAFFIC indicator illuminates.

1.13 Confirm with the Signaller that the section has been returned to TRAFFIC mode.

1.14 Turn the Normal/Operate keyswitch to the NORMAL position and remove the key.

1.15 If applicable, repeat 1.1 to 1.14 for any adjacent section(s).

1.16 Repeat 1.1 to 1.15 at the other associated control position(s).

END

High voltages can be present. The appropriate precautions for working on high voltage equipment shall be implemented and observed.

The particular equipment being tested shall be electrically isolated by removing the appropriate fuse(s).

Before disconnecting any wiring from the RK170, the voltage on A1, A2, M+, M-, 6 and 7 with respect to earth shall be measured and if greater than 25 volts (AC or DC) shall be rectified as corrective maintenance.

TESTS

1. Function Test

1.1 Agree with the Signaller the identity of the power supply to be tested and the equipment to be affected.

1.2 Record the details of that particular power supply.

1.3 Isolate the ELD and associated RK170 unit by removing the associated fuse(s).

1.4 Check the circuit is isolated by measuring the voltage on A1, A2, M+, M-, 6 and 7 with respect to earth).

If the voltage is greater than 25 volts (ac or dc) go to 1.5 otherwise go to 1.6.

Check the correct fuse(s) have been removed before proceeding

1.5 Disconnect and remove the output from the RK170 (terminals 6 and 7) to the trend controller.

1.6 Connect the auxiliary current source to the output wiring to the trend controller.

1.7 Increase the auxiliary current in incremental steps from 4.1mA to 20mA. (See Table1):

RK170 Output (mA)	**Total System Insulation Resistance (kOhm)**	**RCM ‘Insulation Monitoring’ Screen Status**
4.100	19080	(Green) OK
5.455	1200	
5.570	1103	
5.641	1050	
5.710	1003	
5.795	950	(Amber) WARNING
5.880	901	
6.087	800	
12.00	120	
12.350	110	
12.550	105	
12.730	100	(Red) CRITICAL
12.950	95	
13.150	90	
13.600	80	
20.00	0	

Table 1 – Resistance Value (1)

1.8 At each incremental step:

Record the resistance value (kOhm) and Insulation status displayed on the maintenance desk insulation monitoring screen.

1.9 At each alarm transition threshold:

Check the insulation status changes from:

a) ‘OK’ to Warning’ at 1000kOhm.

b) ‘Warning’ to ‘Critical’ at 100kOhm.

If the measured value deviates by more than ±5% from the designated alarm setting 100kOhm (105kOhm – 95kOhm) or 1000kOhm (1050kOhm – 950kOhm) the SM(S) shall be notified.

1.10 When the 20mA increment is reached:

Repeat the test, using the same incremental steps in reverse order, reducing the current from 20mA to 4.1mA. (See table2).

1.11 At each incremental step:

Record the Resistance value (kOhm) and Insulation status displayed on the Maintenance Desk Insulation Monitoring screen.

1.12 At each alarm transition threshold:

Check the insulation status changes from: ‘Critical’ to ‘Warning’ at 100kOhm ‘Warning’ to ‘OK’ at 1000kOhm.

If the measured value deviates by more than ±5% from the designated alarm setting 100kOhm (105kOhm – 95kOhm) or 1000kOhm (1050kOhm – 950kOhm) the SM(S) shall be notified.

RK170 Output (mA)	Total System Insulation Resistance (kOhm)	RCM ‘Insulation Monitoring’ Screen Status
20.00	0	(Green) OK
13.600	80	
13.150	90	
12.950	95	
12.730	100	
12.550	105	(Amber) WARNING
12.350	110	
12.00	120	
6.087	800	
5.880	901	
5.795	950	
5.710	1003	(Red) CRITICAL
5.641	1050	
5.570	1103	
5.455	1200	
4.100	19080	

Table 2 - Resistance Value (2)

1.13 Remove the test equipment.

1.14 Reconnect the trend controller to the RK170. (Terminals 6 and 7).

1.15 Replace all fuses.

1.16 Check the ELD LCD is displaying the resistance value. (The value shall be greater than 1000kOhm).

1.17 Check the maintenance desk insulation monitoring screen is displaying resistance values greater than 1000kOhm and the Insulation status is (green) ‘OK’.

1.18 Record details and test results.

END

There is no provision for a maintenance control to prevent a release being given for the section under test. A safe system of work shall be implemented in liaison with the Signaller.

1. Test

1.1 Obtain the signaller’s permission to test the apparatus.

1.2 Check that the TRAFFIC indicator is illuminated.

1.3 Check that the PATROL push button function is inoperative with the Normal/Operate keyswitch in the NORMAL position.

1.4 Check that the Normal/Operate keyswitch cannot be operated without its unique key.

1.5 Arrange a release with the signaller and insert the key and turn the Normal/Operate keyswitch to the OPERATE position.

1.6 Check that the key is retained in keyswitch.

1.7 Press the button marked PATROL and check that the TRAFFIC indicator extinguishes and the PATROL indicator illuminates.

1.8 Confirm with the Signaller that the delimited section is in PATROL mode. e.g. signal 203 to signal 204.

1.9 Turn the Normal/Operate keyswitch to the NORMAL position and check that the PATROL indicator remains illuminated.

1.10 Request the signaller to cancel the release and confirm that the section remains in PATROL mode The PATROL mode indicator remains illuminated.

1.11 Turn the Normal/Operate keyswitch to the OPERATE position and press the button marked TRAFFIC.

1.12 Check that the PATROL indicator extinguishes and the TRAFFIC indicator illuminates.

1.13 Confirm with the Signaller that the section has been returned to TRAFFIC mode.

1.14 Turn the Normal/Operate keyswitch to the NORMAL position and remove the key.

1.15 If applicable, repeat 1.1 to 1.15 for any adjacent section(s).

1.16 Repeat 1.1 to 1.16 at the other associated control position(s).

END

General

Treadles shall be set and checked using one of the following methods:

a) Line/bob-weights and associated plastic gauge.

b) Extendable bar treadle gauge.

The metal treadle arm gauge shall not be used for this task.

Record all results on the Record Card.

1. Treadle Gauging - Method One (Line and Bob)

Gauge Set-up

A line shall be attached to the plumb weights that allows for the weights to suspend the line over both running rails. See Figure 1.

Gauge Test

The plastic gauge can then be used with the notched end against the line and the stepped side against the treadle arm. The height below and from the rail can then be read from the scale. See Figure 2 and Table 1.

Figure 1 - Use of the Treadle Gauge

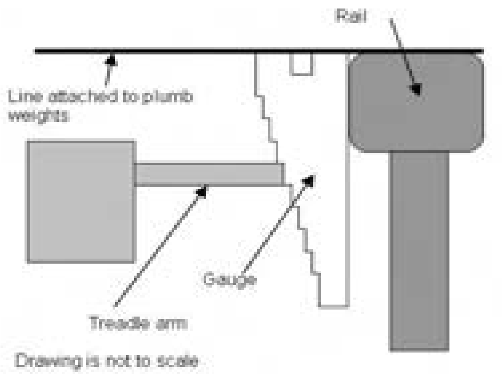


Figure 2 - Treadle Gauging Equipment

Treadle Type	Height Below Rail Level (H)	Distance From Running Edge of Rail (X)
69	16mm (±1mm)	10mm (+2mm or -5mm)

Table 1 - Treadle height and arm limits

2. Treadle Gauging - Method Two (Integrated Gauge)

Gauge Set-up

2.1 Place one end of the new treadle gauge on the rail and release the lock nut in the centre, extend the rod until the gauge reaches the opposite rail.

2.2 Check that both measuring ends are undamaged, in the correct position and correspond.

2.3 Hand tighten the centre release lock nut on the rod and check that both ends are positioned correctly on the rail. The gauge should be allowed to move freely without stalling or stuttering, see Figure 3.

Figure 3 – Using the Gauge

Gauging Test

<u>The 5mm Check - Inner running edge of the rail & the treadle arm.</u>

2.4 Place the gauge with the 5mm section in front of the arm and offer / move the gauge towards the treadle arm.

The 5mm section should pass through the gap.

2.5 Note if the gap is smaller, then the treadle arm needs to be adjusted, after treadle adjustment, repeat this check.

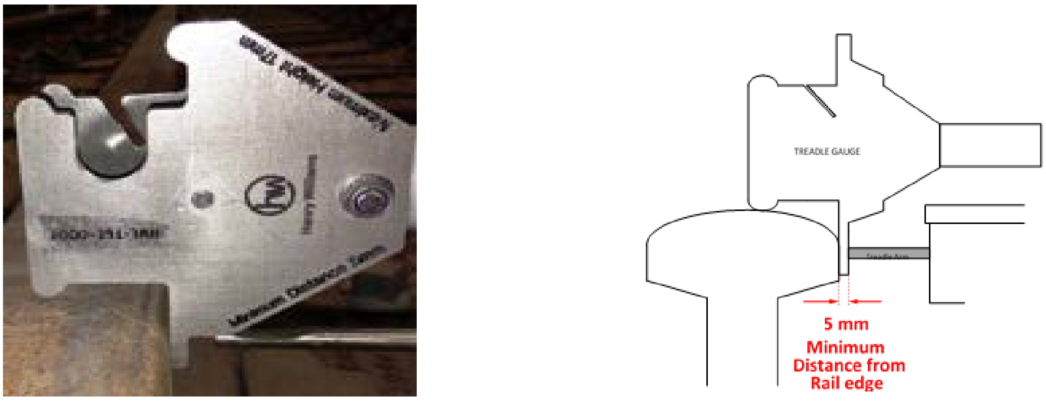


Figure 4 – 5mm Check

<u>The 12mm Check - Inner running edge of the rail & the treadle arm.</u>

2.6 Place the gauge with the 12mm section in front of the arm and offer / move the gauge towards the treadle arm.

The 12mm section of the gauge should only just pass through the gap touching the trip arm.

2.7 If the gap is greater than 12mm then the treadle arm, needs to be adjusted, after treadle adjustment, repeat this check.

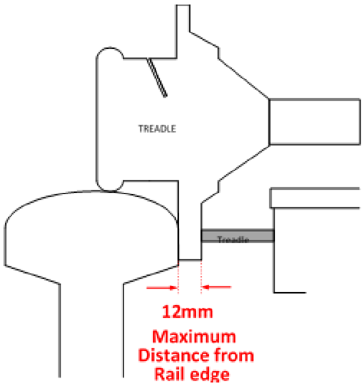


Figure 5 – 12mm Check

NOTE: *Caution should be taken to prevent an operation of the treadle arm when completing this check.*

<u>The 15mm Check - Measuring the Height of the treadle.</u>

2.8 Place the gauge with the 15mm section in front of the arm and offer / move the gauge towards the treadle arm.

The gauge should just pass over the treadle arm.

2.9 If the 15mm gauge fails to pass over the treadle arm, then the treadle height needs to be adjusted, after treadle adjustment, repeat this check

NOTE: *Caution should be taken to prevent an operation of the treadle arm when completing this check.*

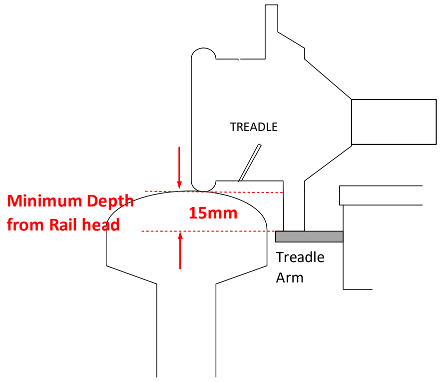


Figure 6 - 15mm Check

<u>17mm Check - Measuring the Height of the treadle.</u>

2.10 Place the gauge with the 17mm section of the gauge in front of the arm and offer / move the gauge towards the treadle arm.

The gauge should JUST TOUCH the top of the trip arm.

2.11 If the 17mm gauge fails, then the treadle height needs to be adjusted. After treadle adjustment, repeat this check.

This is the Optimum arm height setting for reliability and is important that this is achieved

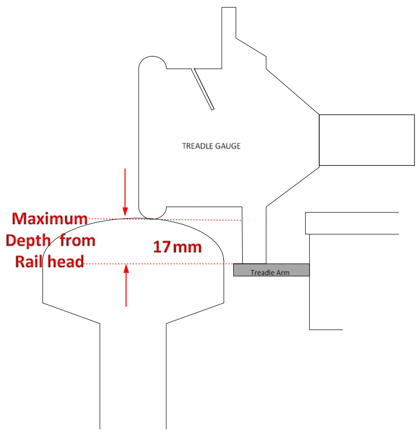


Figure 7 - 17mm Check

NOTE: *Caution should be taken to prevent an operation of the treadle arm when completing this check.*

Treadle Arm Wear Gauging Check.

The Integrated Treadle Gauge has two arm wear measurement slots within the gauge, these are uniquely identified and are used to indicate arm wear of over 75% (exceeding 2.6mm wear) and over 100% (exceeding 3.5mm wear).

This enables the Technician to report to SM(S) the arm wear condition at each maintenance visit and enables the timely planning of Treadle replacement.

Trip Arm Wear Check

2.12 Select the 75% wear gauge, align the gauge slot with the Treadle Trip Arm and slide the gauge across the worn area of the trip arm horizontally (approximately 10mm from end of trip arm).

If the wear exceeds the 75% wear gauge, repeat with the 100% wear gauge and record the reading.

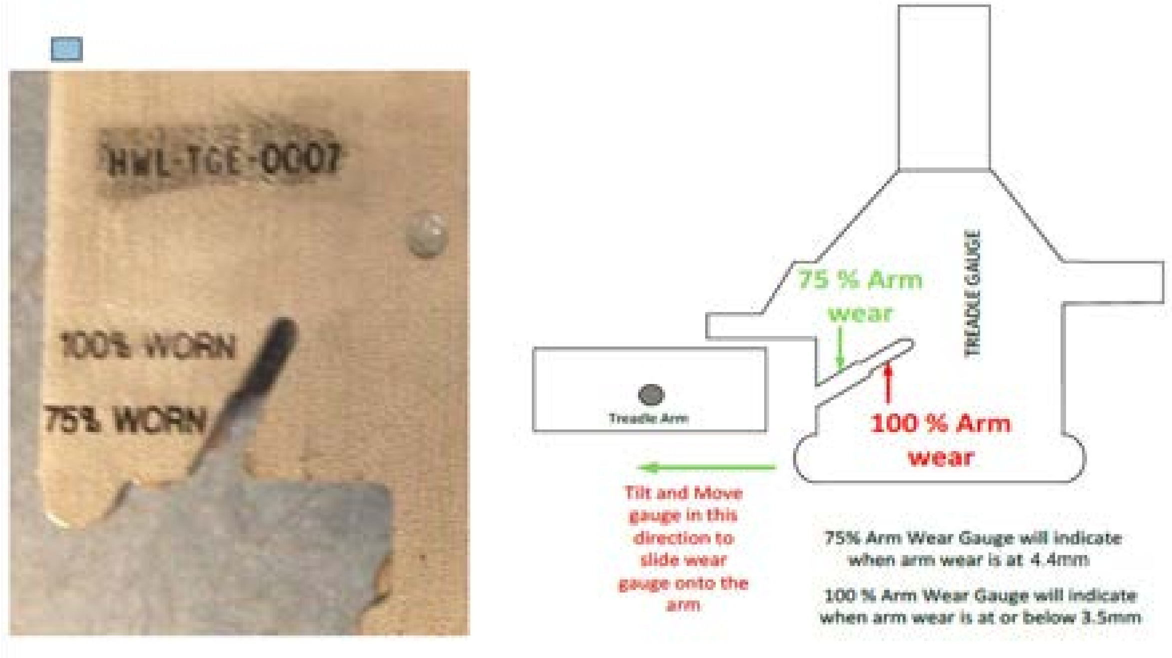


Figure 8 - Trip Arm Wear Check

2.13 Technicians shall inform SM(S) when arm wear has reached the 75% worn level, Treadles which are found to have 100% arm wear shall be reported immediately and replacement planned in as soon as possible.

2.14 Sites which have accelerated arm wear, shall have the arm heights re-checked for compliance with this guide.

END

Includes:	For EPOS Units - Hot Axle Box Detector (HABD)
Excludes:	All other types HABD systems

1. General

1.1 Manual post calibration is required in the following cases:

a) After cleaning the optical components.

b) After installing a new EPOS unit.

1.2 "Manual post calibration" creates a new "current characteristic", which immediately takes the current attenuation characteristics (e.g. changes due to cleaning) of the measuring system into consideration.

NOTE: *The passage of an actual train will interrupt the Manual Post Calibration Test.*

2. Manual Calibration

2.1 To carry out a "manual calibration" complete the following steps:

a) Launch the "Satellite Management UI" application.

b) Click on "Calibration" in the "Satellite Management UI" menu bar.

2.2 The following dropdown menu appears.

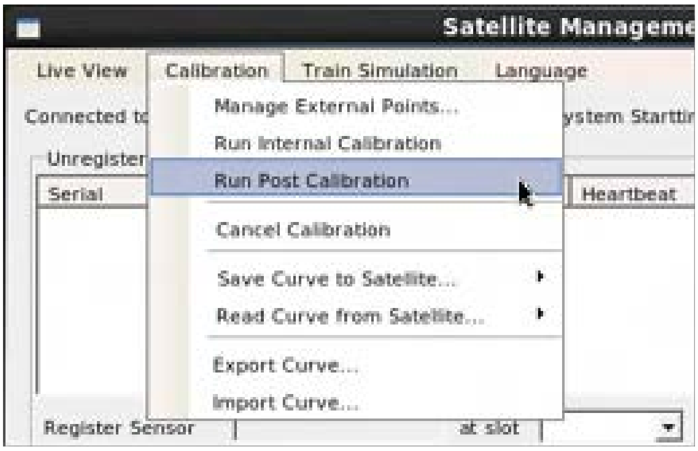


Figure 1 - Dropdown menu “Calibration" – item “Run Post Calibration”

2.3 Click the "Run Post Calibration" menu.

The FUES-EPOS system starts post calibration for all measuring points at the same time.

2.4 A log window opens, in which you can monitor the calibration process. See Figure 2.

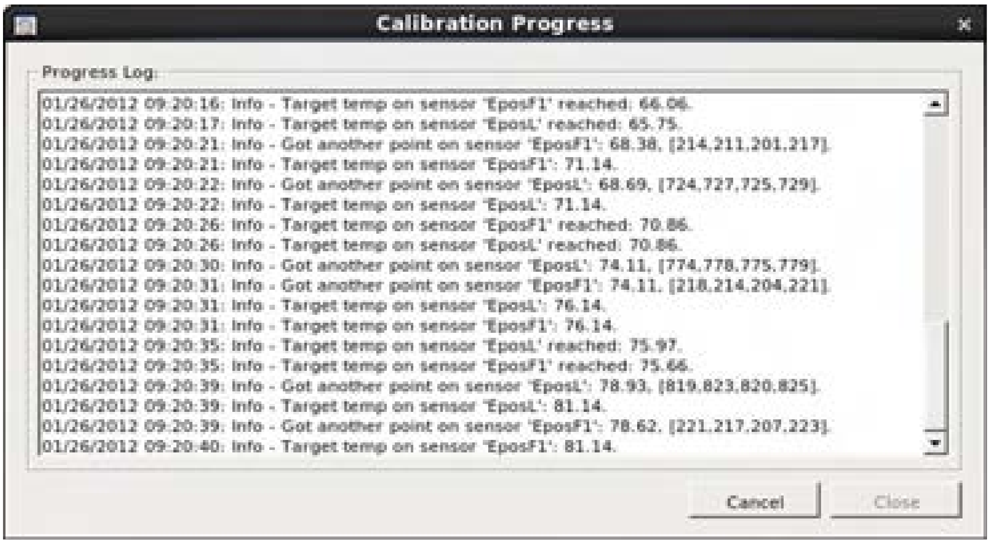


Figure 2 - Log window after starting post calibration

2.5 The internal calibration process has been successfully completed when event logging stops and the last line confirms successful calibration with the following message: New calibration curve ready. See Figure 3.

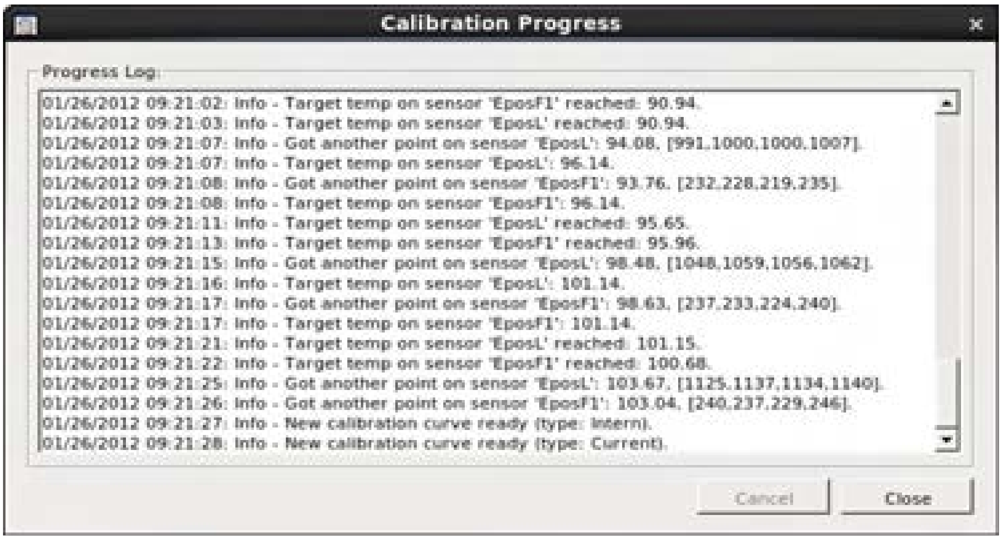


Figure 3 - Log window after completing post calibration

2.6 Close the log window by clicking the <Close> button. This completes "manual post calibration".

END

Includes:	For RSR123 Sensors fitted on Hot Axle Box Detector (HABD)
Excludes:	All other types of RSR123 Sensors fitted on other systems

1. Occupancy Detection Capability Test - Using PB200 Plate

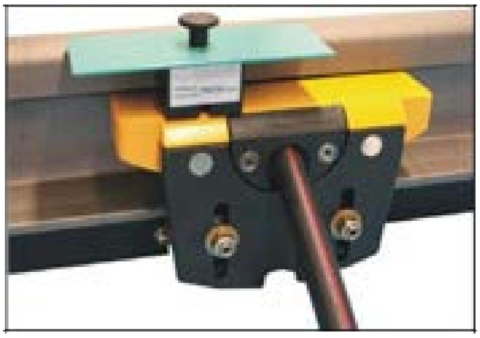


Figure 1 - PB200 above System 1

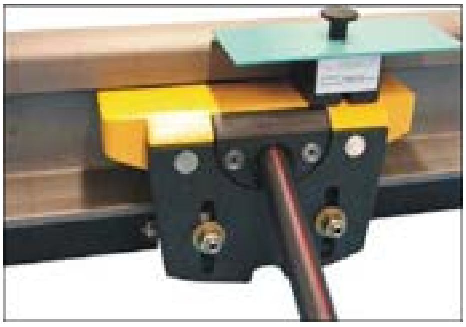


Figure 2 – PB200 above System 2

1.1 Carry out the following:

a) Place the PB200 testing plate above the system to be tested as shown in Figure 1 and check the SP board is indicating occupancy.

b) Move the PB200 to the position shown in Figure 2 and check the SP board is indicating occupancy.

c) Remove the PB200 testing plate.

1.2 If the SP board fails to indicate occupancy, carry out NR/SMS/PartB/Test/184 (EPOS – RSR123 Wheel Sensor Voltage Adjustment), followed by repeating this test.

END

Includes:	EPOS HABD
Excludes:	All other HABD Systems

1. Verifying the Measuring Precision

1.1 Run the train simulation (measurement) as follows:

a) Switch on the heat source.

b) Set the corresponding temperature value on the heat source control panel.

c) Position the heat source at the EPOS unit to be verified.

d) Launch the "Satellite Management UI" application.

e) Click the "Train Simulation" menu item.

f) The dropdown menu shown in Figure 1 appears.

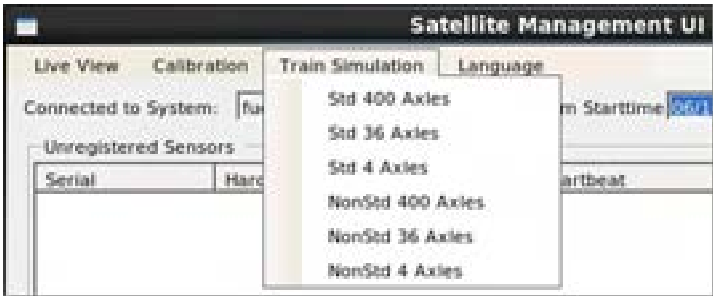


Figure 1 - Drop-down menu "Train Simulation"

g) You can run the train simulations shown in this menu, See Figure 2.

- The wheel sensor signals are simulated by the software.
- The shutters are opened.

Menu item	Function
Std 400 Axles	Train simulation in standard direction with 400 axles at 60 km/h
Std 36 Axles	Train simulation in standard direction with 36 axles at 360 km/h
Std 4 Axles	Train simulation in standard direction with 4 axles at 120 km/h
Non Std 400 Axles	Train simulation in non-standard direction with 400 axles at 60 km/h
Non Std 36 Axles	Train simulation in non-standard direction with 36 axles at 360 km/h
Non Std 4 Axles	Train simulation in non-standard direction with 4 axles at 120 km/h

Figure 2 – Simulation Options

NOTE: *These train simulations can also be run by pressing buttons on the control and evaluation unit's SP board.*

1.2 When the heat source has reached a steady target temperature, run any train simulation via the dropdown menu or the buttons on the IC board.

The FUES-EPOS system simulates a train passage. The shutters off the EPOS units open and the system records the temperature of the heat source.

1.3 We recommend verifying measuring accuracy at the following temperature values:

Measuring position	Temperature [°C]
HBD	85
HWD	300

Table 1 – Temperature Values

2. Checking the Measuring Results

2.1 Open the graphical user interface TIS GUI on the desktop of the FUES-EPOS system.

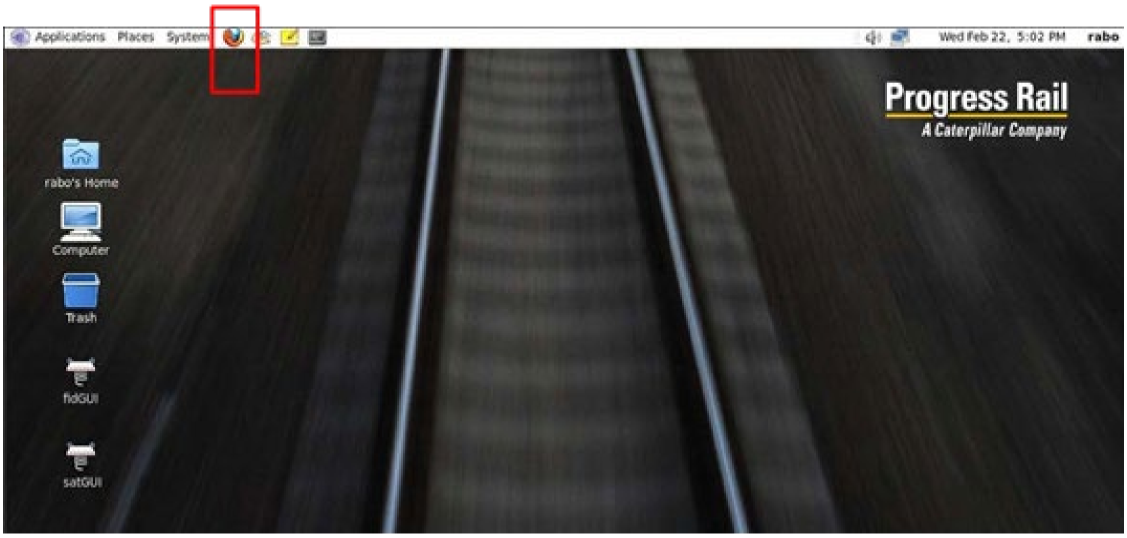


Figure 3 - FUES-EPOS system desktop (example)

NOTE: *Quick start icon for the web browser for opening the TIS GUI shown in the red box*

2.2 Click on the quick start icon for the web browser to open the TIS GUI The TIS GUI login window appears.

2.3 Enter the username and password.

The TIS GUI start window appears.

2.4 Click the Train ID button in the Last Train area below the navigation menu (see Figure 4, circled in red).

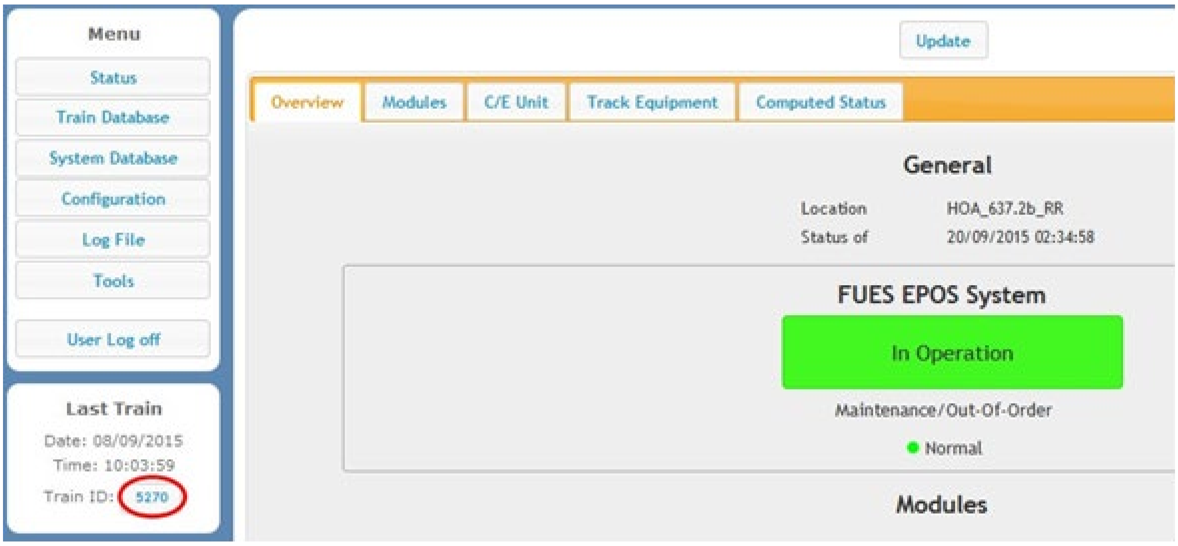


Figure 4 - Selecting the last train in the "Train selection" tab

2.5 This opens the tabs with the corresponding train data.

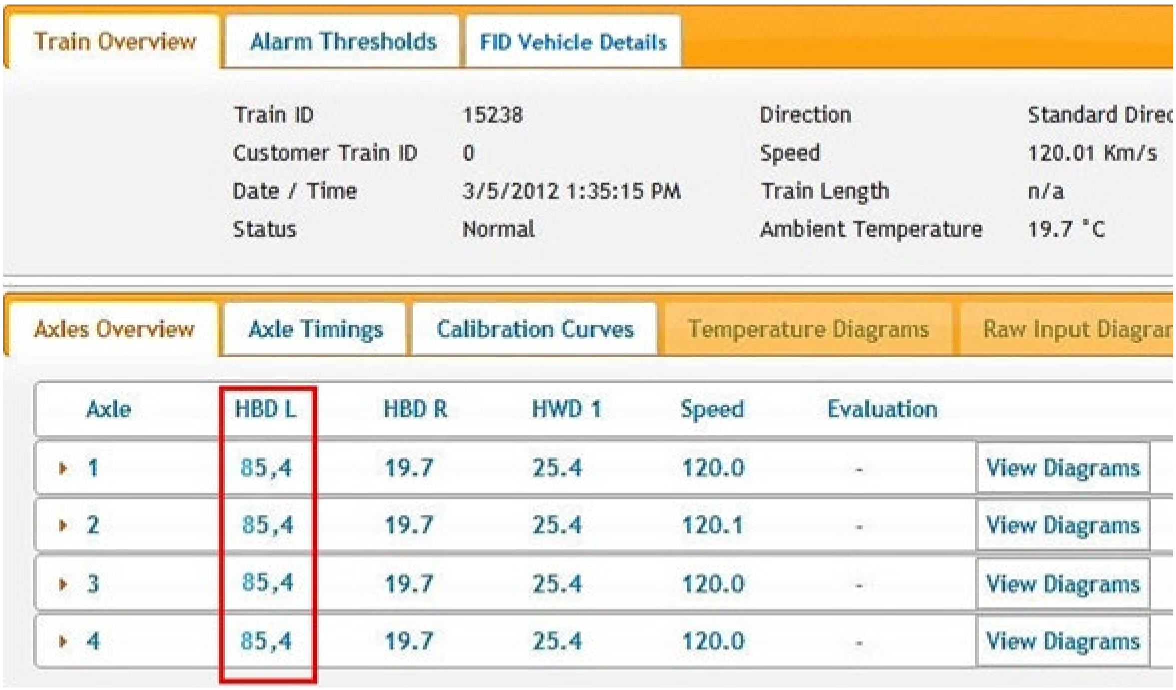


Figure 5 - Reading off the measured temperature values in the axle overview (HBD-L as an example)

2.6 Read off the temperatures measured for the selected measuring system in the axle data of the simulated train (see Figure 5).

2.7 Enter the average temperature value in the corresponding log.

You can use the following documents for this:

a) Document 5500219 "On-site testing (SAT)".

b) Document 5500220 "Factory testing (FAT)".

c) Document 5500222 "Maintenance Schedule/Record".

2.8 Check whether the defined tolerances are observed.

The following defaults apply:

Measuring position	Temperature
HBD	85 °C ± 3 C
HWD	300 °C ± 10 C

Table 2 – Temperature Tolerances

2.9 Repeat the measuring precision verification for all installed EPOS units.

2.10 If the measuring precision of an EPOS unit is outside of the defined tolerances carry out NR/SMS/PartB/Test/183 (EPOS – Basic Calibration).

END

Includes:	EPOS HABD
Excludes:	All other HABD Systems

1. General

1.1 If deviations outside of tolerance are determined while verifying measuring precision (e.g., during annual maintenance a "Basic Calibration" shall be performed.

Basic calibration gives you the ability to adjust the measuring system on the EPOS unit in question to changes that cannot be adequately compensated for by automatic post basic calibration (e.g. caused by irreversible soiling, scratches, or aging effects).

2. Performing "external calibration"

2.1 Click on "Calibration" in the "Satellite Management UI" menu bar.

The following dropdown menu appears, see Figure 1.

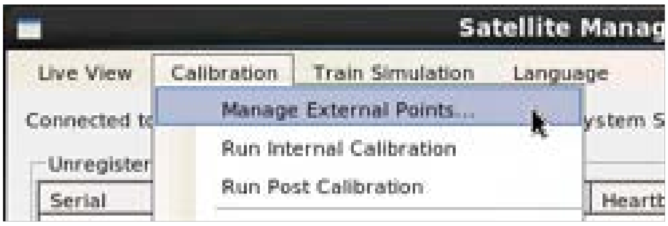


Figure 1 - Dropdown menu "Calibration" – item "Manage External Points"

2.2 Click the "Manage External Points" menu item.

This opens the "External Calibration Manager" dialogue window (see Figure 2)

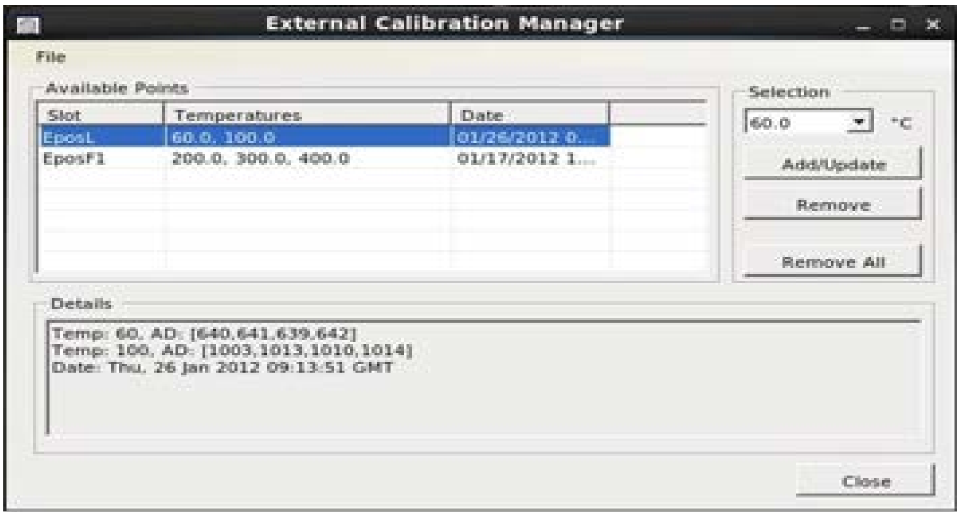


Figure 2 - "External Calibration Manager" dialogue window

2.3 In the list of "Available Points" select the measuring system (EPOS unit) for which you will be performing calibration. See Figure 2.

2.4 Select the temperature value in the dropdown list.

NOTE: *You only need to perform basic calibration of EPOS units whose measuring precision is outside of the tolerance.*

If multiple EPOS units are affected, we recommend a specific approach to choosing the calibration point order in line with Table 1.

NOTE: *that cooling and heating the calibration radiator takes a considerable amount of time, and that the suggested measuring points have proved useful in basic calibration.*

Measuring position	Temperature [°C]
HBD-L	60
HBD-R	60
HBD-L	100
HBD-R	100
HWD1	200
HWD2	200
HWD1	300
HWD2	300
HWD1	400
HWD2	400

Table 1 - Recommended order of measuring systems for external calibration

2.5 Switch on the calibration radiator(s).

2.6 Set the corresponding temperature value on the calibration radiator control panel.

2.7 Position the calibration radiator at the EPOS unit to be calibrated.

2.8 When the calibration radiator has reached a steady target temperature, click the "Add/Update" button to start the measuring process.

The shutter on the corresponding EPOS unit opens and the system records the digital values measured. The measuring process is complete when the shutter closes again.

2.9 Repeat this process for all required calibration points.

After completing the last required calibration point, the external calibration is complete.

3. Performing "internal calibration"

3.1 Click on "Internal Calibration" in the "Satellite Management UI" menu bar.

The dropdown menu shown in Figure 3 appears.

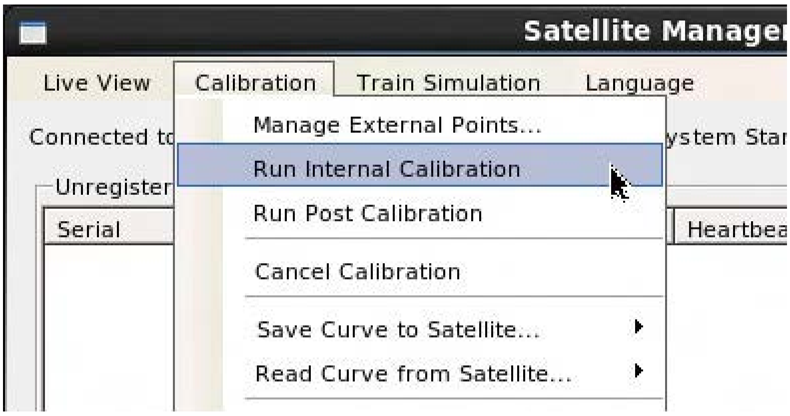


Figure 3 - Dropdown menu "Calibration" – item "Run Internal Calibration"

3.2 Click the "Run Internal Calibration" menu.

A selection window opens, see Figure 4.

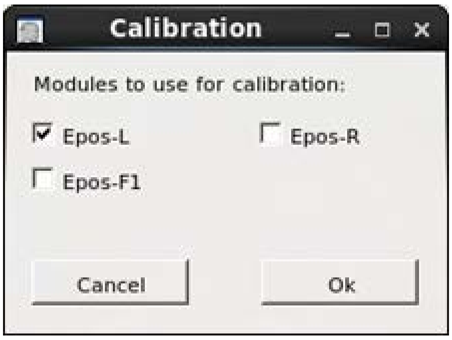


Figure 4 - Selection window

3.3 Select the measuring system(s) to be calibrated using ☑.

3.4 Click the <OK> button to start the internal calibration process.

The FUES-EPOS system starts internal calibration for the selected measuring system(s)

This opens a Log window (see Figure 5), in which you can monitor the calibration process.

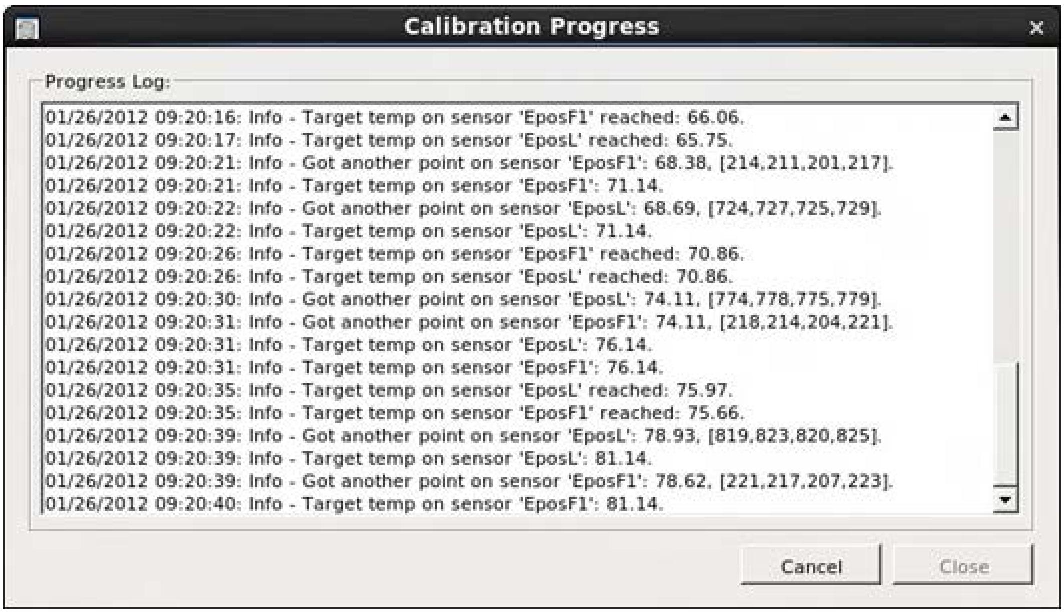


Figure 5 - Log window after starting internal calibration

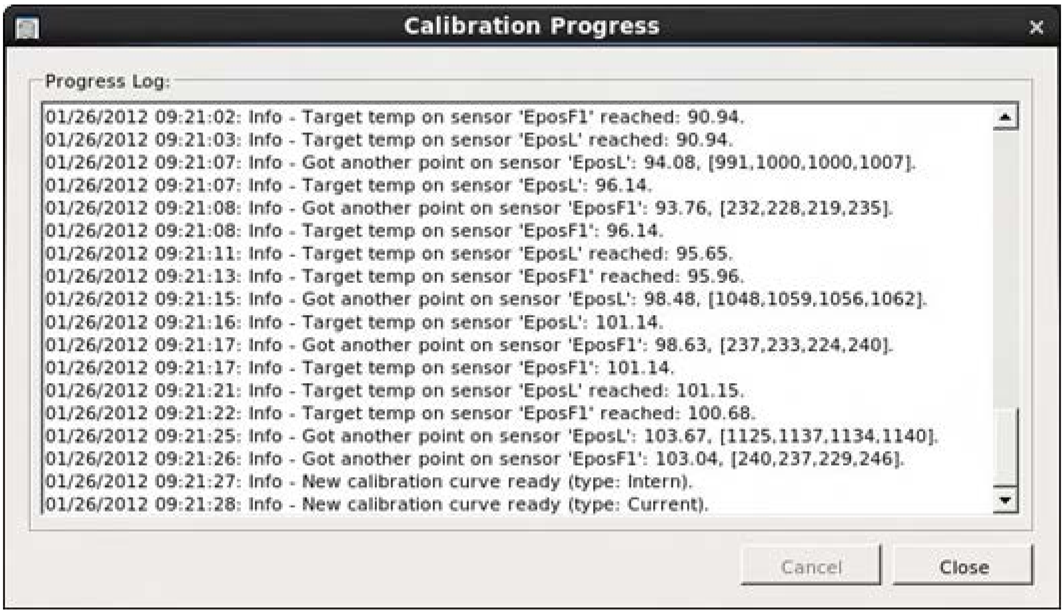


Figure 6 - Log window after completing internal calibration

The internal calibration process has been successfully completed when event logging stops and the last line confirms successful calibration with the following message: **New calibration curve ready,** see the last line of the screen shown in Figure 6.

3.5 Close the log window by clicking the <Close> button.

3.6 This completes the internal calibration.

4. Completing basic calibration

4.1 After completing internal calibration, the system computes the "basic characteristic" from the external and internal calibration data; this forms the basis for temperature measurements.

4.2 The basic calibration data are automatically stored in the FUES-EPOS system database where they are immediately available for the next train run.

Additionally, the basic calibration data in the newly calibrated EPOS unit shall be stored in the EPOS's Units memory. This means that the calibration data of this EPOS unit are available for use at other locations.

5. Storing the calibration data on an EPOS unit

5.1 Click on "Internal Calibration" in the "Satellite Management UI" menu bar.

The corresponding dropdown menu appears.

5.2 Move the cursor to the "Save Curve to Satellite" menu item, but do not press the mouse button.

Another dropdown menu appears where you can select the measuring system as shown in Figure 7.

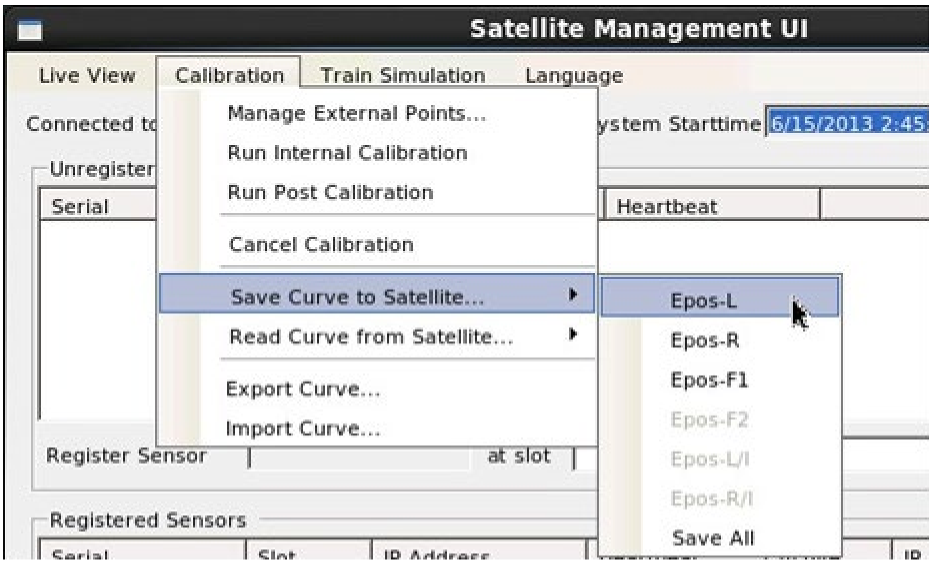


Figure 7 - Dropdown menu "Calibration" item "Save Curve to Satellite"

5.3 Move the cursor to the desired measuring system and left click.

The system starts to transfer the calibration data. This opens a log window where you can monitor the data transfer progress (see Figure 8 and Figure 9).

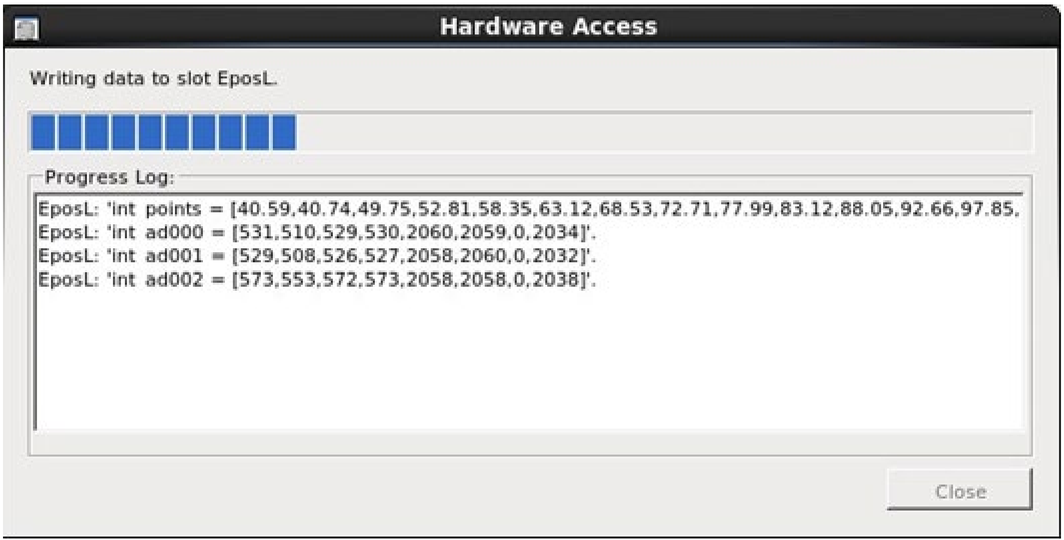


Figure 8 - Transferring the calibration data to an EPOS unit - start

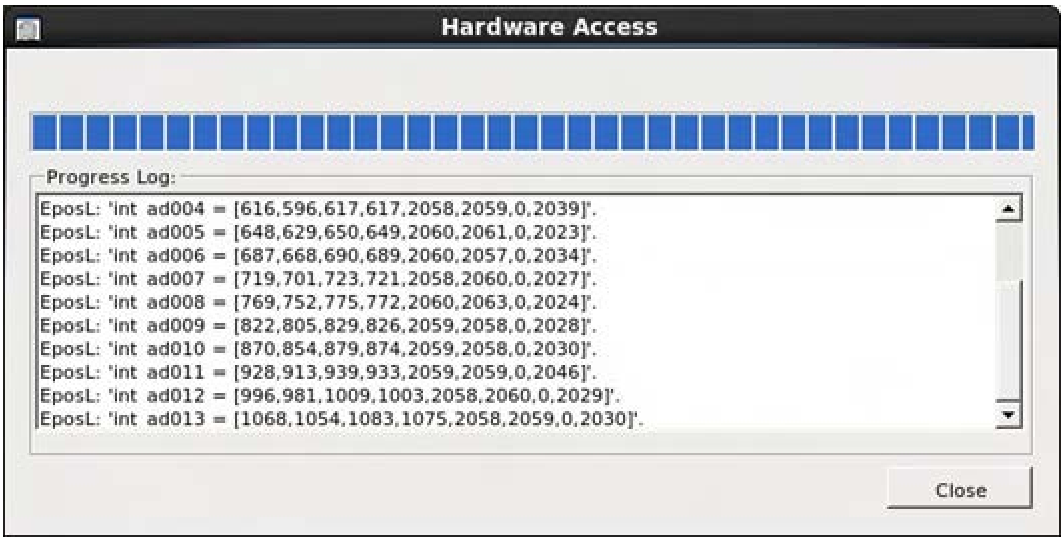


Figure 9 - Transferring the calibration data to an EPOS unit - end

5.4 Close the log window by clicking the <Close> button.

APPENDIX A - List fields "External Calibration Manager"

<table>
<tr><th>Designation / Column</th><th colspan="2">Description</th></tr>
<tr><td>Available points</td><td colspan="2"></td></tr>
<tr><td></td><td colspan="2">This list shows all the EPOS units (measuring systems) logged into and active on the EPOS system.
EPOS units with an error status are greyed.</td></tr>
<tr><td rowspan="5">Slot</td><td colspan="2">Designation of the measuring system; the following measuring systems are possible:</td></tr>
<tr><td>EPOS-L</td><td>EPOS HBD unit left</td></tr>
<tr><td>EPOS-R</td><td>EPOS HBD unit right</td></tr>
<tr><td>EPOS-F1</td><td>EPOS HWD1 unit</td></tr>
<tr><td>EPOS-F2</td><td>EPOS HWD2 unit</td></tr>
<tr><td>Temperatures</td><td colspan="2">Temperature values in °C at which the last external calibration was performed.</td></tr>
<tr><td>Date</td><td colspan="2">Date of the last external calibration.</td></tr>
<tr><td>Details</td><td colspan="2">This list displays the digital values of the last external calibration for the measuring system selected in "Available Points":</td></tr>
<tr><td rowspan="3"></td><td>Temp</td><td>Temperature value in °C for external calibration</td></tr>
<tr><td>AD</td><td>Corresponding digital values for the detector elements (E1, E2, …)</td></tr>
<tr><td>Date</td><td>Date and time of the last external calibration of the selected measuring systems</td></tr>
<tr><td>Select</td><td colspan="2">Dropdown list for selecting preselected temperature values in °C.

You can also define new temperature values. To do so, type a new temperature value in the numeric field and then perform external calibration with this value. The system stores this default value.</td></tr>
<tr><td>Add</td><td colspan="2">Clicking this button tells the system to start a measuring cycle and assign the digital values measured to the preselected measurement value in °C.
A calibration radiator with its temperature set to exactly this defined value must be located above the measuring system.</td></tr>
<tr><td>Remove</td><td colspan="2">Deletes the selected defined value</td></tr>
<tr><td>Remove all</td><td colspan="2">Deletes all defined values</td></tr>
</table>

END

Includes:	EPOS - RSR123 Wheel Sensor (HABD)
Excludes:	All other uses of the RSR123 Wheel Sensor

1. Voltage adjustment RSR123

1.1 The voltage adjustment via software is performed using the application "Satellite Management UI" Application.

1.2 Open the "Satellite Management UI" application by double clicking the corresponding “satGUI” icon on the desktop of the FUES-EPOS system.

1.3 Open the "Calibration" menu and click "Wheel sensor calibration” and a second drop-down menu showing “RR", “MK” or “GR” appears, click as required. See Figure 1.

If several wheel sensors need adjusting, use "All" to adjust all wheel sensors at the same time.

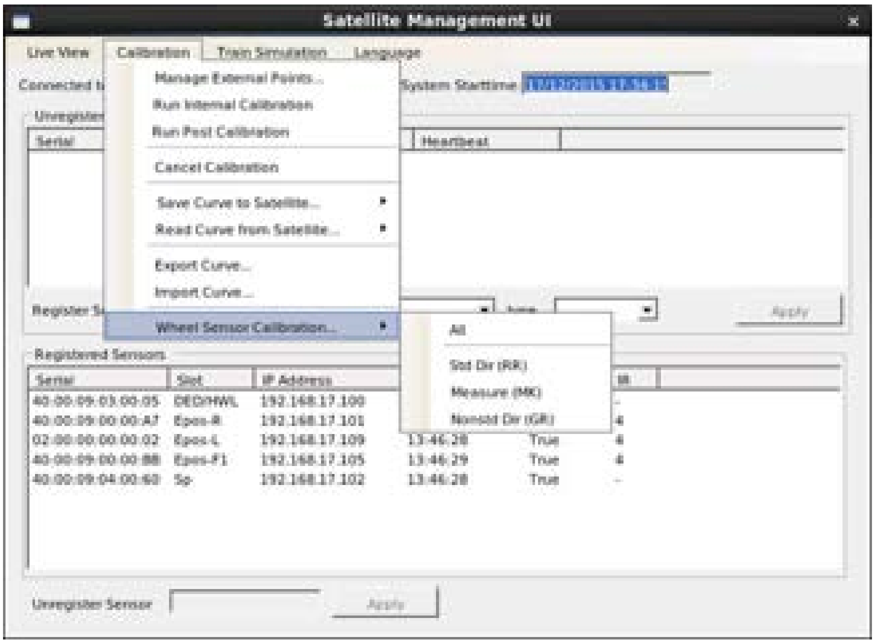


Figure 1 - Voltage adjustment of RSR123 – via software

1.4 Making a selection starts the process.

a) The status of the adjustment is displayed by a progress bar.

b) The completion of the adjustment is displayed by pop-up window.

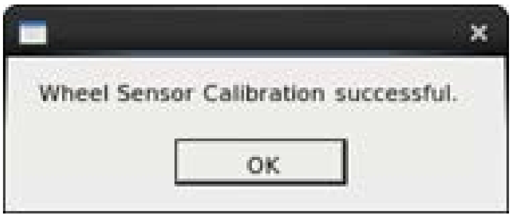


Figure 2 - Pop-up window after completion of the adjustment

END

SERVICE A TESTS

Details of the indications to be expected can be found in Appendix A

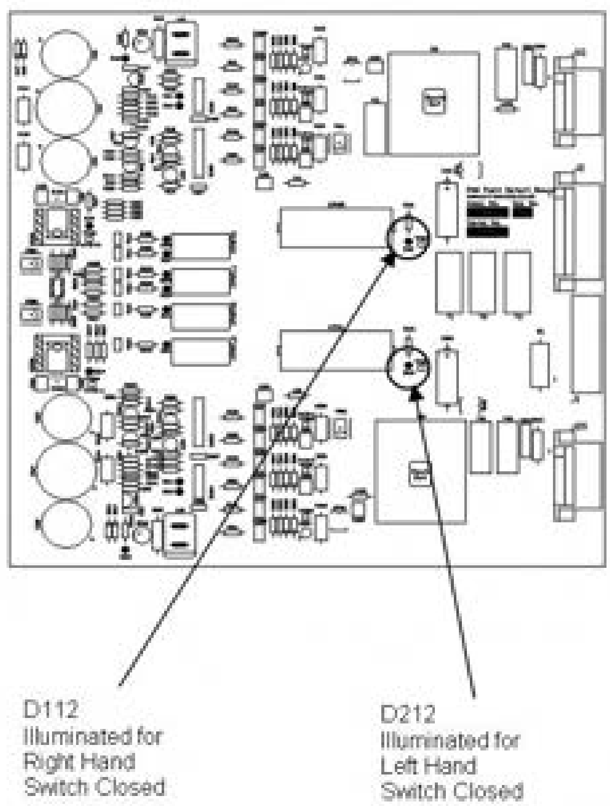
1. Test

1.1 Operate the points normal and reverse in turn and check that the Points Operating Module (POM) indications (Figure 1) and the Points Adaptor Module (PAM) detection relays (Figure 2) correspond with the lie of the points.

1.2 Check the position of the Signallers control device for the points and the Signallers indications correspond with the lie of the points.

APPENDIX A - Equipment Identification

Figure 1 - Point Operating Module (POM)



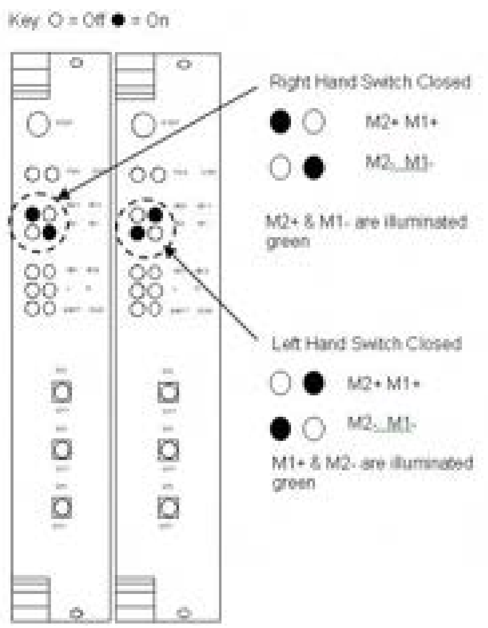


Figure 2 - Points Detect Module (PAM)

END

Details of the location of indications and push buttons can be found in Appendix A.

Abbreviations

LHSC: Left hand switch closed RHSC: Right hand switch closed

SERVICE B TESTS

1. Test

1.1 Check that the points operate correctly with no faults indicated or observed.

1.2 Move the points to the RHSC position. Check that D112 is illuminated and D212 extinguished.

1.3 Remove the lightning suppressors 4 & 5 to disconnect the PAM 4-wire interface.

1.4 Press PB21 and hold for approximately 1 second.

This will generate a simulated fault in the LHSC safety relay. D109/209 will illuminate and D111/211 will extinguish.

1.5 Perform a continuity check at the PAM side (top) of the terminal rail, to verify the following configuration (Figure 1):

a) Terminals 10, 12, & 15 connected together.

b) Terminal 13 not connected.

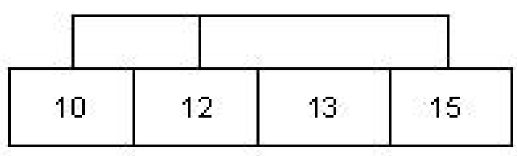


Figure 1 – Configuration 1

1.6 Remove and re-instate the auxiliary power to the Points Adaption Module (PAM) at terminals 54 &55. D109/209 will extinguish and D111/211 will illuminate, as for normal operation. The bi- stable fault relays shall both still be set.

1.7 Perform a continuity check at the PAM side (top) of the terminal rail, to verify the following configuration (Figure 2):

- Terminals 10, 12, 13 & 15 connected together.

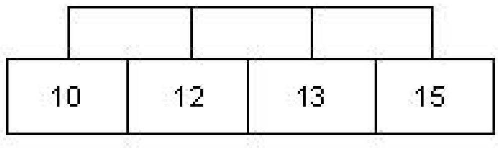


Figure 2 – Configuration 2

1.8 Press PB10. D110 should flash momentarily and the RHSC bi-stable fault relay should be reset.

1.9 Perform a continuity check at the PAM side (top) of the terminal rail, to verify the following configuration (Figure 3):

- Terminal 10,12,13,15 connected together

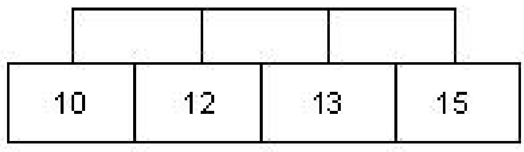


Figure 3 – Configuration 3

1.10 Press PB20. D210 should flash momentarily and the LHSC bi-stable fault relay should be reset.

1.11 Perform a continuity check at the PAM side (top) of the terminal rail, to verify the following configuration (Figure 4):

a) Terminal 10 connected to terminal 13

b) Terminal 12 connected to terminal 15

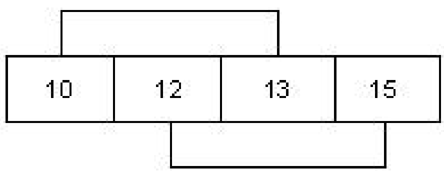


Figure 4 – Configuration 4

1.12 Replace lightning suppressors 4 & 5 to re-connect the PAM 4-wire interface.

1.13 Move the points to the LHSC position. D212 should be illuminated and D112 extinguished.

1.14 Remove lightning suppressors 4 & 5 to disconnect the PAM 4-wire interface.

1.15 Press PB 11 and hold for approximately 1 second.

This will generate a simulated fault in the RHSC safety relay. D109/209 will illuminate and D111/211 will extinguish.

1.16 Perform a continuity check at the PAM side (top) of the terminal rail, to verify the following configuration (Figure 5):

a) Terminal 10, 12, & 15 connected together.

b) Terminal 13 not connected.

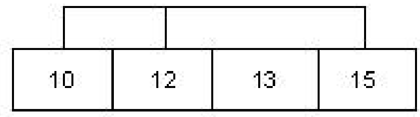


Figure 5 – Configuration 5

1.17 Remove and re instate the auxiliary power to the PAM at terminals 54 & 55. D109/209 will extinguish and D111/211 will illuminate, as for normal operation. However, the bi-stable fault relays shall still be set.

1.18 Perform a continuity check at the PAM side (top) of the terminal rail, to verify the following configuration (Figure 6):

- Terminals 10, 12, 13 & 15 connected together

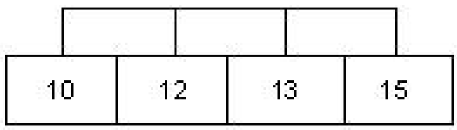


Figure 6 – Configuration 6

1.19 Press PB 20. D210 should flash momentarily and the LHSC bi-stable fault relay should be reset.

1.20 Perform a continuity check at the PAM side (top) of the terminal rail, to verify the following configuration (Figure 7):

- Terminals 10, 12, 13 & 15 connected together

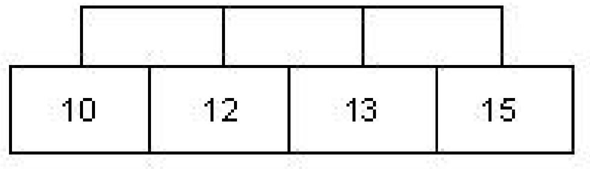


Figure 7 – Configuration 7

1.21 Press PB 10. D110 should flash momentarily and the RHSC bi-stable fault relay should be reset.

1.22 Perform a continuity check at the PAM side (top) of the terminal rail, to verify the following configuration (Figure 8):

a) Terminal 10 connected to terminal 12

b) Terminal 13 connected to terminal 15

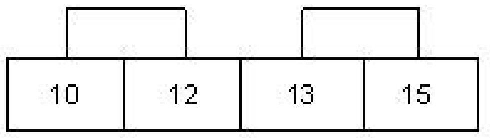


Figure 8 – Configuration 8

1.23 Replace lightning suppressors 4 & 5 to re- connect the PAM 4-wire interface.

NOTE: *It is important that all continuity testing is conducted at the top of the terminal rail. (i.e. the PAM side of the WAGO links).*

If the continuity testing is conducted on the wrong side of the WAGO links (incoming cable side), then the points detect module will not be tested correctly. This may also cause the POM to go in to error mode.

APPENDIX A - Point Detection Module

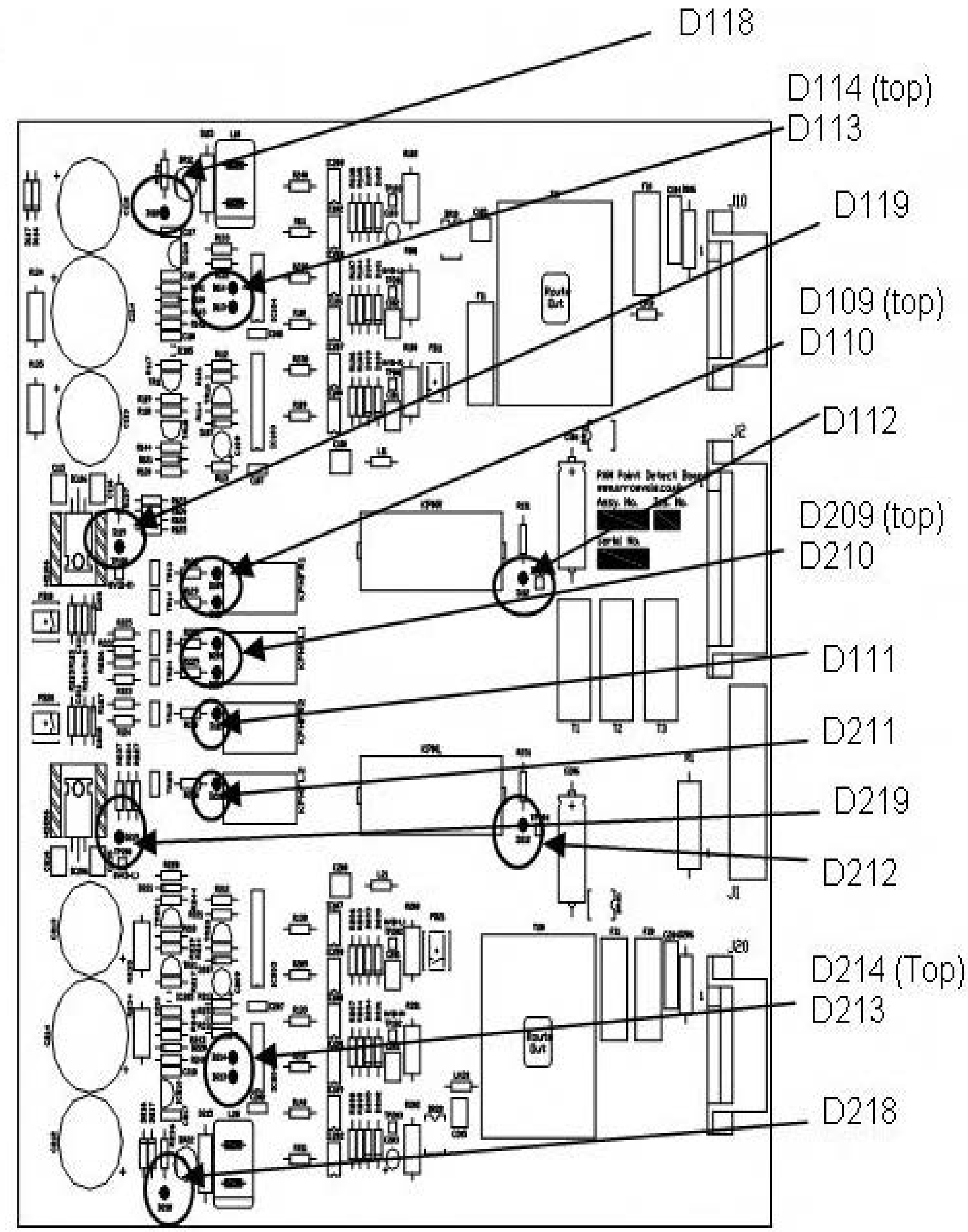


Figure 9 - The position of the LED indicators on the point detection module

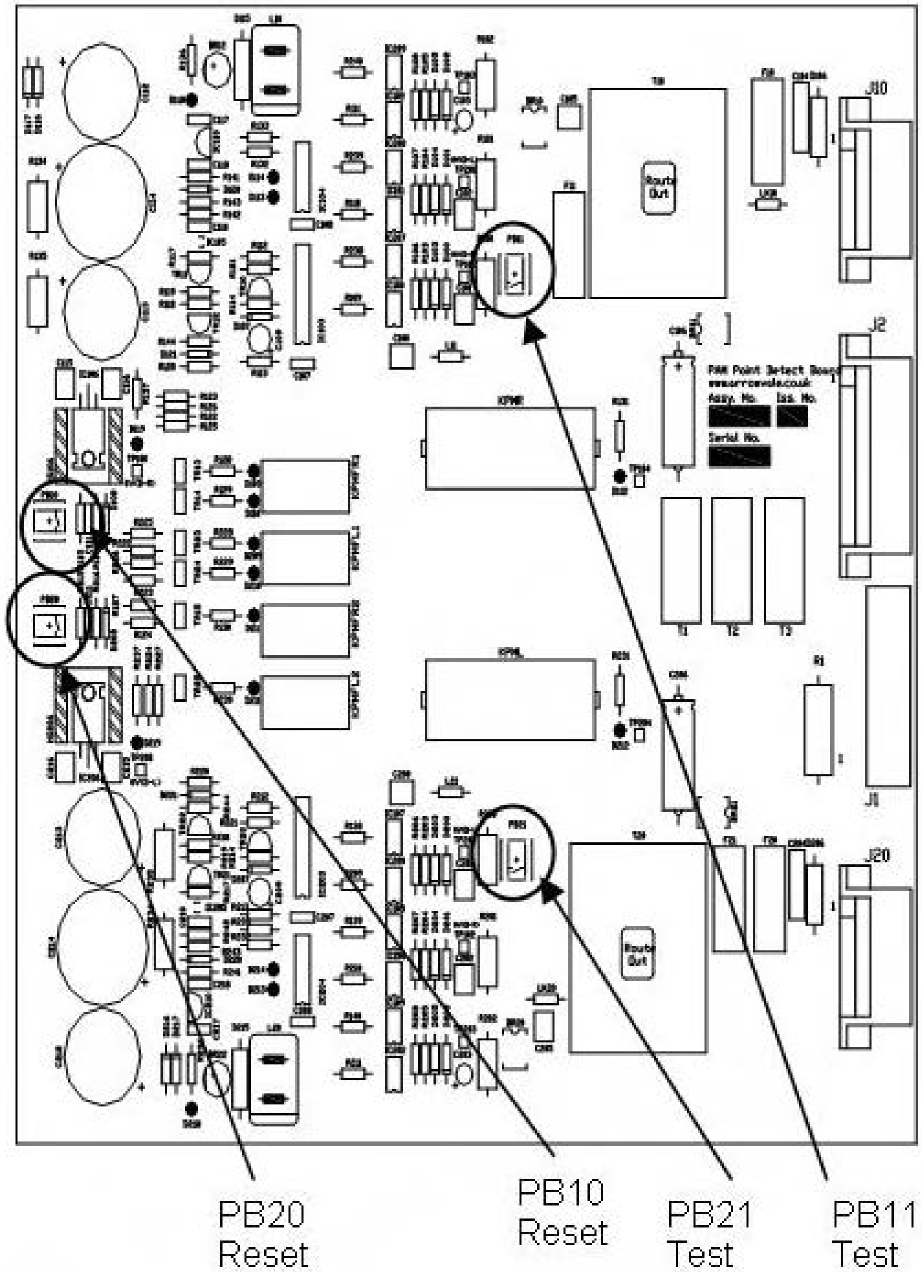


Figure 10 - The location of the push buttons on the point detector module

END

Details of the waveforms and connection of the dummy load resisters can be found in Appendix A.

Equipment Required Fluke 199 Scopemeter LEM PR 30 Current Probe.

1. Test

1.1 Connect the LEM current probe to Channel A of the Scopemeter and switch on both the Scopemeter and the probe.

1.2 Set up the equipment as follows:

a) Set channel A to be scaled in Amps.

b) Adjust the current probe offset to zero using the Scopemeter.

c) Set the Scopemeter to 500ms/div (with a 500ms pre-trigger) and a vertical scale of 1A/div.

d) Set the trigger to channel A (positive edge), 0.5A and single shot.

1.3 Connect the current probe to terminal 15 (connection L2 of the 4 wire interface).

1.4 Move the point machine in both directions and check that the envelope of the current waveform is always greater than 2.0A throughout the movement.

a) If this is the case (see Appendix A, Figure 1) then the dummy load resistors are not required.

b) If this is not the case (see Appendix A Figure 2) then the dummy resistors shall be connected in circuit.

1.5 If the dummy load resistors have been fitted, repeat 1.4 to check the current waveform is now correct.

1.6 Connect the current probe to terminal 12 (N connection of the 4 wire interface).

1.7 Move the points in both directions and check the envelope of the current waveform.

A distinct “blip” should be noticeable at the end of the waveform (see Appendix A Figure 3), this signifies that the point has reached its end position under power and the load resistors do not have to be fitted.

1.8 If this “blip” is not observed at the end of the waveform (see Appendix A, Figure 4 4), this would suggest that the points operating module has switched off power prematurely and the point machine is “freewheeling” into position.

This is not an acceptable condition and the dummy load resistors shall be connected in circuit.

1.9 If dummy load resistors have been fitted, repeat 1.7 to confirm the current waveform is now correct.

APPENDIX A - Scope Traces

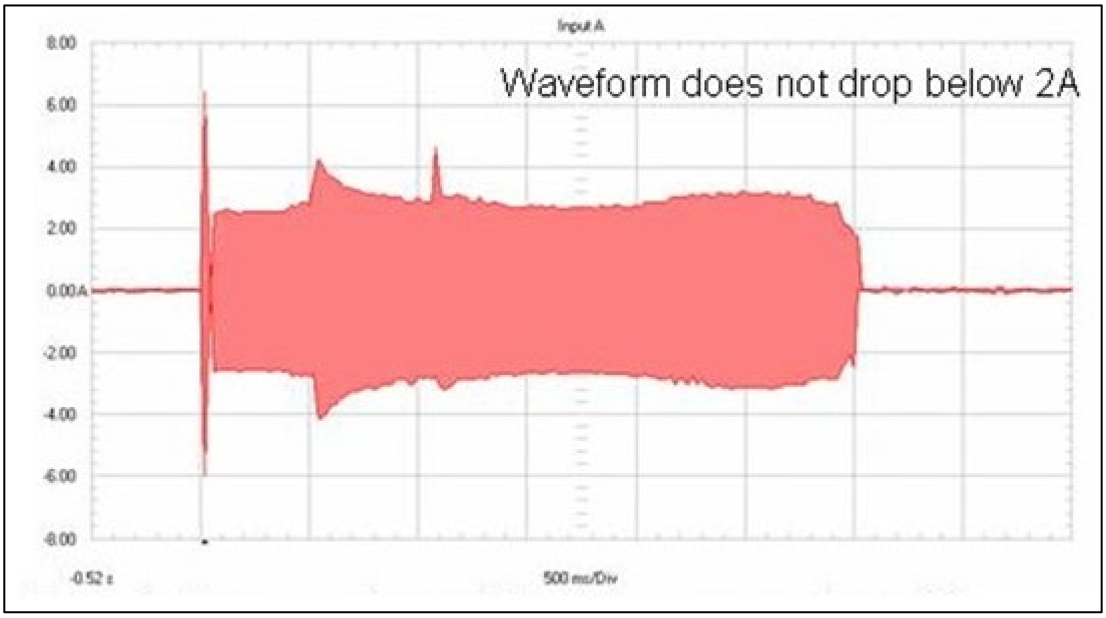


Figure 1 – Trace 1: Current probe on L2, running current above 2A
Dummy load resistors not necessary

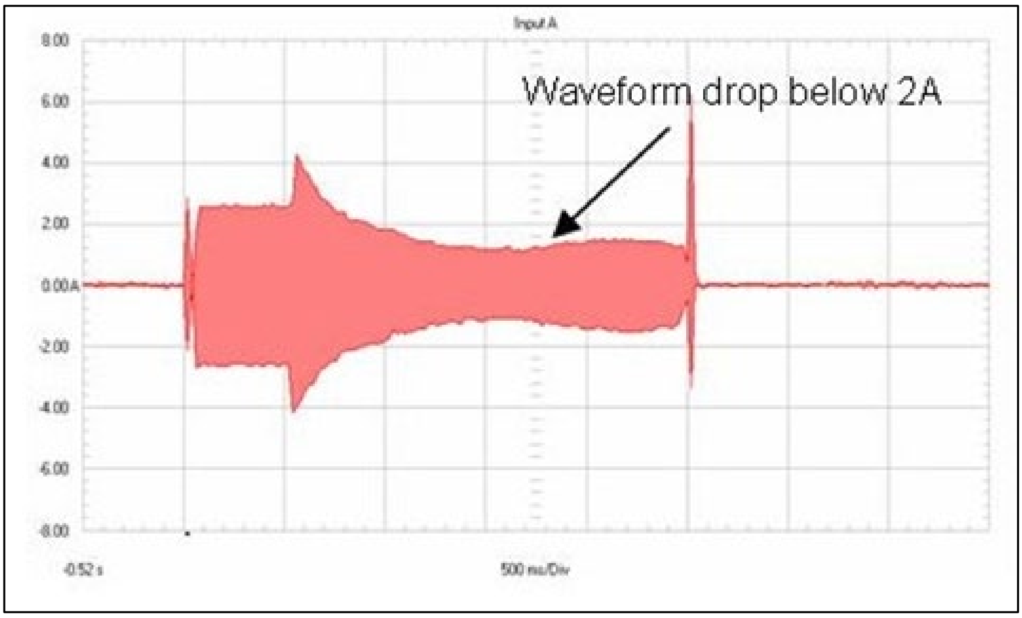


Figure 2 – Trace 2: Current probe L2, running current 2A
Dummy load resistors necessary

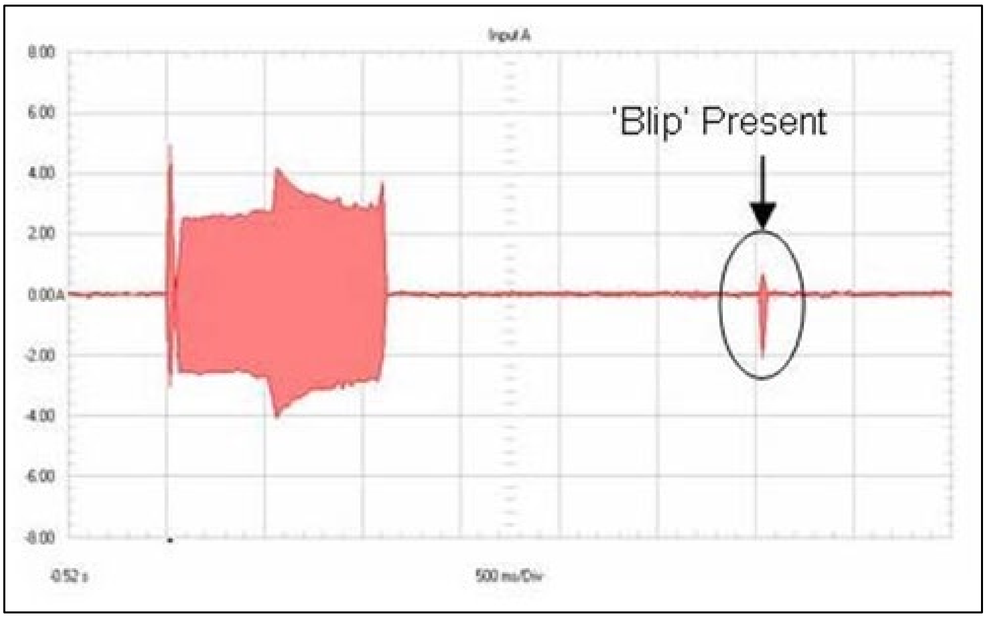


Figure 3 – Trace 3: Current probe on N, correct operation
Dummy load resistors not necessary

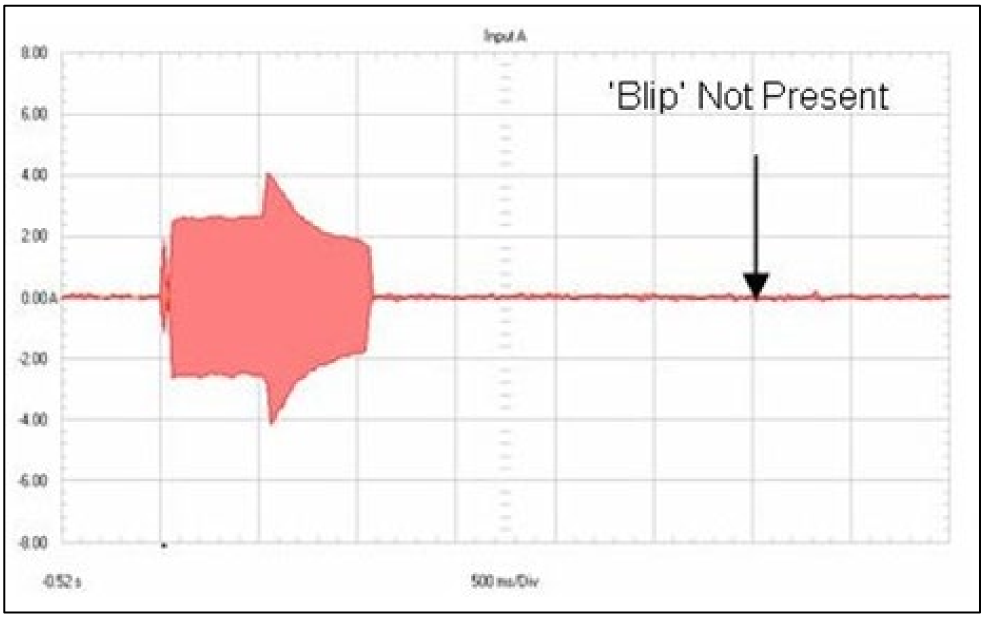


Figure 4 – Trace 4: Current probe N, Incorrect Operation
Dummy load resistors necessary

Connection of dummy load resistors.

1. Isolate the Points Adaption Module.
2. Remove the protective plastic cover protecting the motor power module.
3. Move the connection from J11 to J10, J13 to J12 and J15 to J14.
4. Replace the protective plastic cover protecting the motor power module.
5. Reconnect the Points Adaption Module.

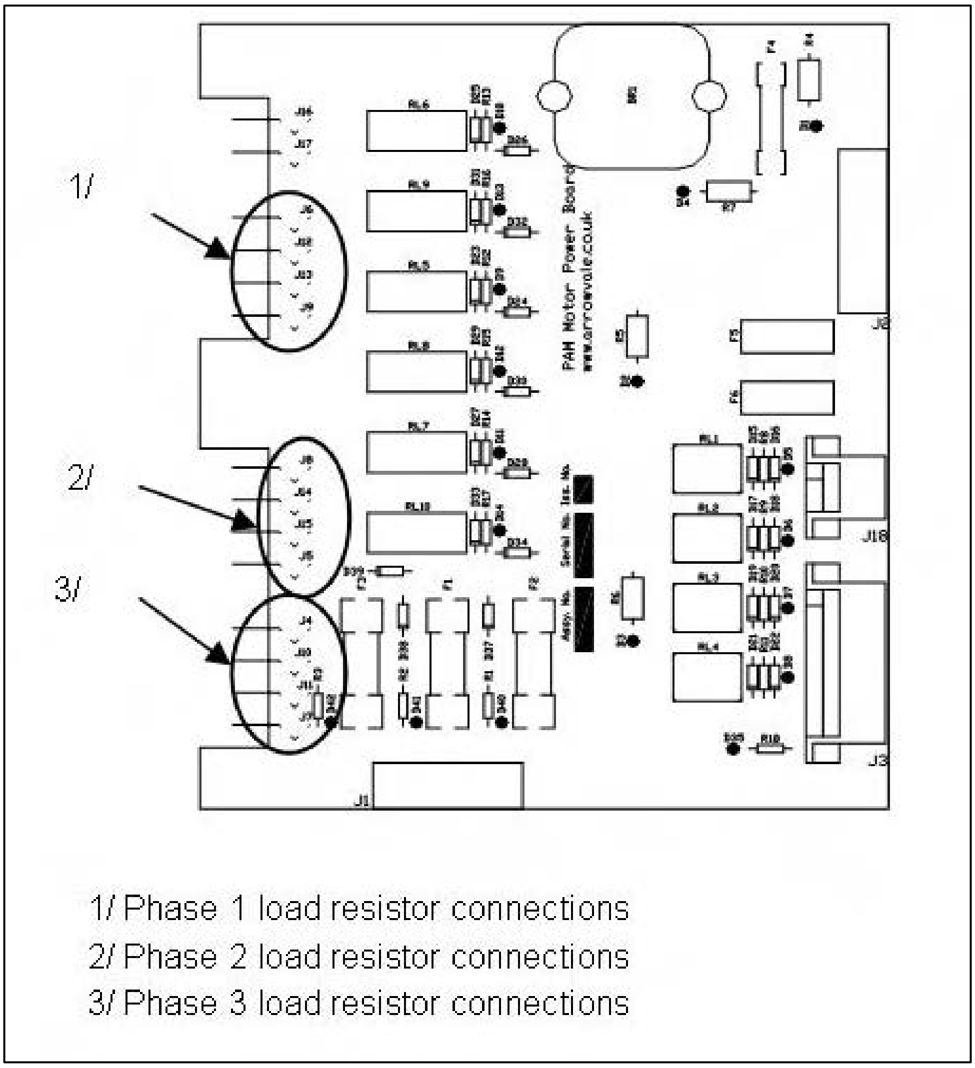


Figure 5 – Motor Power Module

END

Additional information on the KVB test set can be found in SMS Appendix 23

1 Balise Test

1.1 A balise test requires the test tool to be set flat on the balise along its longitudinal axis, after turning on the tester, the following message is displayed;

		A	P	P	U	Y	E	R		s	u	r		L	E	C	T		
			p	o	u	r		d	e	c	l	e	n	c	h	e	r		
							l	e		t	e	s	t						

1.2 Pressing the ‘LECT’ (read) key initiates the 27.115MHz signal towards the Balise to allow reception of a complete message.

Marker Balise

When the tester recognises a message from a Marker Balise, the display is as follows:

					M	A	R	Q	U	E	U	R							

Fixed or Switchable Balise

When the tester recognises a Fixed or Switchable Balise, with triplet data being transmitted, the display is as follows:

A	:	[	>	<	-	]													
X	:	5	M	E	9	4													
Y	:	C	M	2	1	D													
Z	:	7	M	4	0	1													

1.3 Observe the message being displayed on the KVB test set and confirm it is correct by comparing the DCO files and the signal aspect displayed.

1.4 To return to start, press ‘ECHAP’ (escape) Key.

2 “Presence train” Test, from the Balise

This test is intended to replicate the presence of a train. This is achieved by illuminating the yellow LED on the front face of the encoders UCS card when one of the balise’s driven by this encoder is energized by the test tool.

Due to the speed of the train, the energization time is too short for the LED to be seen lit by an observer.

2.1 A ‘presence train’ test requires the test tool to be set flat on the balise along its longitudinal axis, after turning on the tester, the following message is displayed;

```
  APPUYER sur LECT
   pour declencher
       le test
```

2.2 Press ‘1’ and the display will show the following message;

```
TEST PRESENCE TRAIN

maintenir LECT
    pendant le test
```

(Presence train test – Keep pressing LECT (read) during the test)

2.3 With one person at the balise, and one person at the encoder, Press and hold the ‘LECT’ (read) and check the yellow LED illuminates.

2.4 Return to main menu by releasing the ‘LECT’ (read) key and press ‘ECHAP’ (escape) Key.

3 Test of Encoder Output at Tail Cable

3.1 The tool must be connected to the end of the tail cable at the plug coupler of the balise, after turning on the tester, the following message is displayed:

```
  APPUYER sur LECT
   pour declencher
     le test
```

3.2 Press ‘LECT’ (read) to read the message coming from the encoder.

3.3 Compare message displayed to the DCO/Wiring Diagrams.

3.4 To return to start, press ‘ECHAP’ (escape) Key.

3.5 Repeat steps above for different aspects/messages if required.

4 Test from SBI Maintenance Card.

4.1 Connecting the tester to the SBI maintenance card, after turning on the tester, the following message is displayed:

	T	E	S	T		S	U	R		C	O	D	E	U	R		N		:
E	n	t	r	e	r		l	e		n	u	m	é	r	o		d	e	
l	a		s	o	r	t	i	e		a		t	e	s	t	e	r		
t	o	u	c	h	e	:		1	,		2	,		3		o	u		4

(Test on encoder N – Enter the output number to be tested – Key 1, 2, 3 or 4).

4.2 Choose the output that requires testing by pressing the relevant output key.

Pressing on any key ‘1’, ‘2’, ‘3’, or ‘4’ causes the tool to communicate towards the relevant output.

4.3 To return to start, press ‘ECHAP’ (escape) Key.

END

Includes:	Electromagnetic Lock when used at Level Crossing
Excludes:	All other Electromagnetic Lock Test

1. Indications Test

1.1 Check the crossing keeper/signallers crossing indication is illuminated when gate is closed and locked. Now check the following :

a) The alarm sounds within 3 seconds when gates are not locked.

b) The indication light does not illuminate when gate is closed and not locked.

c) The audible warning sounds and the fault light indications illuminate when gate is closed but not locked.

d) The audible warning can be cancelled by pressing the alarm acknowledge push button

e) Repeat 1.1 steps a) to d) for each crossing gate.

2. The Hall Effect Switch Test

2.1 Open the gate and place a single plastic blue .002mm disposable gauge between the lock and the armature (Figure 1) and carry out the following: -

Figure 1 - Magnetic lock mechanism

a) Energise the lock and observe that after approximately three seconds the audible warning sounds in the signal box and the fault light indications illuminates **do not** sound or illuminate.

b) Check that two people pushing each gate cannot force the gates open (Figure 2).

The gate should be pushed by applying pressure to the gate from a standing position, without jarring or shoving.

c) De-energise the lock and remove the gauge.

Figure 2 - Push Test

d) Repeat for all other gates.

2.2 After this test is complete recheck indications and audible alarms are functioning correctly for each gate before leaving site.

The plastic gauge shall only be used for one level crossing and disposed of. A new gauge shall be used for subsequent testing at other level crossings.

END

Includes:	Phoenix MD sensors only
Exclude:	All other types of HABD Sensor

The Variotherm works from a 230v supply.

The sensors shall have been in continuous operation for at least 1 hour before the test (2 hours if they have been switched off for more than half an hour).

Calibration Test

An on-site recalibration of the sensors can be undertaken to adjust any drift in measured values within reasonable limits.

Recalibration is only permitted in “Super” mode. The system / sensors are required to be stable before calibration is commenced.

Recalibration involves four steps:

1 Measured Values : Comparing measured values against a reference value

2 Determining the correction values

3 Transferring the correction values to the sensor.

4 Checking the results.

1 Measured Values

1.1 Select “Super” from the System Menu.

1.2 Select “DiMo” from the SCT Menu.

1.3 Maximise the DiMo window.

1.4 Enter the command “Testmode ON” to suppress data to the Signaller.

<u>**HDB1 Low Value**</u>

1.5 Enter the command “NKAL H1 ON” to suppress auto-calibration.

1.6 Enter the command “KASTFULL H1”

The SCT symbol will change from M to S whilst the standardisation is running, then to M again.

1.7 Enter the command “NACHKAL H1 ON” to commence calibration for the respective sensor under test.

1.8 Place the Heat Source on the sensor and check it is fitted correctly.

1.9 Set to the desired temperature of 60ºC.

1.10 Enter the command “MMS H1 ON” to commence reading the measured values of the sensor under test. Once the incoming values appear to be stable stop reading the measured values by entering the command “MMS H1 OFF”.

1.11 Measure and record the value in the calibration section of the paper or digital record card.

HDB1 High Value

1.12 Adjust to the desired temperature of 110ºC.

1.13 Enter the command “MMS H1 ON” to commence reading the measured values of the sensor under test. Once the incoming values appear to be stable stop reading the measured values by entering the command “MMS H1OFF”.

1.14 Measure and record the value in the calibration section of the paper or digital record card.

HDB2 Low Value

1.15 Allow the Heat Source time to cool below 60ºC.

1.16 Enter the command “NKAL H2 ON” to suppress auto-calibration.

1.17 Enter the command “KASTFULL H2”.

1.18 Enter the command “NACHKAL H2 ON” to commence calibration for the respective sensor under test.

1.19 Place the Heat Source on the sensor and check it is fitted correctly.

1.20 Adjust the Heat Source to 60ºC.

1.21 Enter the command “MMS H2 ON” to commence reading the measured values of the sensor under test. Once the incoming values appear to be stable stop reading the measured values by entering the command “MMS H2OFF”.

1.22 Measure and record the value in the calibration section of the paper or digital record card.

HDB2 High Value

1.23 Adjust the Heat Source to 110ºC.

1.24 Enter the command “MMS H2 ON” to commence reading the measured values of the sensor under test. Once the incoming values appear to be stable stop reading the measured values by entering the command “MMS H2 OFF”.

1.25 Measure and record the value in the calibration section of the paper or digital record card.

HWD1 Low Value

1.26 Enter the command "NKAL F1 ON" to suppress auto-calibration.

1.27 Enter the command "KASTFULL F1".

1.28 Enter the command "NACHKAL F1 ON" to commence calibration for the respective sensor under test.

1.29 Place the Heat Source on the rail sensor and check it is fitted correctly.

1.30 Adjust the Heat source to 200ºC.

1.31 Enter the command "MMS F1 ON" to commence reading the measured values of the sensor under test. Once the incoming values appear to be stable stop reading the measured values by entering the command "MMS F1 OFF".

1.32 Measure and record the value for channels 1 to 4 in the calibration section of the paper or digital record card.

1.33 Place the Heat Source on the centre sensor and check it is fitted correctly.

1.34 Enter the command "MMS F1 ON" to commence reading the measured values of the sensor under test. Once the incoming values appear to be stable stop reading the measured values by entering the command "MMS F1 OFF".

1.35 Measure and Record the value for channels 5 to 8 in the calibration section of the paper or digital record card

HWD1 High Value

1.36 Adjust the Heat source to 350ºC.

1.37 Enter the command "MMS F1 ON" to commence reading the measured values of the sensor under test. Once the incoming values appear to be stable stop reading the measured values by entering the command "MMS F1 OFF".

1.38 Measure and Record the value for channels 1 to 4 in the calibration section of the paper or digital record card.

1.39 Place the Heat Source on the centre sensor and check it is fitted correctly.

1.40 Enter the command "MMS F1 ON" to commence reading the measured values of the sensor under test. Once the incoming values appear to be stable stop reading the measured values by entering the command "MMS F1 OFF".

1.41 Measure and Record the value for channels 5 to 8 in the calibration section of the paper or digital record card.

<u>HWD2 Low Value</u>

1.42 Allow the Heat Source time to cool below 200ºC.

1.43 Enter the command “NKAL F2 ON” to suppress auto-calibration.

1.44 Enter the command “KASTFULL F2”.

1.45 Enter the command “NACHKAL F2 ON” to commence calibration for the respective sensor under test.

1.46 Place the Heat Source on the rail sensor and check it is fitted correctly.

1.47 Adjust the Heat source to 200ºC.

1.48 Enter the command “MMS F2 ON” to commence reading the measured values of the sensor under test. Once the incoming values appear to be stable stop reading the measured values by entering the command “MMS F2 OFF”.

1.49 Measure and record the value for channels 1 to 4 in the calibration section of the paper or digital record card.

1.50 Place the Heat Source on the centre sensor and check it is fitted correctly.

1.51 Enter the command “MMS F2 ON” to commence reading the measured values of the sensor under test. Once the incoming values appear to be stable stop reading the measured values by entering the command “MMS F2 OFF”.

1.52 Measure and Record the value for channels 5 to 8 in the calibration section of the paper or digital record card.

2 Determining Correction Values

2.1 Double-click on the “Nachkal” icon on the Windows user interface. A screen titled “Phoenix MB Nachkalibrierung” will be displayed.

2.2 Select the sensor that you wish to enter values for by clicking on the respective target.

2.3 Enter the temperature values that you have noted down for each respective channel against the correct measured temperature.

2.4 After entering the values for both temperature settings click the “Calculate” button. The values for offset and gain for each channel will be calculated and displayed.

2.5 Click “OK” and the measured values are tested against offset and gain limits. These limits are listed as follows:

- HBD Limits = [-15< Offset < 15], [0.8 < Gain < 1.2]
- HWDSB = [-30< Offset < 30], [0.8 < Gain < 1.2]

2.6 If the measured values pass this test the correction values is written to the hard disk. Follow the on screen commands to terminate the program.

3 Transferring Correction Values to Sensor

Enter the command "NACHKAL H1 OFF" in the DiMo window.

This transfers the values stored on the hard disk drive to the appropriate sensor.

At this stage the process ends for one sensor and needs to be repeated for each of the other sensors.

4 Checking the Results

In the following sections If an "x" is shown in a command it should be substituted for the following alphanumeric code associated with the sensor being worked on:

a) For HBD1 = H1
b) For HBD2 = H2
c) For HWD1 = F1
d) For HWD2 = F2

4.1 Enter the command "PRE x" in the DiMo window.

This reads the sensor date from the flash memory.

4.2 Then enter the command "DPA x". This displays the most recent data read from the sensor.

4.3 The lines beginning with Gain and Offset display the correction values for each of the 8 channels.

4.4 The offset is a number divided by 100 whilst the gain is indicated by a number divided by 1000 (e.g. an Offset 123 equals 1.23 whilst a Gain 985 corresponds to 0.985).

4.5 Record the results on the appropriate paper or digital record card.

5 System Closure

5.1 Enter the command "Testmode OFF" in the DiMo window.

5.2 Enter the command "NKAL x OFF" to enable auto-calibration.

5.3 Enter the command "E" in the DiMo window to close the DiMo application.

End

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part E/Test /212		
Phoenix MD Accuracy Test		
Issue No. 1	Issue Date: 03/03/18	Compliance Date: 31/05/18

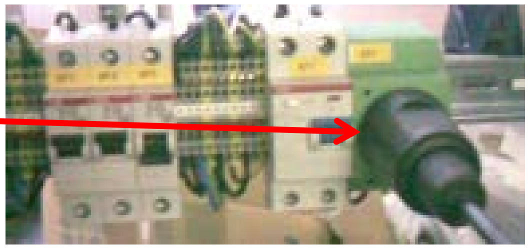
Includes:	Phoenix MD sensors only
Exclude:	All other types of HABD Sensor

The Variotherm works from a 230v supply.

The sensors shall have been in continuous operation for at least 1 hour before the test (2 hours if they have been switched off for more than half an hour).

1 Accuracy Test

1.1 Connect the Variotherm power supply to the socket in the SCT.



1.2 Check the mirrors are clean before the accuracy test is started.

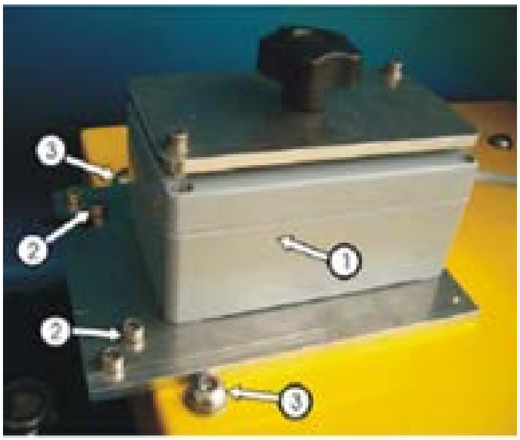
1.3 Switch the SCT to “test mode” to switch off error message reporting during the test.

Do not close the DiMo window.

1.4 Position a Variotherm heat source (1) on top of sensor HBD1.

1.5 The screws (2) shall be touching the sensor hood.

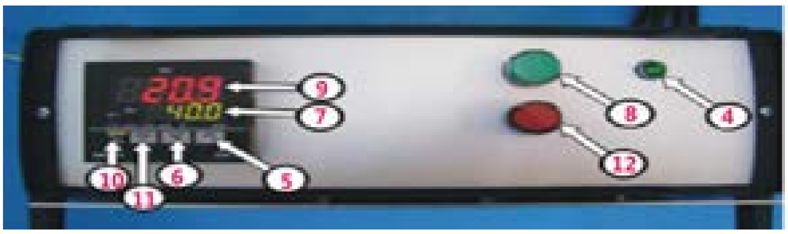
1.6 The Variotherm heat source (1) shall be positioned between the sensor hood screws (3).



1.7 Check the Variotherm Unit’s green power LED is Illuminated (4).

1.8 Using the up and down keys (5 & 6), set the target temperature to 70ºC (7).

1.9 Press green button (7) to activate the heater.



Actual temperature is shown (9).

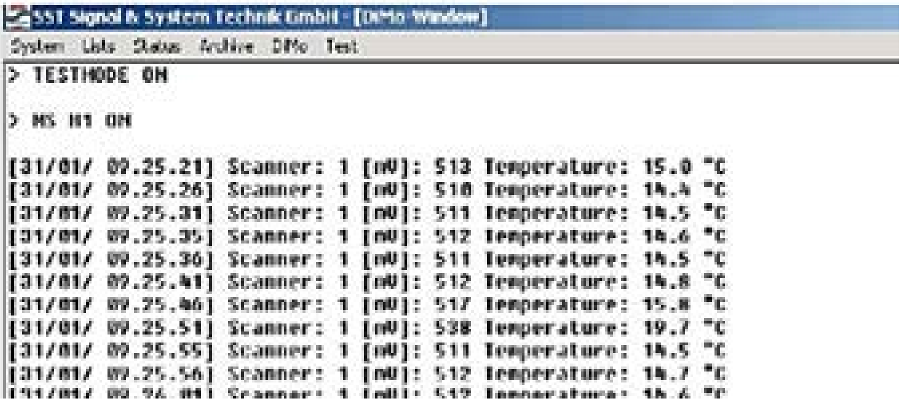
Do not press buttons 10 or 11, as they can affect the calibration.

The red button (12) switches the heater off

1.10 When the temperature shown by the Variotherm panel reaches 70ºC, move to the DiMo window and enter the command "MS H1 ON" and press enter.

H1 Addresses HBD1.

1.11 The HABD will report a temperature measurement every few seconds, and these measurements will be displayed in the DiMo window (Shown below).



1.12 When the readings have settled, stop the measuring process by entering the command "MS H1 OFF".

1.13 Measure and record the temperature on the appropriate paper or digital record card.

If the temperature falls outside the nominal value of 70ºC +/- 3ºC then you shall stop this test and carry out a full Calibration Test as shown in NR/SMS/Test 211.

1.14 Power down the Variotherm heat source using the red button before moving to the correct position on the top of the HBD2 sensor.

1.15 Press green button to activate the heater.

1.16 Using the up and down keys, check the target temperature is still set to 70ºC.

1.17 When the temperature shown by the Variotherm panel reaches 70ºC, move to the DiMo window and enter the command "MS H2 ON" and press enter.

H2 Addresses HBD2.

1.18 When the readings have settled, stop the measuring process by entering the command "MS H2 OFF".

1.19 Measure and record the temperature on the appropriate paper or digital record card.

1.20 If the temperature falls outside the nominal value of 70ºC +/- 3ºC then you shall stop this test and carry out a full Calibration Test as shown in NR/SMS/Test 211.

1.21 Leaving the Variotherm Heat source on HBD2 Use the up and down keys, move the target temperature to 120ºC.

1.22 When the temperature shown by the Variotherm panel reaches 120ºC, move to the DiMo window and enter the command “MS H2 ON” and press enter.

1.23 The HABD will report a temperature measurement every few seconds, and these measurements will be displayed in the DiMo window.

1.24 When the readings have settled, stop the measuring process by entering the command “MS H2 OFF”.

1.25 Measure and record the temperature on the appropriate paper or digital record card.

1.26 If the temperature falls outside the nominal value of 120ºC +/- 5ºC then you shall stop this test and carry out a full Calibration Test as shown in NR/SMS/Test 211.

1.27 Power down the Variotherm heat source using the red button before moving to the correct position on the top of the HBD1 sensor.

1.28 Press green button to activate the heater.

1.29 Using the up and down keys, check the target temperature is still set to 120ºC.

1.30 When the temperature shown by the Variotherm panel reaches 120ºC, move to the DiMo window and enter the command “MS H1 ON” and press enter.

1.31 When the readings have settled, stop the measuring process by entering the command “MS H1 OFF”.

1.32 Measure and record the temperature on the appropriate paper or digital record card.

1.33 If the temperature falls outside the nominal value of 120ºC +/- 5ºC then you shall stop this test and carry out a full Calibration Test as shown in NR/SMS/Test 211.

1.34 Power down the Variotherm heat source using the red button before moving to the correct position on the top of the HWD1 sensor.

1.35 Press green button to activate the heater.

1.36 Using the up and down keys, set the target temperature to 300ºC.

1.37 When the temperature shown by the Variotherm panel reaches 300ºC, move to the DiMo window and enter the command “MMS F1 ON” and press enter.

1.38 When the readings have settled, stop the measuring process by entering the command “MMS F1 OFF”.

1.39 Measure and record the temperature on the appropriate paper or digital record card.

1.40 If the temperature falls outside the nominal value of 300ºC +/- 10ºC then you shall stop this test and carry out a full Calibration Test as shown in NR/SMS/Test 211.

1.41 Power down the Variotherm heat source using the red button before moving to the correct position on the top of the HWD1 sensor.

1.42 Press green button to activate the heater.

1.43 Using the up and down keys, check the target temperature is still set to 400ºC.

1.44 When the temperature shown by the Variotherm panel reaches 400ºC, move to the DiMo window and enter the command “MMS F2 ON” and press enter.

1.45 When the readings have settled, stop the measuring process by entering the command “MMS F2 OFF”.

1.46 Measure and record the temperature on the appropriate paper or digital record card.

1.47 If the temperature falls outside the nominal value of 400ºC +/- 5ºC then you shall stop this test and carry out a full Calibration Test as shown in NR/SMS/Test 211.

1.48 If all temperature values fall within their respective nominal values there is no need to carry out a full Calibration Test.

End

Includes:	TPWS Modules or Transmitters
Excludes:	TPWS Self Powered OSS Module (SPOSS)

GENERAL

All tests requiring TPWS Transmitter Loop field strength and frequency measurements shall use a test meter approved for use with TPWS equipment.

The multimeter shall be set to the correct range to accurately measure frequency with a minimum resolution of 1 Hz.

All test measurements shall be recorded on the TPWS Test record card.

When the power supply to TPWS is disconnected, a fault report will be indicated every time the signal displays a red aspect.

When using the test equipment in third/fourth rail electrified areas, avoid contact between the test aerial lead and the conductor rails.

An 'affected loop' is one that is fed by a Module which has been disturbed/replaced, in which case the pair of loops associated with the Module shall be tested.

An 'affected Module' includes any disturbed/replaced by the work and any associated Signalling Interface Module (and the Overspeed Sensor / Train Stop Modules fed by a disturbed/replaced Signalling Interface Module).

VCR:

Some TPWS installations in SSI areas do not have a VCR relay. Instead, the proving output from the SIM goes directly into an input on a TFM.

To establish if a TPWS failure exists for these installations check either the SSI Technicians' terminal or the failure indication on the Signaller's panel. Indications are shown either as a red lamp failure of the fitted signal or as a TPWS failure.

Where a TPWS Failure Indication Unit (F.I.U.) is provided, a check of the failure indication is a key part of the maintenance requirements for the F.I.U.

The tests are applicable at all TPWS installations.

Tests

1. Initial Fault Reporting Status

1.1 Check that the VCR relay is energised.

1.2 Check that no fault indication is received at the signal-box.

2. Tests at the TSS and OSS Modules and Loops

2.1 Technicians shall be positioned at the correct loop and at the other TPWS enclosure.

Main Signal On (Red Aspect) Subsidiary Signal On (Not Illuminated)

2.2 Arrange for the signal to display a stop aspect (red) and for any suppression function to be de-energised (i.e. no subsidiary signal input or points controls).

2.3 Check that the VCR relay is energised.

2.4 Check that the following LEDs are lit:

Module	Function	LED
TSM/OSM	Main I/P	Yellow
SIM	Loops Active	Yellow

2.5 Check that no other LEDs change state.

2.6 Measure and record the voltage and frequency at the arming loop and the trigger loop (TSS, OSS).

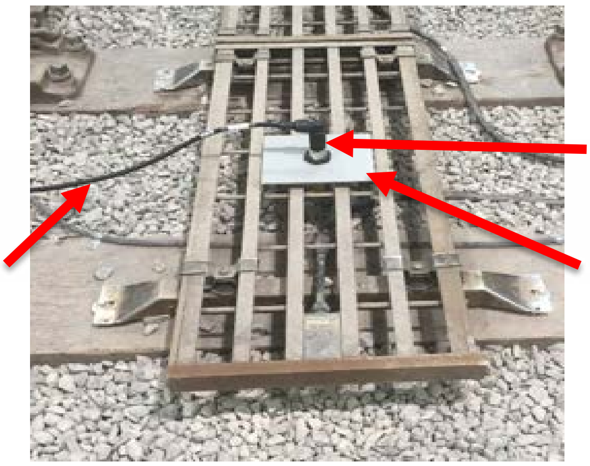


Figure 1: Measuring TPWS Field Strength - Maintenance Test

To measure the voltage and frequency, the TPWS test aerial shall be positioned centrally on the loop using the Maintenance Jig. The meter shall not be held over the loops, to avoid interference from the loop field. as shown in Figure 1.

Details of voltages and frequencies see NR/SMS/PartZ/Z08 (Train Protection - Reference Values).

2.7 The frequency shall within +/-0.01kHz of the stated frequency for each Transmitter Loop's function (f1 to f6 as specified on the location wiring diagrams).

3. Location and Signal-Box Indications

Main Signal On (Red Aspect) Subsidiary Signal On (Not Illuminated)

3.1 Measure the voltage on the outgoing links of each loop and check that:

a) The voltages are within +/- 20% from the first reading on the record card.

b) The difference between the TSS arming loop voltage and TSS trigger loop voltage is less than 0.3V AC.

c) The OSS arming loop voltage is greater than the OSS trigger loop voltage.

If any of the readings are out of tolerance this can indicate high resistance in the loop circuit.

To carry out the following tests, a Technician shall be positioned at the TPWS enclosure. Co-operation with the Signaller is required.

3.2 De-energise the OSS arming loop by slipping links to the loop output circuit and check that the following LED indications are shown:

Module	**Function**	**LED**
OSM/TSM	Fault	Red
SIM	Loop Active	Extinguished

3.3 Check that the VCR relay has de-energised.

3.4 Check that a fault indication is given to the Signaller.

3.5 Re-energise the OSS arming loop by remaking the links to the loop output circuit and check that the following LEDs are illuminated:

Module	**Function**	**LED**
OSM/TSM	Fault	Red
SIM	Loop Active	Yellow

3.6 Check that the VCR relay has energised.

3.7 Reset the system, check that the fault LED is extinguished.

3.8 Repeat tests 3.2 to 3.7 except step 3.4 for the OSS trigger loop.

3.9 Repeat tests 3.2 to 3.7 except step 3.3 for the TSS arming and trigger loops.

Main Signal On (Red Aspect) Subsidiary Signal Off (Illuminated) (If Applicable)

3.10 Arrange for the signal to display a stop aspect (red) and for any suppression function to be energised (i.e. subsidiary signal input).

3.11 Check that the following LEDs are lit:

Module	Function	LED
TSM	Main I/P	Yellow
TSM	Suppression Input	Yellow
TSM SIM	Loops Active	Extinguished

3.12 Check the LED indications on the OSS Modules:

Module	Function	LED
TSM	Main I/P	Yellow
TSM SIM	Loops Active	Yellow

4. Tests for PSR & Buffer Stops Only

For remote PSRs operated by the battery-powered OSS unit go to section 5.

4.1 Check that the green 'Power On' LEDs are illuminated on all modules for the PSR or buffer stop.

4.2 Check that the following LEDs are illuminated:

LED	Function	Colour
OSM	Mains I/P	Yellow
SIM	Loop Active	Yellow

4.3 Check that no other LEDs are illuminated (including fault LEDs).

Some PSR installations will have a suppression input with points controls and hence the yellow "Supp I/P" LED can be illuminated.

4.4 Measure and Record the voltage and frequency at the OSS arming loop and the OSS trigger loop.

a) The signal strength from each loop shall be no less than 29mV and no greater than 53mV measured with the meter set to the 50mV AC range.

b) The frequency shall be correct for the system (f1-f6) and within the tolerances listed in NR/SMS/PartZ/Z08 (Train Protection – Reference Values).

4.5 De-energise the OSS arming loop by slipping links to the loop output circuit and check that the following LED indications are shown:

LED	Function	State
OSM	Fault	Red
SIM	Loop Active	Extinguished

4.6 Check that the VCR relay has de-energised, (buffer stops only).

4.7 Re-energise the OSS arming loop by remaking the links to the loop output circuit and check that the following LED indications are shown:

LED	Function	State
OSM	Fault	Red
SIM	Loop Active	Yellow

4.8 Check that the VCR relay has energised.

4.9 Reset the system and check that the fault LED is extinguished.

4.10 Repeat tests 4.5 to 4.9 for the OSS trigger loop.

5. Final Checks

5.1 Check that the VCR relay is energised (buffer stops only).

5.2 Check that all green ‘Power’ LEDs are illuminated and that all ‘Fault’ LED’s are extinguished.

END

Includes:	TPWS Module or Transmitter
Excludes:	TPWS Self Powered OSS Module

This test is to check that the TPWS system is functioning correctly following plug-in Module replacement or a Transmitter Loop change following a failure

The test sequence checks the system logic and loop power of affected units in the plane of the loop.

An 'affected loop' is one that is fed by a Module which has been disturbed/replaced, in which case the pair of loops associated with the Module must be tested.

An 'affected Module' includes any disturbed/replaced by the work and any associated Signalling Interface Module (and the Overspeed Sensor / Train Stop Modules fed by a disturbed/replaced Signalling Interface Module).

All tests requiring TPWS Transmitter Loop field strength and frequency measurements shall use a test meter approved for use with TPWS equipment.

The multimeter shall be set to a range to accurately measure frequency with a minimum resolution of 1 Hz.

All test measurements shall be recorded on the record card.

1. Test - Following Equipment Failure

Prior to use, the TPWS Maintenance Jig and Test Aerial shall be visually inspected for damage.

1.1 Check the affected TPWS Module LEDs, by observing that only the green ‘power on’ LEDs are lit when the main signal is ‘off’ and any associated position light / semaphore subsidiary signal is unlit / on.

1.2 With the main signal ‘on’ check that the ’Main I/P’ LEDs are alight on the affected Train Stop and Overspeed Sensor Modules.

1.3 Use the TPWS test aerial to test the voltage received by the aerial and the frequency of the signal received at each affected Transmitter Loop in turn.

To measure the voltage and frequency, the TPWS test aerial shall be positioned centrally on the loop using the Maintenance Jig. The meter shall not be held over the loops, to avoid interference from the loop field. as shown in Figure 1.

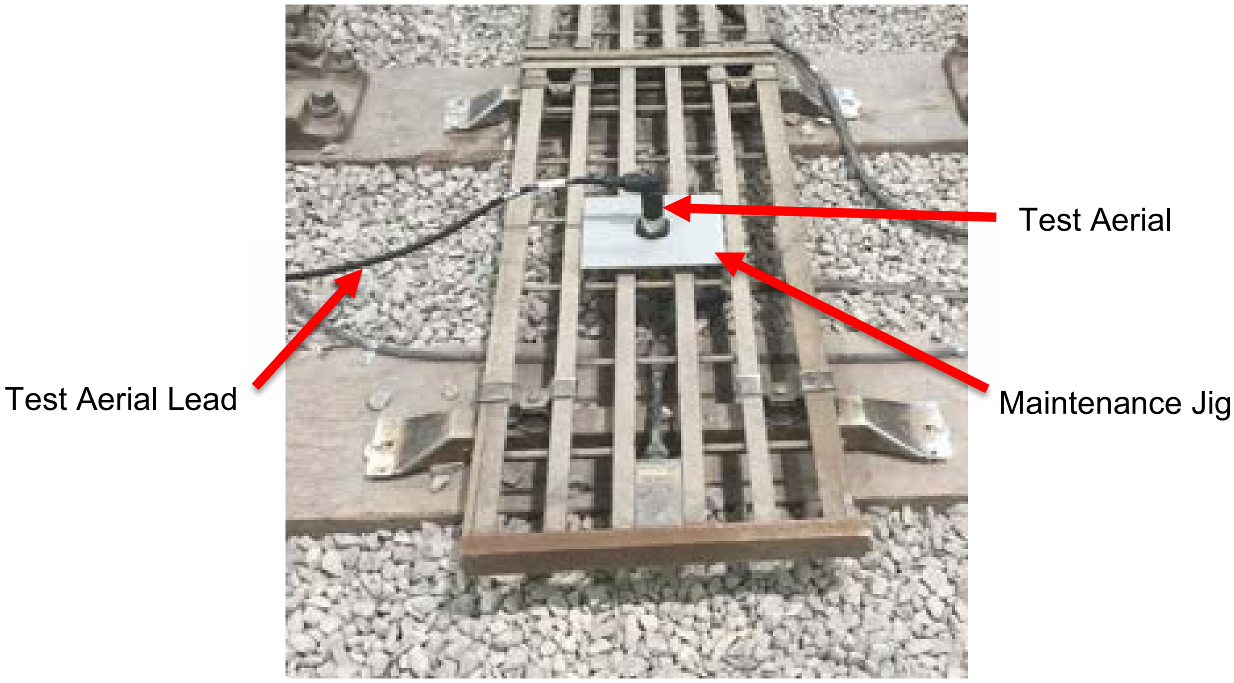


Figure 1: Measuring TPWS Field Strength - Maintenance Test

Details of voltages and frequencies see NR/SMS/PartZ/Z08 (Train Protection - Reference Values).

1.4 The frequency shall within +/-0.01kHz of the stated frequency for each Transmitter Loop's function (f1 to f6 as specified on the location wiring diagrams).

1.5 If a main signal has an associated position light / semaphore subsidiary signal arrange for it to be cleared to the 'off' position and check the 'Supp I/P' LED is illuminated on the affected Module and that no other LEDs change state.

Use the TPWS test aerial to test that the voltage received by the aerial at each affected Transmitter Loop is less than 2mV AC (at the TPWS tone frequency).

1.6 This test is only applicable where position light / semaphore subsidiary signal suppression is fitted)

With the main signal 'off' check that the 'Main I/P' and 'Supp I/P' LEDs are extinguished on the affected Train Stop and Overspeed Sensor Modules and that no other LEDs change state.

Use the TPWS calibrated test aerial to test that the voltage received by the aerial at each of the affected Transmitter Loops is less than 2mV AC (at the TPWS tone frequency).

1.7 If the Module or Transmitter Loop forms part of a Self-Powered OSS (SPOSS) then carry out NR/SMS/PartB/Test/233 - TPWS Self-Powered OSS (SPOSS) Trackside Equipment Test.

1.8 With the signal 'on', simulate a trackside equipment fault by slipping the links for the loop in the trackside apparatus case (OSS or TSS).

a) Check for correct fault indications on the affected module and in the Signal Box.

b) Remove the simulated fault.

c) Reset affected TPWS Modules.

This is done by undertaking a short (five second) isolation (disconnection of the BX110 supply fuse/link to the TPWS on the Baseplate or Trackside Enclosure).

1.9 Check that isolation fuses/links are in the correct position and that screw terminals are tight.

END

Includes:	TPWS Module or Transmitter Loop (following Pway Work)
Excludes:	Any TPWS Module or Transmitter Loop following a Failure

This test is to check that the TPWS system is functioning correctly following transmitter loop replacement associated with permanent way renewals work when the track bed has been laid.

The test sequence checks the transmitted power of the affected loops at 310mm above rail level.

An “affected loop” is one which has been disturbed or replaced by the “work”.

If the loops are to be disturbed as part of permanent way renewals work, then prior to any work commencing, the exact position of the loop shall be clearly marked.

If, because of the scope of the works, it was not possible to mark the original position of the loops prior to the works commencing, then re-measure the required distance (as shown on the location wiring diagram) from the associated signal to each loop.

This is likely to require re-measurement of the required distance (as shown on the location wiring diagram) from the associated signal.

All tests requiring TPWS Transmitter Loop field strength and frequency measurements shall use a test meter approved for use with TPWS equipment.

All test measurements shall be recorded on the TPWS Test record card.

1. Test - Following Equipment Removal and Refitting

Prior to use, the TPWS Commissioning Jig and Test Aerial shall be visually inspected for damage and to check correct alignment of the two mating halves.

1.1 Check that all loops are re-installed in the correct position.

1.2 Check the affected TPWS Module LEDs, by observing that only the green ‘power on’ LEDs are lit when the main signal is ‘off’ and any associated position light / semaphore subsidiary signal is unlit / on.

1.3 With the main signal ‘on’ check that the ’Main I/P’ LEDs are alight on the affected Train Stop and Overspeed Sensor Modules.

1.4 Use the TPWS test aerial to test the voltage received by the aerial and the frequency of the signal received at each affected Transmitter Loop in turn.

To measure the voltage and frequency, the TPWS test aerial shall be positioned centrally on the loop using the Commissioning & Maintenance Jigs.

The TPWS aerial should be placed into the top of the commissioning jig tube.

The meter shall not be held over the loops, to avoid interference from the loop field. as shown in Figure 1.

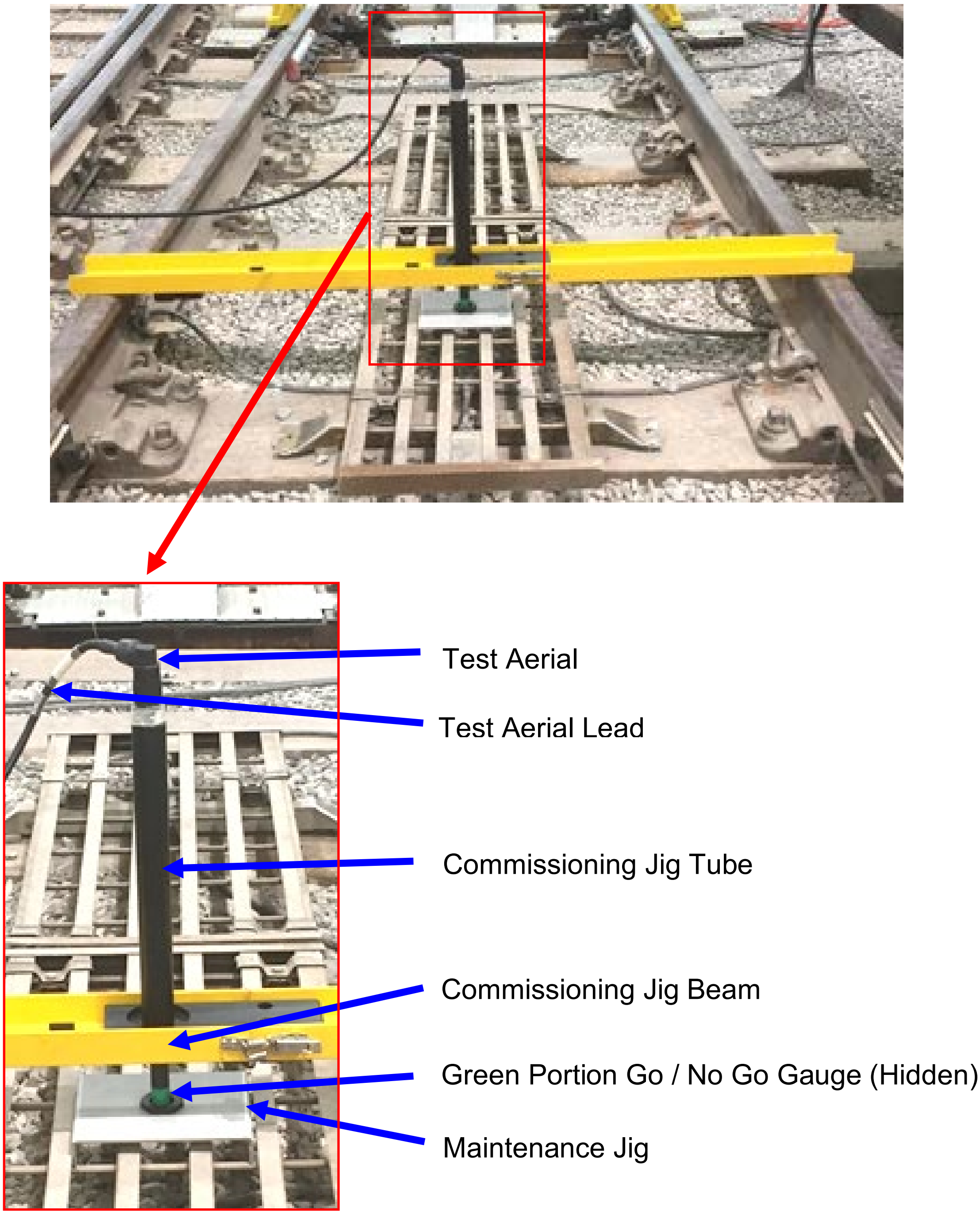


Figure 1: Measuring TPWS Field Strength - Commissioning Test

Details of voltages and frequencies see NR/SMS/PartZ/Z08 (Train Protection - Reference Values).

1.5 The frequency shall within +/-0.01kHz of the stated frequency for each Transmitter Loop's function (f1 to f6 as specified on the location wiring diagrams).

1.6 Measure the height of the top of the loop Below Rail Level (BRL) is within the "green" portion of the commissioning jig which reflects the tolerances specified in NR/SMS/PartZ/Z08 (Train Protection - Reference Values).

1.7 Check that the Transmitter Loop with is mounted in alignment with the track centreline.

1.8 If the Module or Transmitter Loop forms part of a Self-Powered OSS (SPOSS) then carry out NR/SMS/PartB/Test/233 (TPWS Self-Powered OSS (SPOSS) Trackside Equipment Test).

1.9 With the signal 'on', simulate a trackside equipment fault by slipping the links for the loop in the trackside apparatus case (OSS or TSS).

a) Check for correct fault indications on the affected module and in the Signal Box.

b) Remove the simulated fault.

c) Reset affected TPWS Modules.

This is done by undertaking a short (five second) isolation (disconnection of the BX110 supply fuse/link to the TPWS on the Baseplate or Trackside Enclosure).

2. Final Checks

2.1 Check that the VCR relay is energised (buffer stops only).

2.2 Check that all green 'Power' LEDs are illuminated and that all 'Fault' LED's are extinguished.

END

Includes:	TPWS Self-Powered OSS System (SPOSS)
Excludes:	All other TPWS Modules

When using the test equipment in third/fourth rail electrified areas, avoid contact between the test aerial lead and the conductor rails. Also, when using the equipment in wet conditions.

All tests requiring TPWS Transmitter Loop field strength and frequency measurements shall use a test meter approved for use with TPWS equipment.

The multimeter shall be set to a range appropriate to accurately measure frequency with a minimum resolution of 1 Hz.

All test measurements shall be recorded on the appropriate TPWS Test record card

When the power supply to TPWS is disconnected, a fault report will be indicated every time the signal displays a red aspect.

An 'affected loop' is one that is fed by a Module which has been disturbed/replaced, in which case the pair of loops associated with the Module should be tested.

An 'affected Module' includes any disturbed/replaced by the work and any associated Signalling Interface Module (and the Overspeed Sensor / Train Stop Modules fed by a disturbed/replaced Signalling Interface Module).

TEST

1. TPWS Self-Powered OSS System - Battery Test

1.1 To test battery 1, first isolate battery 2 by removing the fuse holder F2.

1.2 Press the ‘LOOP TEST’ button and Check that:

a) The green ‘TEST’ LED is illuminated for 6 seconds; and

b) The red ‘BATTERY LOW’ LED does not flash.

If the green ‘TEST’ LED does not illuminate this indicates that either Fuse 1 has ruptured or the battery is flat.

If the battery fuse has ruptured replace the fuse and re-test from step 1.1. If the battery fuse ruptures again change the SPOSM.

If the red ‘BATTERY LOW’ LED flashes during the test replace both batteries and re- test from step 1.1.

The reason for premature battery failure shall be investigated.

1.3 Re-insert the fuse holder F2.

1.4 To test battery 2 first isolate battery 1 by removing the fuse holder F1 and repeat steps 1.2 and 1.3.

2. TPWS Self-Powered OSS System – System Test.

2.1 Press the ‘SYSTEM TEST’ pushbutton on the SPOSM and Check that all LEDs illuminate (lamp test).

Illumination of all LED indicators confirms that the test sequence has started.

2.2 Depress the train detection treadle within 64 seconds and confirm that the ‘TRAIN DETECT’ green LED indicator remains illuminated while all the other indicators extinguish.

This confirms correct functionality of the train detection treadle input.

2.3 Once the ‘SYSTEM TEST’ pushbutton is pressed, the tester has 64 seconds to operate the train detection treadle and return to the SPOSM to view the indicators.

If the tester does not operate the treadle within 64 seconds the test sequence will abort and normal operation will be resumed.

Should the tester depress the treadle arm but not return to view the indicators within 64 seconds then the test sequence will have to be repeated.

2.4 64s after pressing the ‘SYSTEM TEST’ pushbutton, and provided the treadle input test is successful, the SPOSM will automatically energise the transmitter loops and complete a series of checks on the loop driver circuits and battery status.

This is identified by the green ‘TEST’ LED being illuminated for the duration of this test (6 seconds) confirming that the test is underway.

2.5 Check that none of the red ‘ARMING LOOP FAULT’, ‘TRIGGER LOOP FAULT’ or ‘BATTERY LOW’ LED indicators flash during the 6 seconds that the green ‘TEST’ indicator is illuminated.

If either of the loop fault LEDs flash then this indicates a fault in the respective loop circuit.

If the low battery LED flash this indicates the battery capacity is insufficient.

If the green ‘TEST’ LED not illuminate at all during this test then this also indicates a fault situation.

2.6 Test Mode will automatically end and normal operation will be resumed following completion of loop driver and battery tests.

2.7 To complete the transmitter loop output (voltage and frequency) tests, the SPOSM 'LOOP TEST' pushbutton shall be used to trigger the SPOSM to transmit.

Pressing the 'LOOP TEST' pushbutton will immediately start the SPOSM transmitting for 6 seconds during which time, loop measurements may be taken.

The loop test cycle will repeat continuously for as long as the 'LOOP TEST' pushbutton is held depressed.

This will provide almost continuous loop transmission with only a 375ms gap in transmission every 6 seconds.

2.8 The SPOSS Treadle shall follow standard treadle maintenance requirements as defined in NR/SMS/PartC/TQ01 (Mechanical Treadles).

3. Final Checks

3.1 Check that the VCR relay is energised (buffer stops only).

3.2 Check that all green 'Power' LEDs are illuminated and that all 'Fault' LED's are extinguished.

END

Includes:	TPWS Failure Indication Units
Excludes:	All other TPWS Modules or Units

This test is to check that the TPWS Failure Indication Unit (FIU) for use in mechanical signal boxes is functioning correctly following FIU replacement following a failure.

The test sequence checks the FIU system logic.

1. Test

Master Unit

1. With the 'NOR/ACK' switch in the NOR position, check that the Power On Lamp is illuminated and that the 'TPWS Failed' lamp is extinguished.
2. Press the indication 'Push to Test' pushbutton and check that the 'TPWS Failed' and 'Power On' lamps both flash and the audible alarm sounds.
3. Release the indication 'Push to Test' pushbutton and check that the 'TPWS Failed' lamp extinguishes and the 'Power On' lamp becomes illuminated steadily.
4. Remove the protective terminal cover from the rear of the master unit.
5. Using a digital multi meter, measure the voltage at the power supply input terminals, B12 - N12, check they lie within the range 9V DC to 15.6V DC.
6. Disconnect the wire on Terminal T1 (or T3 if 24V Fault Input is being used) and check that the 'TPWS Failed' lamp flashes and that the audible alarm sounds.
7. Turn the 'NOR/ACK' switch to ACK position and check that the 'TPWS Failed' lamp illuminates steadily and that the audible alarm silences.
8. Reconnect the wire to terminal T1 (or T3 as appropriate) and check that the 'TPWS Failed' lamp flashes but the audible alarm remains silent.
9. Turn the 'NOR/ACK' switch to NOR and check that the 'TPWS Failed' lamp extinguishes.
10. Disconnect the wire on Terminal T4 and check that the 'Power On' lamp flashes.
11. Reconnect the wire to Terminal T4 and check that the 'Power On' lamp becomes steadily illuminated.
12. Remove the termination plug from the top-most FIU and check that the audible alarm sounds.
13. Replace the termination plug and check that the audible alarm is silenced.

14. Check the security of the wiring and replace the protective terminal cover.

Slave Unit

15. With the ‘NOR/ACK’ switch in the NOR position, check that the slave unit ‘TPWS Failed’ lamp is extinguished.

16. Press the indication ‘Push to Test’ pushbutton on the associated master unit and check that the ‘TPWS Failed’ lamps flash on both the master and slave unit, the ‘Power On’ lamp on the master unit flashes and the audible alarm sounds.

17. Release the indication ‘Push to Test’ pushbutton and check that all ‘TPWS Failed’ lamps extinguish and the ‘Power On’ lamp on the master unit becomes illuminated steadily.

18. Remove the protective terminal cover from the rear of the slave unit.

19. Disconnect the wire on Terminal T1 (or T3 if 24V Fault Input is being used) and check that the slave unit ‘TPWS Failed’ lamp flashes and the audible alarm on the Master unit sounds.

20. Turn the ‘NOR/ACK’ switch to the ACK position and check that the ‘TPWS Failed’ lamp on the slave unit is steadily illuminated and that the audible alarm on the master unit is silenced.

21. Reconnect the wire to terminal T1 (or T3) and check that the ‘TPWS Failed’ lamp flashes but the audible alarm on the master unit remains silent.

22. Turn the ‘NOR/ACK’ switch to NOR and check that the ‘TPWS Failed’ lamp extinguishes.

23. Replace the protective terminal cover.

24. Repeat test on any other slave units.

END

Includes:	TPWS Buffer Stop Optimisation Project Equipment
Excludes:	All other TPWS equipment

This test is to check that the TPWS system is functioning correctly following arming loop repositioning associated with the TPWS Buffer Stop Optimisation Project.

The test sequence checks the system logic, loop power of affected units in the plane of the loop, and the transmitted power of the affected loops at 310mm above rail level. An 'affected loop' is one which has been disturbed/replaced by the work.

Prior to any work commencing, the exact position of the repositioned arming loop shall be clearly marked as detailed in the site specific method statement.

All tests requiring TPWS Transmitter Loop field strength and frequency measurements shall use a test meter approved for use with TPWS equipment. The TPWS Multimeter from Fluke is approved for such applications.

All test measurements shall be recorded on NR/SMS/PartR/TP11/RC01 (TPWS Test: Equipment Associated with Signals Record Card (Front)), together with the reason for the test “Arming Loop Re-positioned”.

A Signal Maintenance Testing Logbook entry and the TPWS Buffer Stop Optimisation Project Test Certificate shall be completed for each installation.

Prior to use, it is recommended that the TPWS Commissioning Jig is visually inspected for damage and to confirm correct alignment of the two mating halves. If a bend of more than 10mm when measured at the centre of the beam to with respect to the ends, the Commissioning Jig should not be used.

1. Test

1. Measure and record the leading edge separation distance between the arming and trigger loop on the Test Certificate.

2. Check that all loops are re-installed in the correct position to the schedule in the site specific method statement or work plan.

3. Check the affected TPWS Module LEDs by ensuring that the green ‘Power On’ LEDs and the ’Main I/P’ LEDs are alight on the affected Sensor Modules.

4. Use the TPWS calibrated test aerial to test the voltage received by the aerial and the frequency of the signal received at the arming transmitter loop.

   The voltage shall be greater than 4.26mV AC see NR/SMS/PartZ/Z08 (Train Protection - Reference Values) for values. To measure the voltage, the TPWS test aerial shall be positioned centrally above the plane of the loop using the Commissioning Jig and recorded to the 5 digit capability of the multimeter.

When taking measurements, the meter shall not be held over the loops, to avoid interference from the loop field. It shall instead be held as far outside of the rails as the test aerial lead allows, as shown in NR/SMS/PartB/Test/232 (TPWS Module or Transmitter Loop Test (following P Way Work).

Use the TPWS calibrated test aerial to test the voltage received by the aerial and the frequency of the signal received at the arming transmitter loop.

The voltage should be between 59mV and 107mV AC for Buffer Stop Mini-Loops, and the frequency within +/-0.01kHz of the stated frequency (as specified on the location wiring diagrams).

To measure the voltage and frequency, the TPWS test aerial shall be positioned centrally within the plane of the loop using the Maintenance Jig and recorded to the 5 digit capability of the multimeter.

When taking measurements, the meter shall not be held over the loops, to avoid interference from the loop field.

It shall instead be held as far outside of the rails as the test aerial lead allows, as shown in NR/SMS/Part03/Test/231 (TPWS Module or Transmitter Loop Test (following failure).

5. Measure the height of the top of the loop Below Rail Level (BRL) and check that it is within the tolerances specified in NR/SMS/PartZ/Z03 (Train Detection Reference Values).

6. Measure the height of the loop above the sleeper and check that it is within the following tolerances:

   For loops mounted on steel sleepers check the loop is a minimum of 70mm above the top surface of the sleeper.

   For loops mounted on concrete slab track check the loop is a minimum of 50mm above the top surface of the sleeper.

7. Check that the centre line of the Transmitter Loop is within 10mm of the centre line of the track.

8. Check that tamper-proof seals are intact of the Thales pre-wired equipment.

9. De-energise the affect loops by slipping links to the loop output circuit and check for correct fault indications on the affected module and in the signal box (if provided). Remove the simulated fault.

10. Reset affected TPWS Modules by undertaking a short term isolation (disconnection of the BX110 supply fuse/link to the TPWS on the Baseplate or Trackside Enclosure) for five seconds.

This shall be done with the main signal ‘off’ to clear any fault indication.

11. Check that isolation fuses/links are in the correct position and that screw terminals are tight.

12. Record the values on the maintenance record card, see NR/SMS/PartR/Index.

END

Includes:	Primary Cell Fed, TJ/Secondary Cell Fed, Feed set Fed, AC immune and non- immune
Excludes:	All other types of track circuit

GENERAL

DC track circuits fed from primary cells usually tend to have low feed voltages, feed resistance, rail voltage, relay resistance and operating values. This is a design trait to conserve the limited life of power available from a primary cell.

Track circuits fed indirectly from mains supplies will have higher values of those mentioned which improves reliability and detection under poorer conditions (rusty rails, low ballast resistance etc).

Design improvements have also led to systems that require no feed resistance adjustment and have immunity to AC interference.

A faulting guide and adjustment details for this type of track circuit can be found in NR/SMTH/Part10/FF02 (Faulting Guide: DC Track Circuits).

1. Maintenance Test

Feed End

1.1 Measure and record the DC voltage across the rails.

Feed End Relay (If fitted)

1.2 Connect a train shunt across the track links. Obtain a drop shunt and pick up shunt value. Disconnect the shunt box.

If the track links are not accessible, connect the train shunt across the rails.

If the drop shunt is lower than the minimum value NR/SMS/PartZ/Z03 (Train Detection - Reference Values) carry out the full test.

Relay End

1.3 Measure and record the DC voltage across the energised track relay coil.

1.4 Connect a train shunt across the track links. Obtain a drop shunt and pick up shunt value. Disconnect the train shunt.

If the track links are not accessible, connect the train shunt across the rails.

If the drop shunt is lower than the minimum value NR/SMS/PartZ/Z03 (Train Detection - Reference Values) carry out the Full Test.

Where a feed end relay is also provided, carry out this test by observing the relay end track relay.

1.5 Assess the condition of ballast/ground conditions.

1.6 Record the results on the record card.

1.7 Compare results with previous records for any significant variations. Where there is a significant variation in values, retest with the train shunt applied to the rails.

If any adjustments are carried out a Full Test shall be carried completed.

A variation in drop shunt value can be caused by variations in the equipment or environment.

In wet conditions, a higher value of drop shunt can be expected. In dry or icy conditions, a lower value can be obtained. Poor ballast conditions can also affect the value of the drop shunt.

2. Full Test

The full test should be carried out whenever alterations are made including relaying, lead/jumper renewal, equipment replacement, adjustment etc.

Feed End

2.1 Measure the feed voltages, currents and other parameters as required on the record card.

Feed End Relay (If fitted)

2.2 Connect a train shunt across the rails. Obtain a drop shunt and pick up shunt value. Disconnect the shunt box.

If the drop shunt is lower than the minimum value NR/SMS/PartZ/Z03 (Train Detection - Reference Values) the track circuit shall be regarded as failed and the cause shall be investigated.

Relay End

2.3 Measure the relay voltages, currents and other parameters as required on the record card.

2.4 Measure the DC voltage on the track relay coil.

2.5 Connect a shunt box across the rails. Obtain a drop shunt and pick up shunt value. Disconnect the shunt box.

If the drop shunt is lower than the minimum value (NR/SMS/Part/Z03 (Train Detection - Reference Values) the track circuit shall be regarded as failed and the cause shall be investigated.

Where a feed end relay is also provided, carry out this test by observing the relay end track relay.

2.6 With the train shunt set to 0.5Ω, apply the shunt across the rails at all the extremities of the track circuit. Check that the track relay drops sharply.

2.7 Assess the condition of ballast/ground conditions.

2.8 Record the results on the record card. Compare results with previous records for significant variation.

Where there is a significant variation in values the cause shall be investigated and rectified. The Full Test shall then be carried out again.

Remember to take into account weather and ballast conditions.

3. Residual Voltage Check

This check is not required if the track circuit is fitted with a feed end relay.

3.1 Measure the drop away and pick up voltages of the track circuit at the relay end.

A 150kΩ shunt should be used when testing with a fluke meter.

3.2 Disconnect the feed end track links.

3.3 After a period of 120 seconds, measure the voltage across the coils of the track relay. This voltage shall be compared to the voltages recorded in 3.1.

If the recorded voltage is:

a) Greater than 30% (but less than 70%) of the minimum drop away voltage, report immediately to the SM(S).

If the voltage does not exceed 70% of the minimum drop away voltage, the S&TME can authorise the track circuit to remain in service provided that any jumpers in the bonding, including fishplates and other types of bonding are duplicated, and all types of bonding are inspected at 4 weekly intervals.

Plain Line TCs with no jumpers can be inspected at 13 weekly intervals.

This is to allow time for corrective maintenance actions to be undertaken to identify and eliminate the source of the residual voltage or other measures such as replacement of rail pads and insulations on concrete sleepers and slab track to be undertaken.

Such actions shall normally be completed within 12 Months.

b) Greater than 70% of the minimum drop away, the track circuit shall not remain in service unless the S&TME can confirm that a Risk Assessment and Time Bound Action Plan has been submitted and authorised by the RAM(S).

The S&TME shall keep a register of all track circuits where residual voltages exceed 30% of the minimum drop away Voltage.

END

Includes:	EBI Track 200 Audio Frequency Track Circuit (formally known as TI21) and Aster21
Excludes:	All other Track Circuits

The Aster21 Application is detailed in NR Standard NR/L2/SIG/11766 which defines that the EBI Track 200 SMS covers Aster21 with the exception that the relay drive is 24VDC for Aster21.

1. Maintenance Test A1

Feed (Transmitter) End

1.1 Check all rail connections and bonding are tightened to the correct torque. (Appendix F of NR/SMS/Appendix/08).

Impedance Bonds (where fitted)

1.2 Check the impedance bond for the following:

a) Bond Covers correctly fitted and not damaged.

b) Drain holes clear (on Howells & WH3 bonds).

It might be necessary to drill drain holes if they are not present. (Pre installation check).

c) Tuning capacitor or tuning module connections.

1.3 Check all rail connections and bonding are tightened to the correct torque (Appendix F of NR/SMS/Appendix/08).

Relay (Receiver) End

1.4 Check all rail connections and bonding are tightened to the correct torque (Appendix F of NR/SMS/Appendix/08).

1.5 Measure the rail-to-rail voltage at the EBI Track 200 equipment rail connections (Pole) using a TTM/MTM (Vp, (Appendix F of NR/SMS/Appendix/08).

For consistency, this measurement shall always be carried out at the rails.

1.6 Measure the rail current in the rail within 1 metre and on the track circuit side of the rail connections with a Rocoil.

For a Single Rail track circuit the measurement shall be made in the Signal rail.

1.7 Where a tuned zone is involved, Measure using a FSM/MTM the rail-to-rail voltage at the companion TU rail connection (Zero) at the frequency of the track circuit under test. (Vz).

The voltage measured in 1.5 (Vp Pole) divided by the voltage at the companion TU (Vz Zero) gives the Tuned Zone ratio (Tzr) where Tzr = Vp/Vz.

Check the ratio against Appendix B of NR/SMS/Appendix/08. If the ratio is below specification, the low result usually relates to badly dressed cables and or poor connections, therefore, Check that the cables are dressed correctly and that all Tuning units' connection are correct, clean and tight.

1.8 If a digital receiver is in use, Check the display for a steady 'PICK' or 'drop' indication. If one of these indications cycles with the indication 'ERR' then refer to Appendix E4 of NR/SMS/Appendix/08 and investigate the reason for the error. An 'ERR' state shall not be left without authority from the SM(S).

A significant deviation is indicated if the change of track current is greater than:

a) ±20% OR
b) ±10mA.

On The Receiver

Press OK then 'NEXT' until 'INOW'

Press OK then Next Until 'USB'

Press OK and note the value

Press 'BACK' then 'NEXT' until 'LSB'

Press OK and note the value

Calculate and record sideband imbalance by dividing the larger value by the smaller value.

If the sideband imbalance exceeds the ratio values above, the track circuit shall be investigated to ascertain the cause of the imbalance. Carry out steps 2.4.7 to 2.4.11 of NR/SMS/Appendix/08.

1.9 For Analogue receivers Measure the voltage across the 1Ω resistor; compare this reading against the Record Card.

For Digital receivers Record the Inow AV current using the display on the receiver and compare this reading against the Record Card.

If the obtained reading is not within 10% of the Commissioning reading or last Set-up reading on the Record Card, the reason for the discrepancy shall be investigated.

If adjustment is required, the initial setting for an analogue RX shall be selected from Appendix D Table D1 of NR/SMS/Appendix/08 using the voltage across the

1Ω resistor, followed by a drop shunt test. For digital RX, an auto-set routine shall be performed. (See Appendix E of NR/SMS/Appendix/08)

The RX current is the best measure of the track circuits' stability. Significant deviations from previous readings shall be investigated.

For track circuits which continually give problems, the frequency of checking the receiver current might need to be increased to help in diagnosing the cause of any issues.

A significant change shall be determined by which is the greater of :

a) ±20% OR
b) ±10mA.

1.10 Record the ballast and weather conditions on the track circuit Record Card.

1.11 Using a shunt applied to the rails between the RX tuning unit rail connections obtain a drop shunt value and a pick up shunt value.

Shunt Box and Connection Verification Check
Connect a shunt box across the rails at the receiver TU or ETU track connections.
Set the drop shunt to 0.0Ω.
Check that clear track current (INOW) has fallen to less than 5mA.

If the readings are equal to or higher then 5mA then the Shunt Box, meter leads and connections should be checked to confirm it is giving a 0.0Ω shunt.

Shunt values are detailed in NR/SMS/Part/Z03.

On the pick-up shunt, allow 2 seconds between each value to allow the slow to pick relay drive from the RX to operate.

The pick-up value should normally be 0.1Ω higher than the drop shunt.

Compare the results with previous records (if available) obtained under similar conditions. If the results are not within ±10% the cause shall be investigated and rectified as appropriate. A FULL TEST shall then be carried out.

2. Full Test

2.1 Examine the track circuit in accordance with NR/SMS/TC16 service A.

Feed (Transmitter) End (Digital TX and Analogue TX)

2.2 Examine the TX unit case, connector and terminations and check the plug coupler is pushed fully home. Also check the plug coupler on any PSUs, TCUs or LMUs used are also pushed fully home.

2.3 Regardless of the supply voltage Check/Set the PSU input tappings to P5 and P115.

For Analogue Transmitters:

Measure the input and output voltages of the power supply.

These should be in the range of:

a) Input: 99V to 121V AC
b) Output: 22.5V to 30.5V DC

For Digital Transmitters:

Measure the input voltage of the power supply.

If the supply is over 115VAC, adjust the PSU output tappings to give between 25V DC and 27V DC. Otherwise, adjust the PSU output tappings to give ideally 24V – 26V DC.

Digital TX of MOD strike 2 may show a red POWER LED indication if the power supply voltage is over 27V DC. This can be ignored provided that the TX has been set up as stated above.

Digital TX of MOD strike 2 to 4 will shut down at 30.5V DC therefore it is important to check the voltage is kept below this threshold.

Record the PSU Output Voltage

2.4 Measure the DC current drawn by the equipment.

a) Normal Power 1.3A to 2.2A.
b) Low Power/TCU 0.2A to 0.5A
c) Low Power Plus 0.2A to 0.55A

2.5 Measure the total AC+DC current drawn by the equipment. If the measured value is 20% above the expected maximum value (i.e. 2.6A for Normal Power TX, 0.6A for Low Power TX, 0.65A for Low Power Plus TX) then investigate from where this additional current is being generated.

2.6 Measure the TX output voltage across terminals OP/1 and OP/2 using a TTM.

For Analogue Transmitters the voltages should be:

a) Frequencies A, C, E, G: 10V – 11V RMS
b) Frequencies B, D, F, H: 15V – 16V RMS

For Digital Transmitters

c) 8.5V to 12.5V RMS regardless of frequency.

For either type of transmitter, when connected in low power mode or low power plus mode, the output voltage may be up to 5V RMS higher than in normal power.

2.7 Measure the rail-to-rail voltage at the TU (Pole) or ETU rail connections using a FSM/TTM (Vp, Appendix A of NR/SMS/Appendix/08).

For a TCU system refer to the low power figures.

For consistency this measurement shall always be carried out at the rails.

2.8 Measure the rail current in the rail within 1 metre and on the track circuit side of the rail connections with a Rocoil.

For a Single Rail track circuit the measurement shall be made in the Signal rail.

2.9 Where a tuned zone is involved, Measure using a FSM/TTM the rail-to-rail voltage at the companion TU rail connection (Zero) at the frequency of the track circuit under test. (Vz).

The voltage measured in 3.7 (Vp Pole) divided by the voltage at the companion TU (Vz Zero) gives the Tuned Zone ratio (Tzr) where Tzr = Vp/Vz.

Check the ratio against Appendix B of NR/SMS/Appendix/08. If the ratio is below specification, Check that the cables are routed correctly and that all Tuning Unit connections are correct, clean and tight.

Impedance Bond and Track Capacitors (Where fitted)

The impedance of an impedance bond can be checked by measuring the EBI Track 200 voltage across the bond and the current through it. To take the current measurements use a Rocoil connected to a TTM.

2.10 Check all rail connections and bonding are tightened to the correct torque (Appendix F of NR/SMS/Appendix/08).

2.11 Check the security and the fixing of the Track capacitor.

2.12 Measure using a FSM/TTM the rail-to-rail voltage.

Clauses 2.13 and 2.14 are not applicable to B3 3000 and B3 500 bonds.

2.13 Measure the voltage across the auxiliary coil or tuning module, Check it is in the correct ratio with the rail-to-rail voltage (Appendix C of NR/SMS/Appendix/08). If it is not the impedance bond shall be investigated for a fault.

2.14 Apply a short circuit across the tuning capacitor/module, Check that the rail voltage falls then remove the short circuit and Check the voltage rises.

Clauses 2.15 to 2.19 are applicable to Intermediate bonds only.

2.15 Place the Rocoil over the rail 1 metre before the Bond (TX side) and note the reading on the TTM (= amps, I1).

2.16 Repeat the measurement 1 metre from the bond on the RX side (I2)

2.17 Subtract I2 from I1 obtaining the current through the bond at the EBI Track 200 frequency.

2.18 Measure the rail to rail voltage (V) across the impedance bond.

2.19 Divide the voltage (V) by the current calculated from 2.17 giving the impedance (Z), Z= V / (I1-I2).

This value should be greater than 8Ω. If less than 8Ω, Check for traction imbalance before remedial action is taken with the impedance bond.

Relay (Receiver) End

2.20 Examine the RX unit case, connectors and terminations and check the plug coupler is pushed fully home. Also check the plug coupler on any PSUs, TCUs or LMUs used are also pushed fully home.

2.21 Measure the input and output voltages of the power supply

a) Input: 99V to 121V AC
b) Output: 22.5V to 30.5V DC

The output voltage should be close to 24V unless there is reason to believe that the I/P conditions are unusual, in which case the input tapping should be adjusted to 120 volts

2.22 Measure the DC current drawn by the equipment.

a) 0.2A to 0.5A.

2.23 Measure the total AC+DC current drawn by the equipment. If the measured value is 20% above the expected maximum value (i.e. 0.6A for RX) then investigate from where this additional current is being generated.

2.24 If a digital receiver is in use, Check the display for a steady ‘PICK’ or ‘drop’ indication. If one of these indications cycles with the indication ‘ERR’ then refer to Appendix E4 of NR/SMS/Appendix/08 and investigate the reason for the error. An ‘ERR’ state shall not be left without authority from the SM(S).

2.25 If a digital receiver is in use, confirm the track circuit has a Sideband imbalance ratio less than:

a) 1.6:1 for TU/ETU/SPETU
b) 1.8:1 for TCU

On The Receiver

Press OK then 'NEXT' until 'INOW'

Press OK then Next Until 'USB'

Press OK and note the value.

Press 'BACK' then 'NEXT' until 'LSB'

Press OK and note the value.

Calculate and record sideband imbalance by dividing the larger value by the smaller value.

If the sideband imbalance exceeds the ratio values above, the track circuit should be investigated to ascertain the cause of the imbalance. Carry out steps 2.4.7 to 2.4.11 of NR/SMS/Appendix/08.

2.26 Measure the rail-to-rail voltage at the TU (Pole) or ETU rail connections using a FSM/TTM (Vp Appendix A of NR/SMS/Appendix/08).

For a TCU system refer to the low power figures.

For consistency this measurement shall always be carried out at the rails.

2.27 Measure the rail current in the rail within 1 metre and on the track circuit side of the rail connections with a Rocoil.

For a Single Rail track circuit the measurement shall be made in the Signal rail.

Low rail volts or rail current could be due to ballast or other track equipment, as well as a fault at the TX end of the track.

2.28 Where a tuned zone is involved, Measure using a FSM/TTM the rail-to-rail voltage at the companion TU rail connection (Zero) at the frequency of the track circuit under test. (Vz).

The voltage measured in 2.26 (Vp Pole) divided by the voltage at the companion TU (Vz Zero) gives the Tuned Zone ratio (Tzr) where Tzr = Vp/Vz.

Check the ratio against Appendix B of NR/SMS/Appendix/08. If the ratio is below specification, the low result usually relates to badly dressed cables and or poor connections, therefore, Check that the cables are dressed correctly and that all Tuning units' connection are correct, clean and tight.

2.29 For Analogue receivers Measure the voltage across the 1Ω resistor; compare this reading against the Record Card.

For Digital receivers Record the Inow AV current using the display on the receiver and compare this reading against the Record Card.

If the obtained reading is not within 10% of the Commissioning reading or last Set-up reading on the Record Card, the reason for the discrepancy shall be investigated.

If adjustment is required, the initial setting for an analogue RX shall be selected from Appendix D Table D1 of NR/SMS/Appendix/08 using the voltage across the 1Ω resistor, followed by a drop shunt test. For digital RX, an auto-set routine shall be performed.

The RX current is the best measure of the track circuits' stability. Significant deviations from previous readings shall be investigated.

A significant deviation is indicated if the change of track current is greater than:

a) ±20% OR
b) ±10mA.

2.30 Measure the voltage across the energised track relay coils.

a) 40V to 75V DC for the analogue RX
b) 40V to 44V DC for the digital RX MOD 1 & 2
c) 48V to 52V DC for the digital RX MOD 3 or later

Aster21 Receivers are configured for 24VDC relay drive therefore the voltage across the energised track relay coils will be 20V to 26V DC.

2.31 Using a train shunt applied to the rails between the RX tuning unit rail connections obtain a drop shunt value and a pick up shunt value.

Shunt Box and Connection Verification Check
Connect a shunt box across the rails at the receiver TU or ETU track connections.
Set the drop shunt to 0.0Ω.
Check that clear track current (INOW) has fallen to less than 5mA.

If the readings are equal to or higher then 5mA then the Shunt Box, meter leads and connections should be checked to confirm it is giving a 0.0Ω shunt.

Shunt values are detailed in NR/SMS/Part/Z03.

On the pick-up shunt allow 2 seconds between each value to allow the slow to pick receiver relay drive to operate.

2.32 Compare the results with previous records (if available) obtained under similar conditions. If the results are not similar the cause shall be investigated and rectified as appropriate. The FULL TEST shall then be repeated.

2.33 Record the ballast and weather conditions on the track circuit Record Card.

Interference Test

Check that all tracks in vicinity of track to be tested are energised and working

This test checks the levels of in band and traction interference present at the RX, and requires temporary disconnection of the TX.

Check the fusing arrangements before this test as more than one track circuit might be affected.

2.34 Remove the B24 fuse to the TX and Check that the correct track relay drops. Set the TTM to the 20mV range (30mV range for FSM) and the frequency to that of the track circuit under test. Measure the voltage across the 1Ω resistor at the RX.

Readings greater than 8mV for double rail tracks and greater than 3mV for single rail tracks are un-acceptable, the track circuit shall be signed out of use and your SM(S) informed.

Where a digital RX is in use, these readings as currents, can be read directly from the RX display where they are displayed in mA. Since the Voltage reading above is taken across a 1Ω resistor the mA reading directly equates to the mV reading.

Extremity Tests

2.35 Apply a shunt at the extremities of the track circuit, in accordance with the track plan, and Check the track relay drops for each application.

Minimum Shunt values are detailed in NR/SMS/Part/Z03.

End

Includes:	SF15 / U Type Aster track circuits
Excludes:	Aster 21, EBI Track 200 (formally known as TI21) and EBI Track 400. All other types of track

General

The TX and RX shall not be disconnected at the same time.

As this could result in an adjacent track circuit feeding through and causing a possible wrong side failure.

Centre Fed Track Circuits

Each half of a centre fed track circuit operates as an independent track circuit and should be tested as such. Record cards should be kept for each part.

Cut Section Track Circuits

Each cut section should be treated as an individual track circuit and record cards kept accordingly.

Disconnection of Units

The Tx and Rx should not be disconnected at the same time as this could results in an adjacent track circuit feeding through and causing a possible wrong side failure.

Test Equipment

A frequency selective meter (FSM), or TI21 Test Meter (TTM), set to the frequency of the track circuit under test.

Gain Settings

The gain setting shall not be increased without consulting your SM(S).

Tuned Zones

These shall be kept clear of all metallic objects including new or scrap lengths of rail for a distance of at least 1.25m (4ft).

The tail cables from the TU/ACT to the rails form part of the tuned circuit, because of this they should be bound together wherever possible, not allowed to form loops and not be run in parallel with the running rails.

Failure to observe these items can result in the effectiveness of the tuned area being altered.

Bonded Rail Joints

Bonds across rail joints should be of a low resistance as this can influence the characteristics of the track circuit.

1. Maintenance Test

Relay (Receiver) End

1.1 Measure and record at the power supply (T/J or Charger) the AC input voltage and the DC output voltage (between 22.5V and 29.5V).

1.2 Measure and record at the receiver unit the AC input voltage between T1 and T2.

1.3 Where a tuned zone is involved.

a) Measure the rail-to-rail voltage at the TU rail connections using a FSM/TTM

b) Measure the rail-to-rail voltage at the adjacent TU rail connection at the frequency of the track circuit under test.

The ratio between these two measurements should be compared to the table in Appendix C.

1.4 Apply a train shunt across the rails at the tuning unit and obtain a drop shunt and a pick-up shunt.

The test results where the receiver is adjacent to a pair of insulated rail joints shall be compared to the table in Appendix B.

For shunt values refer to NR/SMS/PartZ/Z03 (Train Detection - Reference Values).

1.5 With the track circuit not shunted by trains or a train shunt, measure the DC voltage across the track relay coil terminals R1(+) and R2(-).

2. Full Test

The full test should be carried out whenever alterations are made including; relaying, lead/ jumper renewal, equipment replacement, adjustment etc). The full test should also follow the clearing of a fault.

All measurements taken at track circuit frequency are to be taken using a frequency selective meter.

The minimum drop shunt value with the train shunt applied across the rails at the transmitter-tuning unit is 0.3Ω.

2.1 Examine the track circuit in accordance with NR/SMS/PartC/TC10 (Track Circuits: Aster SF15 / U Type) - Service A.

Feed (Transmitter) End

2.2 Measure and record at the power supply (T/J or Charger) the AC input voltage and the DC output voltage (between 22.5V and 29.5V).

2.3 Measure and record at the transmitter unit the AC output voltage between terminals 1&2 or 1&3 and measure the AC feedback voltage between T1&T2.

2.4 Measure and record at the tuning unit the AC voltage between T1&T2. Check they are as follows:

TU Voltage (T1/T2)		
TC Length	Min	Max
50m	1.6V	2.7V
1000m	2.5V	5.3V

Table 1 – TU Voltages

2.5 Measure the rail-to-rail voltage at the TU rail connections using a FSM/TTM. For consistency this measurement shall always be carried out at the rails.

2.6 Where a tuned zone is involved.

a) Measure the rail-to-rail voltage at the TU rail connections using a FSM/TTM,

b) then measure the rail-to-rail voltage at the adjacent TU rail connection at the frequency of the track circuit under test.

The ratio between these two measurements shall be compared to the table in Appendix C.

Relay (Receiver) End

2.7 Measure and record at the power supply (T/J or Charger) the AC input voltage and the DC output voltage (between 22.5V and 29.5V).

2.8 Check the tappings REC1, REC2 and straps A/-/H on the receiver unit for the track circuit length (Appendix A).

NOTE: *The tappings are only a guide and adjustment to obtain satisfactory shunts should always take priority.*

2.9 Measure and record at the receiver unit the AC input voltage between T1 and T2.

2.10 Measure and record at the tuning unit the AC voltage between T1 and T2. Check they are as follows:

TU Voltage (T1/T2)		
TC Length	Min	Max
50m	1.7V	2.8V
1000m	0.25V	0.8V

Table 2 - AC Voltages

2.11 Measure and record the rail-to-rail voltage at the TU rail connections using a FSM/TTM. For consistency this measurement shall always be carried out at the rails.

2.12 Where a tuned zone is involved.

a) Measure the rail-to-rail voltage at the TU rail connections using a FSM/TTM.

b) Measure the rail-to-rail voltage at the adjacent TU rail connection at the frequency of the track circuit under test.

The ratio between these two measurements should be compared to the table in Appendix C.

2.13 Apply a train shunt across the rails at the tuning unit and obtain a drop shunt and a pick-up shunt.

2.14 The test results where the receiver is adjacent to a pair of insulated rail joints should be compared to the table in Appendix B.

For shunt values refer to NR/SMS/PartZ/Z03 (Train Detection - Reference Values).

2.15 Train Shunt Test all extremities of the track circuit. This test should also obtain simultaneous track circuit occupation where an overlapping section exists.

2.16 With the track circuit not shunted by trains or a train shunt, measure the DC voltage across the track relay coil terminals R1(+) and R2(-) and the tuning unit input voltage between T1 and T2.

2.17 Apply a train shunt to the tuning unit terminalsT1 & T2 and obtain a drop shunt and pick up.

2.18 Record the obtained results and other details along with the latest setting numbers on the paper or digital record card.

Where the Receiver Is Adjacent to A Pair of Insulated Rail Joints

2.19 Report situations where track circuit track tail cables are not terminated within 1m of an IRJ.

2.20 Drop shunt test at three positions approximately 15m apart, within 50m of transmitter and its terminations. For a feed end the test should be outside the tuned zone. Results are listed in Appendix B.

Interference Test

2.21 Remove the B24 fuse to the Tx and check the track relay drops. Set a frequency selective meter to the frequency of the track circuit under test and measure the AC input voltage at the Rx unit between T1 and T2.

2.22 Compare this voltage with the one obtained in 2.9, if it is greater than 25% of this voltage, the track circuit shall be signed out of use and your supervisor informed immediately.

APPENDIX A - Receiver Gain Connections

Length (m)	REC1	REC2	Strap
Min	A	B	-
50	C	D	-
	A	D	BC
100	D	E	-
	A	E	BD
	C	E	-
	A	E	BC
200	E	G	CF
	E	G	AF BD
	E	G	DF
	D	G	AF BC
300	D	G	CF
	B	G	AF
	F	G	-
	A	G	BF
400	C	G	DF
	A	G	BC DF
	D	G	EF
	A	G	BD EF
500	C	G	EF
	A	G	BC EF
	E	H	CG
	E	H	AG BD
600	E	H	DG
	D	H	AG BC
	D	H	CG
	B	H	AG

Length (m)	REC1	REC2	Strap
700	G	H	-
	A	H	BG
	C	H	DG
	A	H	BC DG
800	D	H	EG
	C	H	EG
	A	H	BC EG
900	E	H	CF
	E	H	AF BD
	E	H	DF
	D	H	AF BC
1000	D	H	CF
	B	H	AF
	F	H	-
	A	H	BF
	C	H	DF
	A	H	BC DF
	D	H	EF
	A	H	BD EF
	C	H	EF
	A	H	BC EF
MAX	-	-	-

Table 3 - Receiver Gain Connections

The receiver gain connections listed above are to be used as a guide.

Adjustment can be required to suit local conditions.

APPENDIX B - Test Results Where the Receiver Is Adjacent to A Pair of Insulated Rail Joints

Where the drop shunt values below 0.5W (0.7W when wet):

- Inform your SM(S).
- Reduce the gain on the receiver and retest. If unsatisfactory, arrange for the receiver and tuning units to be replaced.

Track circuits that cannot be properly adjusted should be advised to the Signaller.

APPENDIX C - Tuned Zone Ratios

Ratio	Action
2:1 or less	The relevant tuning unit shall be replaced within 48 hours
Between 3:1 & 2:1	IF the other end of the TC not under test is formed of a tuned zone, test the Tuned Zone Ratio at the far end and if that is less than 5:1, replace the tuning unit with the lower Tuned Zone Ratio value
Above 3:1	No action

Table 4 - Tuned Zone Ratios

END

Includes:	HVI Track Circuit equipment
Excludes:	All other Track Circuit types

GENERAL

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

In 3rd rail DC traction areas and in dual electrified areas (3rd rail DC and AC overhead line) HVI track circuit transformer/terminal boxes (known as 'bread bins') can experience a catastrophic arcing across the terminals when the 3rd rail DC traction supply is short circuited to the 'signalling' rail.

As these traction short circuits can be unpredictable (they can be caused by trains, conductive rubbish etc) no preventative or corrective maintenance shall be undertaken inside the 'bread bin' with the 3rd rail DC traction current energised.

If preventative or corrective maintenance requires access inside the 'bread bin' the 3rd rail DC traction current shall be isolated for the entire length of the track circuit(s) concerned. Alternatively remove all track leads, including any adjacent leads that are housed in the same bread bin. Measurements shall be taken on the rails.

In 3rd rail DC traction supply areas where track access can be restricted, there can be permanent 'test leads' installed from the rails to a special test box in a position of safety. In this situation the terminations in the test box may be used to obtain measurements where the test asks for readings 'on the rails'.

The resistance of the test leads (stated on the test box) shall be taken into account when obtaining measurements by this method.

This does not apply in non-electrified areas or if the traction supply is by AC overhead line only.

The tests are marked with a # symbol, only the tests applicable to the traction current supply in the area of the track circuit shall be carried out. If you are unsure, ask your SM(S).

# Symbol	Meaning
#1	Non-electrified areas and overhead line (AC & DC) areas only
#2	3rd rail DC traction areas and dual supply traction areas (3rd rail and overhead line) only
#3	All areas

NOTE: *A faulting guide and adjustment details for this type of track circuit can be found in NR/SMTH/Part10/FF06 Faulting Guide: High Voltage Impulse (HVI) Track Circuits*

1. Maintenance test

1.1 #1 Drop Shunt Test (T1): Using a shunt box, carry out a drop shunt test at the relay end track transformer track terminals.

The drop shunt values can be found in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

1.2 #2 Drop Shunt Test (T2): Using a shunt box, carry out a drop shunt test at the relay end on the rails.

1.3 #3 Track Relay Voltage Test (T3): Using a digital voltmeter set on DC manual range, measure the voltage at the track relay plug board contacts.

There will be a fluctuation in the reading.

Electrified and Non-Electrified Lines	
V1+ to V1-	**V2+ to V2-**
Min 20V	Min 30V
Max 50V	Max100V

1.4 #1 Relay End Track Transformer Voltage (T4): Measure the relay voltage at track relay end track transformer track terminals, using adapter integrator with a digital voltmeter on auto range.

1.5 #2 Relay End Track Transformer Voltage (T4): Measure the relay voltage at track relay end on the rails, using adapter integrator with a digital voltmeter on auto range.

Polarity Ratio +ve : -ve	**Electrified Lines**		**Non- Electrified Lines**	
	V+ to V-		**VA to VB**	
	Min 50V	Max 150V	Min 20V	Max 120V
Min 5:1 Max 10:1	Min 8V	Max 22V	Min 2V	Max 12V

1.6 #1 Relay End Load Test (T5): Load test at relay end track transformer track terminals with a 0.5Ω shunt across the rails, using adaptor integrator.

1.7 #2 Relay End Load Test (T5): Load test at relay end with a 0.5Ω shunt across the rails, using adaptor integrator.

Electrified Lines	**Non-Electrified Lines**
V+ to V-	**VA to VB**
Min 10V	Min 6V

2. Full Test

2.1 #1 Drop Shunt Tests (T1 & T2): Using a shunt box, carry out a drop shunt test at the relay end track transformer terminals and on the rails.

The drop shunt values can be found in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

2.2 #2 Drop Shunt Tests (T2): Using a shunt box, carry out a drop shunt test at the relay end rails.

2.3 #3 Track Relay Voltage Test (T3): Using a digital voltmeter set on dc manual range, measure the voltage at the track relay plugboard contacts.

There will be a fluctuation in the reading.

Electrified and Non-Electrified Lines	
V1+ to V1-	**V2+ to V2-**
Min 20V	Min 30V
Max 50V	Max100V

2.4 #1 Relay End Track Transformer Voltage (T4): Measure the relay voltage at track relay end track transformer track terminals, using adapter integrator with a digital voltmeter on auto range.

2.5 #2 Relay End Track Transformer Voltage (T4): Measure the relay voltage at track relay end on the rails, using adapter integrator with a digital voltmeter on auto range.

Polarity Ratio +ve : -ve	**Electrified Lines**	**Non- Electrified Lines**
	V+ to V-	**VA to VB**
	Min 50V Max 150V	Min 20V Max 120V
Min 5:1	Min 8V Max 22V	Min 2V Max 12V

2.6 #1 Relay End Load Test (T5): Load test at the relay end track transformer track terminals with a 0.5Ω shunt across the track terminals, using adaptor integrator.

2.7 #2 Relay End Load Test (T5): Load test at relay end track transformer track terminals with 0.5Ω shunt across the rails, using adaptor integrator.

Electrified Lines	**Non-Electrified Lines**
V+ to V-	**VA to VB**
Min 10V	Min 6V

2.8 #3 Power Supply Test (T6): Measure the power supply voltage and current, under full working load using a digital meter.

Electrified and Non-Electrified Lines	
Voltage Parameters	**Current Parameters**
Min 95V Max 121V	Min 0.3A Max 0.5A

2.9 #3 Transmitter Power Test (T7): (To be completed within 2 minutes)

a) Connect a short circuit between transmitter terminals C- and t6. Disconnect any strapping between t1 and t6.

If any terminal other than t6 is connected to outgoing links, remove the links.

b) Using the Adapter Integrator and a digital meter measure the transmitter power between terminals 1 (+ve) & 3 (-ve) of the transmitter.

c) Reconnect terminals and links.

Electrified and Non-Electrified Lines
Minimum 120V

2.10 #1 Feed End Voltage Test (T8): Measure feed voltage at feed end track transformer track terminals, using adapter integrator with a digital voltmeter on auto range.

2.11 #2 Feed End Voltage Test (T8): Measure feed voltage at feed end, on the rails, using adapter integrator with a digital voltmeter on auto range.

Polarity Ratio +ve : -ve		**Electrified Lines**		**Non- Electrified Lines**	
		V+ to V-		**VA to VC**	
		Min 50V	Max 150V	Min 20V	Max 120V
Min 5:1	Max 10:1	Min 8V	Max 22V	Min 2V	Max 12V

2.12 #3 Pulse Rate Test (T9): Touch the rear casing of the feed end track transformer and count the number of pulses.

Electrified and Non-Electrified Lines	
Number of Pulses in 7 Seconds	
Min 15	Max 30

2.13 #3 Un-shunted External Interference Test (T10): Disconnect the PSU fuses and using a digital voltmeter set to DC manual range. Measure the voltage at track relay terminals. Reconnect the PSU fuses.

Electrified Lines	**Non-Electrified Lines**
V2+ to V2-	
Max 10V	Max 6V

2.14 #3 Shunted External Interference Test (T11): Disconnect the PSU fuses and Connect a short circuit across the feed end transformer V+V-. Using a digital voltmeter set to DC manual range; Measure the voltage at track relay terminals. Reconnect the PSU fuses and remove the short circuit.

Electrified and Non-Electrified Lines
V2+ to V2-
Max 7V

END

Includes:	BR-WR Quick Release Track Circuit equipment
Excludes:	All other Track Circuit types

There is no simple relationship between the drop shunt value across the rails and the drop shunt value across the relay (the track relay being remote from the rails and associated transformer-rectifier).

If the voltage across the relay at drop away does not vary on subsequent maintenance tests by more than the percentage permitted, this can be considered a valid drop shunt test for this type of track circuit.

1 Maintenance test

1.1 Carry out a drop shunt test.

Where this is not practicable because the TR is remote from the rails, the following test can be used as an alternative.

a) At the relay end of the track circuit with the train shunt applied across the relay end links, obtain the drop away voltage value across the relay coils.

Details of drop shunt values are in NR/SMS/Part/Z03.

The variation of the drop away voltage should not exceed +/ 10% of the voltage recorded at the last FULL TEST of the track circuit. If the variation exceeds these limits the shunt value shall be determined by a FULL TEST.

1.2 Measure the voltage across the track relay coil with the track circuit clear of trains and train shunt.

1.3 Assess the condition of the ballast.

1.4 Record all test results on the paper or digital record card.

2 Full Test.

A FULL TEST shall be carried out following installation and after alterations (e.g. relaying, ballast cleaning or insulation changing, renewed/ repaired apparatus, leads or jumpers) or changed settings.

2.1 Examine the track circuit (NR/SMS/TC14 Service A.)

Feed End

2.2 Measure the voltages and note the feed unit output strapping, as required on the paper or digital record card. Adjust as necessary.

Relay End

2.3 Measure the rail volts at the relay end rail terminations.

2.4 Measure the track relay coil voltage with the track circuit clear of trains and train shunt.

Final Check

2.5 Train Shunt test all extremities of the track circuit.

2.6 Drop Shunt test the track circuit.

The value of the drop shunt shall be noted, either as the track relay just makes its back contacts, or where only front contacts exist when they are fully open.

2.7 Check, by visual observation, that relay operation is sharp and positive.

Details of drop shunt values are in NR/SMS/Part/Z03

2.8 Record all test results on the paper or digital record card.

2.9 With the shunt box applied across the rails at the relay end, obtain the pickup shunt value.

2.10 Carry out a Maintenance Test.

Appendix A - Feed and Relay Units

1. **Colour Coding of Feed and Relay Units Feed End:**

Westinghouse original units - grey. Other - red.

Relay End:

- Yellow - BR938
- Blue - Shelf Type, 2.25Ω Red - NT1
- White - BR938, DC immune – for DC point heating

2. **Setting up a Quick Release Track Circuit for Testing**

At the track feed unit, adjust the input strapping to suit the 110Vac busbar voltage. Adjust the output strapping to match the length of the track circuit as given in the following table:

Length of Track (Approx) metres	Output Voltage	Strapping
1000	20	2 and 18
900	19	1 and 18
800	18	0 and 18

700	17	2 and 15
600	16	1 and 15
500	15	0 and 15
400	14	2 and 12
300	13	1 and 12
Below 300	12	0 and 12

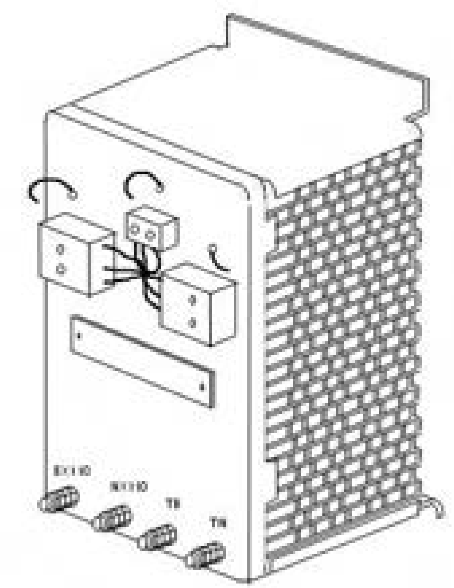


Figure 1: Input strapping and connections

End

Includes:	Reed Type RT Track Circuit equipment (Jointed and Jointless versions)
Excludes:	All other Track Circuit types

High voltages can be present on impedance bonds and other track circuit terminations. Switch off mobile phones if you are working in the proximity (3 meters) of the TX or RX equipment.

A double rail jointed reed track circuit shall never be re-configured as a single rail track circuit.

Due to operating problems, only the jointed configuration can be used in electrified areas. It may be configured as a single rail or a double rail track circuit.

Double rail track circuits require the use of impedance bonds.

More information on Reed Type RT track circuits can be found in NR/L2/SIG/11763

Layout Configurations

The Reed type RT track circuit is an audio frequency track circuit capable of operating in jointless and jointed modes. Both types use the same TX & RX but differ in the way the audio frequency signal is taken from the rails at the TX & RX.

The jointed configuration uses direct connections to the rails as in other TC types; the jointless version uses compound loops between the rails which inductively couple the audio frequency signal between the rails and TX/RX.

The Jointless version is always center fed (except where it adjoins a jointed section) the jointed version can be center fed or end fed.

Additional intermediate RXs can be positioned within both types (Jointed and Jointless) of a Reed TC, with a simple loop of cable mounted in the four foot.

The audio signal in the rails is detected by the simple loop and fed via an attenuator and the RX amplifier/filter to the TR which functions as at a jointed RX.

Track Circuits with Intermediate Receivers

Each of the two overlapping sections where a simple loop is fitted operates as an independent track circuit and shall be tested as such with record cards kept accordingly. Note that the TR will only be shunted by a train directly over the loop.

Centre Fed Track Circuits

Each half of a centre fed track circuit operates as an independent track circuit and shall be tested as such and record cards kept for each part.

Cut Section Track Circuits

Each cut section shall be treated as an individual track circuit and record cards kept accordingly.

Impedance Bond Tuning

Any impedance bond within the track circuit shall be tuned with the correct resonating capacitor across the auxiliary coil. Each tuning capacitor or module identifies the style of bond to which it should be fitted.

'Beating' Receiver Readings

If the receiver filter or dummy amplifier output or track relay voltage readings are seen to 'beat' (the measured voltage will rise and fall at a slow regular rate) interference between two track circuits of the same frequency is occurring. This shall be reported to your SM(S) immediately.

1. Maintenance Test Relay (Receiver) End

1.1 Connect a train shunt to the incoming track circuit terminations in the apparatus case and obtain a drop shunt value.

Where there is a variation in the shunt value from the last recorded (after making allowance for differing weather conditions) the drop shunt test shall be verified by a test carried out with the shunt applied to the rails.

Drop shunt values are in NR/SMS/PartZ/Z03 – Train Detection Reference Values.

1.2 Measure using a digital meter the AC voltage on the receiver track filter (RT7202, RT7212) between terminals 11 and 12.

- 150mV to 300mV

If an attenuator filter is fitted (RT7302) replace this with a dummy amplifier and Measure the output voltage.

- 75mV approx.

If the voltages are incorrect investigate the cause. If the resistor tapings are adjusted the FULL TEST shall be carried out.

1.3 With the track circuit clear of trains and train shunts, Measure the voltage across the track relay coils R1(+) and R4(-).

- Between 11.5V and 13.5V.

This indicates the correct functioning of the receiver.

1.4 Check that the surge arrestor is not hot to the touch. If it is hot check the track circuit adjustments and connections.

1.5 Assess the condition of ballast/ ground conditions.

1.6 Compare results with previous records for significant variation.

A variation in drop shunt value may be caused by variations in the equipment or environment. In wet conditions, a low value of drop shunt can be expected. In dry or icy conditions, a higher value will be obtained.

If the drop shunt exceeds the highest value for the track circuit, look for degraded ballast or debris.

If the drop shunt is lower than the minimum value, the track circuit shall be regarded as failed.

2. Full Test

The full test shall be carried out whenever alterations are made including; relaying, lead/ jumper renewal, equipment replacement, adjustment etc).

2.1 Examine the track circuit in accordance with NRSMS/PartC/TC06 – Track Circuits: Reed - Service A.

2.2 Check the impedance bond (where fitted and where accessible and without removing) for the following:

a) • Correct glands fitted.

b) • Drain holes clear (on Howells & WH3 bonds).

c) • Terminal box connections.

d) • Tuning capacitor.

2.3 Check that the impedance bonds are tuned with the correct resonating circuit across the auxiliary coil.

2.4 With a suitable meter connected across the rails, check that when the resonating circuit is disconnected the rail voltage falls, and when it is re- connected the rail voltage rises.

2.5 Measure the voltage across the resonating circuit; Check that it is in the correct ratio with the rail-to-rail voltage (Appendix A). If not, the impedance bond shall be investigated for a fault.

2.6 Check that all the rail connections and bonding are secure.

If tightened is required, it shall be to the torque detailed in NR/SMS/PartZ/Z03 – Train Detection Reference Values.

Feed (Transmitter) End

2.7 Measure the primary AC voltage of the constant voltage transformer (NT1202) between terminals BX110 and NX110.

- 99V to 121V.

2.8 Measure the supply to the power amplifier between terminals T5 and T6.

- 14V to 16V.

2.9 Measure the DC input voltage of the oscillator amplifier (RT5001) between terminals A1(+) and A2(-):

- 15V to 17V.

2.10 Disconnect a track feed link and connect a suitable meter (capable of measuring AC current to at least 2A) on the AC current range across the link.

a) Apply a short circuit across the rails at the feed end connections and Measure the current (Appendix B).

b) Remove the short circuit and observe that the current reading falls.

c) The current fall should be less than 150mA.

d) Remove the meter and restore the link.

e) Be aware that high back E.M.F. may develop across the link terminals when the link is disconnected.

f) The link terminals shall not be shorted together to discharge the E.M.F. this shall be done using a resistor of approximately 250kΩ or a meter with an equivalent internal resistance.

g) Do not short circuit the output of the power amplifier as this could result in serious damage to the equipment.

Relay (Receiver) End

2.11 Measure the input AC voltage of the power supply unit (RR9121).

- 99V to 121V.

2.12 Measure the DC supply voltage at the receiver amplifier (RR2002) between terminals D2(+) & A3(-)

- 12V to 13.8V.

2.13 Measure using a digital meter the AC voltage on the receiver track filter (RT7202, RT7212) between terminals 11 and 12.

- 150mV to 300mV.

2.14 If any of the values obtained in 2.13 are out of range, the receiver track filter (RT7202, RT7212) shall be adjusted by changing the tapings on terminals 21, 22, and 23.

Before any adjustments are made consideration should be given to the condition of the track causing low ballast resistance or any factors.

2.15 If after adjustments have been made in 2.14 and voltages in 2.13 are still out of range, the feed end track filter (RT7202, RT7212) shall be adjusted on terminals 21, 22 and 23.

When adjustments have been made in 2.13 and 2.14 it is necessary to re-start the FULL TEST at 2.9.

2.16 With the track circuit clear of trains and train shunts Measure the voltage across the track relay coils R1(+) and R4(-)

- Between 11.5V and 13.5V.

Compound Loops (Jointless configurations only)

2.17 Check that the loop is undamaged and securely fitted in the four foot. Check that the connections between the loop and the track filter / surge divider are undamaged and secure.

Intermediate Receivers with Simple Loops (Jointed/Jointless configurations where provided)

2.18 Check that the loop is undamaged and securely fitted in the four foot. Check that the connections between the loop and the attenuator filter are undamaged and secure.

2.19 Measure the input AC voltage of the power supply unit (RR9121).

- 99V to 121V.

2.20 Measure the DC supply voltage at the receiver amplifier (RR2002) between terminals D2(+) & A3(-)

- 12V to 13.8V.

2.21 Replace the attenuator filter (RT7302) with a dummy amplifier and Measure the AC output voltage with a suitable digital meter:

- 75mV approx.

2.22 If any of the values obtained in 2.21 are out of range, the attenuator filter (RT7302) it shall be adjusted by using its variable resistor settings.

Before any adjustments are made consideration should be given to the condition of the track causing low ballast resistance.

2.23 If after adjustments have been made in 2.22 and voltages in 2.21 are still out of range, the feed end track filter (RT7202, RT7212) shall be adjusted on terminals 21, 22 and 23.

When adjustments have been made in 2.21 and 2.22 it is necessary to re-start the FULL TEST at 2.9.

2.24 With the track circuit clear of trains and train shunts Measure the voltage across the track relay coils R1(+) and R4(-)

- Between 11.5V and 13.5V.

Final Checks

2.25 With the train shunt set to 0.5Ω, (0.3Ω if impedance bonds are fitted) drop shunt all extremities of the track circuit.

2.26 With the train shunt applied across the rails, obtain a drop shunt and a pick-up shunt value.

Drop shunt values are in NR/SMS/PartZ/Z03 – Train Detection Reference Values.

2.27 Assess the condition of ballast/ ground conditions and Record all details along with any new settings on the paper or digital record card.

Interference Test

2.28 Remove the BX110 fuse to the TX and Check that the track relay drops. Measure the AC voltage on the TX track filter.

If a reading greater than 8mV is obtained, replace the RX amplifier with a dummy amplifier and Measure the output of this. If a reading greater than 8mV is still found, inform your SM(S) immediately.

Fault Finding Guidelines

Full fault-finding guidelines can be found in NR/L2/SIG/11763.

APPENDIX A - Impedance Bond Voltage Ratios

Impedance Bond Style	Voltage Ratio
DE	40:1
MR	56:1
P3	45:1
S	56:1
WH3	56:1

APPENDIX B - Transmitter Power Amplifier Currents

TC Type	Amplifier Type	Terminals	AC Current	
			Min	Max
Double Rail	RT7101	1 and 2	1.2A	1.8A
	RT7112	10 and 12		
Single Rail	RT7111	1 and 2	1.1A	1.4A
	RT7112	11 and 12		

APPENDIX C - Transmitter Power Amplifier Voltages

TC Type	Amplifier Type	Terminals	AC Voltage (Approx.)
Double Rail	RT7101	1 and 2	17V
	RT7112	10 and 12	
Single Rail	RT7111	1 and 2	13V
	RT7112	11 and 12	

END

Includes:	AC Rectified (Diode) Track Circuit equipment
Excludes:	All other Track Circuit types

Carry out the following tests and record the results on the paper or digital record card.

1. Maintenance Test – Feed / Relay (Near) End

1.1 Note and record the strapping of the feed resistor.

1.2 Measure and record the AC voltage across the feed resistor.

1.3 Measure and record the AC and DC voltage at the relay coils and across the rails.

1.4 Connect a shunt box across the track circuit links and measure the drop away and pick up shunt.

Drop shunt values are in NR/SMS/Part/Z03.

1.5 Compare the results with previous records for significant variation.

1.6 If any adjustment is required then the FULL TEST shall be carried out.

2. Full Test

The full test shall be carried out whenever alterations are made including; relaying, lead/ jumper renewal, equipment replacement, adjustment etc).

Feed/Relay End (Near)

2.1 Note and record the strapping of the feed resistor.

2.2 Measure and record the AC voltage across the feed resistor.

2.3 Measure and record the AC and DC voltage at the relay coils and across the rails.

2.4 Connect a shunt box across the track circuit links and measure the drop away and pick up shunt.

Diode End (Remote)

2.5 Measure and record the AC and DC voltage across the rails.

2.6 Disconnect one side of the diode and Measure the AC and DC current between the disconnected side of the diode and its termination, reconnect the diode.

2.7 Connect a shunt box across the rails and measure the drop away and pick up shunt.

If adjustments are required to the track circuit to bring the drop shunt to a satisfactory level, the full test shall be carried out again.

Appendix A - Strapping Matrix for Feed Resistor Adjustment

The drop shunt can be varied by adjusting the resistor strapping. Increasing the resistance will lower the voltage and increase the drop shunt, conversely decreasing the resistance will increase the voltage and decrease the drop shunt.

Feed Resistance	Input to	Output to	Strap 1	Strap 2	Strap 3	Strap 4
33Ω	T11	T12	T13 to T15	T15 to T17		
22Ω	T11	T12	T13 to T15	T14 to T16		
13.2Ω	T11	T12	T13 to T15	T15 to T14	T11 to T16	
11Ω	T11	T13	T13 to T14			
8.8Ω	T11	T12	T13 to T15	T14 to T02	T16 to T01	
7.3Ω	T11	T13	T01 to T02	T14 to T15	T15 to T13	
5.5Ω	T11	T13	T01 to T02	T13 to T16	T16 to T15	T15 to T14

End

Includes:	FS 2600 Type Track Circuit equipment
Excludes:	All other Track Circuit types

GENERAL

The FS2600 shall never be configured as a single rail track circuit.

High voltages can be present on impedance bonds and other track circuit terminations.

Test Equipment

Only a high impedance digital voltmeter (DVM) like the Fluke 23, Megger M2006 (or equivalent) shall be used for all readings.

A special test lead is required to connect the meter to the receiver unit monitor point socket.

A manufacturer's set up box is required for the receiver sensitivity set up.

A universal track circuit shunt box shall be used for all drop shunt tests.

Impedance Bonds

Howells or Westinghouse Mk3 type bonds require a 5mm drain hole in the bottom of the termination box to prevent water accumulation.

Impedance Bond Tuning Capacitors

Check the tuning capacitor is mounted as close as possible to the terminal block to reduce failures caused by vibration induced flexing.

Alternatively, the capacitor can be mounted on the wall of the terminal box and connected to the terminals by means of a fly lead made of fine multi-stranded wire soldered to the capacitor and connected to the terminal block by crimp connectors.

Equipment Disconnection

Check that the TX end fuse is removed before making any alterations or connections to the TX end impedance bond. Before removing the TX or RX remove the power supply and track fuses.

After changing an RX unit, the receiver sensitivity procedure shall be carried out. It is however permissible to delay this for up to 24 hours by re-using the configuration plug from the old unit providing a satisfactory drop shunt test has been carried out.

Configuration Plug

It has been found that in some instances internal wires in the configuration plug can become trapped by the cover leading to internal shorting and incorrect operation of the track circuit. When changing the plug always check that no wires have become trapped by the cover.

Carry out the following tests and record the results on the paper / digital record card

1. Maintenance Test Feed

Transmitter End

1.1 Check the security and the fixing of the TX equipment.

Transmitter and Intermediate Impedance Bond (Where Fitted)

1.2 Check the impedance bond for the following:

a) Correct glands fitted.

b) Drain holes clear (on Howells & WH3 bonds).

c) Terminal box connections.

d) Tuning capacitor connecting leads for cracks or fractures.

1.3 Check that all the rail connections and bonding are secure.

If tightened is required, it shall be to the torque detailed in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

Relay (Receiver) End

1.4 Check the security and the fixing of the RX equipment.

1.5 Observe the RX unit LEDs are giving the correct ‘track clear’ indications (Appendix A).

1.6 Remove the RX unit monitor point socket protective cover and connect the DVM to the socket using the special test lead. Measure the track clear monitor point voltage.

1.7 Connect the track shunt box across the rails at the intermediate impedance bond or if at the end of track circuit section connect it at the RX unit.

1.8 Set the shunt box to 0.6Ω and depress the button.

1.9 Observe the LEDs are giving the correct track shunted indications (Appendix A).

LEDs Input-A Valid and Input-B Valid might not change states simultaneously when the track is shunted, a momentary delay might be observed.

1.10 Measure the track shunted monitor point voltage then release the shunt button.

1.11 Compare the results with previous records obtained under similar conditions. If the results are not similar the cause shall be investigated and rectified. A FULL TEST shall then be carried out.

1.12 Disconnect the track shunt box and the DVM from the RX monitor point socket.

1.13 Check that the protective cover is refitted to the RX monitor point socket.

1.14 Check the impedance bond for the following:

a) Correct glands fitted.

b) Drain holes clear (on Howells & WH3 bonds).

c) Terminal box connections.

d) Tuning capacitor connecting leads for cracks or fractures.

1.15 Check that all the rail connections and bonding are secure.

If tightened is required, it shall be to the torque detailed in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

1.16 Record the ballast and weather conditions on the paper / digital record card.

2. Full Test

The full test shall be carried out whenever alterations are made including relaying, lead/jumper renewal, equipment replacement, adjustments etc.

2.1 Examine the track circuit in accordance with NR/SMS/PartC/TC09 (Track Circuits:FS2600) - Service A.

<u>Feed (Transmitter) End</u>

2.2 Examine the TX unit case, connectors, terminations and plug couplers.

2.3 Check the connections, wiring and terminations (as applicable) and ventilation grills. Check that they are not blocked.

2.4 Measure the supply voltage between terminals 14 and 15:

a) 99V to 121V AC.

2.5 Check that the TX voltage adjustment tap is set to 115V (terminal 11 linked to terminal 8).

2.6 Measure using a DVM the voltage on the TX output terminals and the voltage across the rails. Check they are within the limits shown in the Table 1:

TC Type	TX O/P Terminal	O/P Voltage	Rail Voltage
Without Intermediate	3 and 4	80V to 120V AC	5V to 11V AC
With Intermediate Bond	5 and 6	160V to 240V AC	6V to 15V AC

Table 1

Transmitter End Impedance Bond (Where Fitted)

2.7 Remove the TX end track fuse and apply a short circuit across the tuning capacitor then refit the TX end track fuse.

2.8 Measure the voltage across the auxiliary coil. Check that this is less than the voltage across the cables from the TX, if it is not, reverse the phasing of the impedance bond.

2.9 Measure the TX rail voltage, then remove the TX end track fuse, and remove the short circuit across the tuning capacitor. Refit the TX end track fuse.

2.10 Measure the rail voltage, check it has increased with the short removed from the tuning capacitor and is within the limits as follows:

a) No Intermediate Bond 5V to 11V AC.

b) Intermediate Bond Fitted 6V to 15V AC.

Intermediate Impedance Bond (Where Fitted)

2.11 Measure the rail voltage:

a) Minimum of 3V.

2.12 Measure the voltage across the auxiliary coil; Check this voltage when the bond is resonated is in the ratio of 1:56 to the rail voltage.

If it is not the impedance bond shall be investigated for a fault.

2.13 Measure the rail voltage then apply a short circuit across the tuning capacitor, check the voltage falls then remove the short circuit.

2.14 Disconnect the tuning capacitor, check the rail voltage falls. Reconnect the tuning capacitor.

Relay (Receiver) End

2.15 Examine the RX unit case, check the connections, wiring and terminations (as applicable).

2.16 Check the ventilation grilles are not blocked.

2.17 Observe the RX unit LED's are giving the correct 'track clear' indications (Appendix A).

2.18 Measure the supply voltage:

a) 99V to 121V AC.

2.19 Remove the RX unit monitor point socket protective cover and connect the DVM to the socket using the special test lead. Measure the track clear monitor point voltage.

2.20 Connect the track shunt box across the rails at the intermediate impedance bond or if at the end of track circuit section connect it at the RX unit.

2.21 Drop shunt the track circuit, measure the shunt when both RX relays are de-energised.

Drop shunt values are in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

2.22 Observe the operation or the relays through the RX window. Check both relays drop when both Valid LEDs are extinguished.

2.23 Observe the LEDs are giving the correct track shunted indications (Appendix A).

2.24 LEDs Input-A Valid and Input-B Valid might not change states simultaneously when the track is shunted, a momentary delay might be observed.

2.25 Measure the track shunted monitor point voltage.

The Input-A Valid and Input-B Valid LEDs might not extinguish at the same monitor point voltage. However, the higher reading must not exceed the lower reading by 10%.

2.26 If a satisfactory drop shunt cannot be obtained the cause shall be investigated and rectified, a FULL TEST shall be carried out again.

Receiver End Impedance Bond (Where Fitted)

2.27 Measure the rail voltage:

a) Minimum of 3V.

2.28 Remove the RX end track fuse and apply a short circuit across the rails, apply a short circuit across the tuning capacitor then remove the short circuit from across the rails.

2.29 Measure the rail voltage and check it has fallen from the value obtained in 2.27. Remove the short circuit across the tuning capacitor.

3. Final Checks

3.1 Train shunt all extremities of the track circuit.

3.2 Check that the protective cover is refitted to the RX monitor point socket after the DVM is removed.

3.3 Record the ballast and weather conditions on the track circuit record card.

4. Receiver Sensitivity Set Up Procedure

These tests shall be carried out if a receiver unit has been replaced. The set-up box is to be used.

4.1 Connect a shunt box across the rails at the intermediate bond (if fitted) otherwise at the RX end. Check by use of a DVM the rail voltage disappears when 0Ω is applied via the shunt box button.

4.2 Remove the RX track fuse.

This is to check that the RX unit is not damaged when the set-up plug or configuration plug are removed.

4.3 Connect a DVM switched to AC to SK1 and SK2 on the set-up box, set the MIN/MAX control to ‘MAX’, set the COARSE and MEDIUM switches to position 4, set the FINE switch to position 1 and set the ‘LINK’ switch to ‘SET UP’.

4.4 Fit a blank configuration plug shell to the 15-way D type connecter on the set-up box.

4.5 Check for correct alignment and fit.

4.6 Connect the 25-way connector loom to the set-up box and the other ends to the 9-way and 15-way connectors on the RX unit. Re-fit the track fuse.

4.7 Look up the Channel Specific Value for the channel number in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

Check that account is taken of any intermediate bond.

4.8 Press the set-up button and adjust the MIN/MAX control until the reading on the DVM matches the Channel Specific Value. Lock the MIN/MAX control and release the set-up button.

4.9 Set the shunt box to 4Ω. Press the button on the shunt box and the set-up button on the set-up box. Measure the voltage on the DVM and record it as 'ratio'. Release the buttons on both boxes.

4.10 Look up the MPV set up 'step increase' in Appendix B for the channel number and locate the 'ratio' in Appendix C. Move up the table the number of rows of the 'step increase' value and record the target MPV set up value.

4.11 Adjust the 'COARSE', 'MEDIUM' and 'FINE' switches in turn to get the reading on the DVM as close as possible to the target value and within the upper and lower limits.

4.12 Set the 'LINK' switch from 'SET UP' to 'LINK A', if the 'NO LINK' LED is lit go to 4.14. If it is not lit go to 4.13.

Note which LEDs on the set-up box are lit and connect one of the wire links provided with the configuration plug between the pins on the configuration plug corresponding to the lit LEDs on the set-up box.

4.13 If the lit LEDs do not extinguish or if other LEDs light check the link for correct fitment.

4.14 Set the 'LINK' switch in turn to 'LINK B, LINK C' and 'LINK D' Repeat 4.13 if any of the LED's (except the 'NO LINK' LED) light.

4.15 Turn the switch back from 'LINK D' to 'LINK A' ensuring that the LEDs around the configuration plug remain extinguished (except the 'NO LINK' LED).

4.16 If any light, remove all the links using the provided extractor tool and start again at 4.12.

4.17 Remove the configuration plug from the set-up box and check each pin and wire for the links are pushed firmly home into the connector hole. Check each is fully home by gently pulling on the wire.

4.18 Fit the hood to the configuration plug and write the link settings and name of the track circuit on the labels provided affixing these to the hood.

4.19 Remove the RX track fuse. Remove the 15-way D type plug from the RX leaving the 9-way connector in place. Fit the configuration plug to the RX 'SET UP' socket.

Do not over tighten the securing screws.

4.20 Re-fit the RX track fuse and check that the DVM is still indicating a value between the upper and lower limits of the MPV set up. If not start the Receiver Sensitivity Procedure again from 4.1.

4.21 With the shunt box still connected, set it to 0.6Ω and press the button. Measure the monitor point voltage.

4.22 Record the target and actual MPV set up link settings, weather and ballast conditions on the front of the track record card. Compare the new reading with the previous readings reporting any differences to your SM(S).

4.23 Observe that the LEDs in the RX unit are indicating that the track is shunted (Appendix A).

4.24 If the LEDs do not indicate that the track circuit that is shunted with the 0.6Ω drop shunt look for a fault with the track circuit or an error in the set-up process and then repeat the FULL TEST.

4.25 If this does not remedy the low drop shunt it can be improved by adjusting the 'COASE', 'MEDIUM' and 'FINE' switches to lower the MPV (to a minimum of 2.2v). You shall inform your SM(S).

Never increase the gain.

4.26 Remove the 9-way D type connector from the RX 'MONITOR POINT' and check that the protective cover is correctly fitted.

4.27 Drop shunt the track circuit, measure the shunt when both RX relays are de-energised.

Drop shunt details are in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

4.28 Observe the operation or the relays through the RX window. Check that both relays drop when both Valid LEDs are extinguished.

4.29 With the train shunt still applied obtain a pickup shunt value.

4.30 Repeat 4.28 and 4.29 with the train shunt applied to the incoming track circuit cable terminations in the apparatus case/equipment room.

4.31 Record all the obtained values and details with the latest setting number from the front of the record card and the reverse of the card.

Appendix A - Receiver Unit LED Indications

LED	Track Clear	Track Shunted
Supply	On	On
µP A Running	Flashing	Flashing
Input-A Valid	On	Off
µP B Running	Flashing	Flashing
Input-B Valid	On	Off
Output	On	Off

Table 2

Appendix B - MPV Set Up

	Channel Specific Value		
Channel Number	**WITH With Intermediate Bond**	**WITHOUT Without Intermediate Bond**	**MPV set- up Step Increase**
CH 1	0.957	0.961	6
CH 2	0.963	0.967	5
CH 3	0.968	0.972	3
CH 4	0.974	0.977	1
CH 5	0.978	0.980	2
CH 6	0.982	0.984	3
CH 7	0.987	0.989	4
CH 8	0.992	0.993	4
CH 9	0.995	0.996	3
CH 10	1.000	1.000	0

Table 3

Appendix C - MPV Ratio and Limits

Ratio WITH Intermediate Bond	Ratio WITHOUT Intermediate Bond	MPV set- up Target	MPV Upper Limit	MPV Lower Limit
0.523 – 0.531	0.418 - 0.425	7.40	7.49	7.31
0.531 – 0.538	0.425 – 0.432	7.22	7.31	7.13
0.538 – 0.545	0.432 – 0.438	7.04	7.13	6.95
0.545 – 0.550	0.438 – 0.444	6.87	6.95	6.78
0.550 – 0.556	0.444 – 0.449	6.70	6.78	6.62
0.556 – 0.561	0.449 – 0.454	6.54	6.62	6.46
0.561 – 0.566	0.454 – 0.460	6.38	6.46	6.30
0.566 – 0.572	0.460 – 0.465	6.22	6.30	6.15
0.572 – 0.577	0.465 – 0.470	6.07	6.15	6.00
0.577 – 0.582	0.470 – 0.476	5.92	6.00	5.85
0.582 – 0.587	0.476 – 0.481	5.78	5.85	5.71
0.587 – 0.592	0.481 – 0.486	5.64	5.71	5.57
0.592 – 0.597	0.486 – 0.491	5.50	5.57	5.43
0.597 – 0.602	0.491 – 0.496	5.37	5.43	5.30
0.602 – 0.607	0.496 – 0.501	5.23	5.30	5.17
0.607 – 0.612	0.501 – 0.507	5.11	5.17	5.04
0.612 – 0.616	0.507 – 0.512	4.98	5.04	4.92
0.616 – 0.621	0.512 – 0.517	4.86	4.92	4.80
0.621 – 0.626	0.517 – 0.522	4.74	4.80	4.68

Ratio WITH Intermediate Bond	Ratio WITHOUT Intermediate Bond	MPV set- up Target	MPV Upper Limit	MPV Lower Limit
0.626 – 0.630	0.522 – 0.527	4.63	4.68	4.57
0.630 – 0.635	0.527 – 0.531	4.51	4.57	4.46
0.635 – 0.640	0.531 – 0.536	4.40	4.46	4.35
0.640 – 0.644	0.536 – 0.541	4.30	4.35	4.24
0.644 – 0.648	0.541 – 0.546	4.19	4.24	4.14
0.648 – 0.653	0.546 – 0.551	4.09	4.14	4.04
0.653 – 0.657	0.551 – 0.555	3.99	4.04	3.94
0.657 – 0.661	0.555 – 0.560	3.89	3.94	3.84
0.661 – 0.666	0.560 – 0.565	3.80	3.84	3.75
0.666 – 0.670	0.565 – 0.569	3.70	3.75	3.66
0.670 – 0.674	0.569 – 0.574	3.61	3.66	3.57
0.674 – 0.678	0.574 – 0.578	3.53	3.57	3.48
0.678 – 0.682	0.578 – 0.583	3.44	3.48	3.40
0.682 – 0.686	0.583 – 0.587	3.36	3.40	3.32
0.686 – 0.690	0.587 – 0.592	3.27	3.32	3.23
0.690 – 0.694	0.592 – 0.596	3.19	3.23	3.16
0.694 – 0.698	0.596 – 0.600	3.12	3.16	3.08
0.698 – 0.701	0.600 – 0.604	3.04	3.08	3.00
0.701 – 0.705	0.604 – 0.608	2.97	3.00	2.93
0.705 – 0.709	0.608 – 0.613	2.89	2.93	2.86
0.709 – 0.712	0.613 – 0.617	2.82	2.86	2.79
0.712 – 0.716	0.617 – 0.621	2.75	2.79	2.72
0.716 – 0.719	0.621 – 0.625	2.69	2.72	2.65
0.719 – 0.723	0.625 – 0.628	2.62	2.65	2.59
0.723 – 0.726	0.628 – 0.632	2.56	2.59	2.53
0.726 – 0.730	0.632 – 0.636	2.50	2.53	2.47
0.730 – 0.733	0.636 – 0.640	2.43	2.47	2.40
0.733 – 0.736	0.640 – 0.643	2.38	2.40	2.35
0.736 – 0.739	0.643 – 0.647	2.32	2.35	2.29
0.739 – 0.742	0.647 – 0.650	2.26	2.29	2.23
0.742 – 0.746	0.650 – 0.654	2.21	2.23	2.18
0.746 – 0.749	0.654 – 0.657	2.15	2.18	2.13
0.749 – 0.752	0.657 – 0.661	2.10	2.13	2.07
0.752 – 0.755	0.661 – 0.664	2.05	2.07	2.02
0.755 – 0.757	0.664 – 0.667	2.00	2.02	1.97
0.757 – 0.760	0.667 – 0.670	1.95	1.97	1.93
0.760 – 0.763	0.670 – 0.674	1.90	1.93	1.88

Ratio WITH Intermediate Bond	Ratio WITHOUT Intermediate Bond	MPV set- up Target	MPV Upper Limit	MPV Lower Limit
0.763 – 0.766	0.674 – 0.677	1.86	1.88	1.83
0.766 – 0.769	0.677 – 0.680	1.81	1.83	1.79
0.769 – 0.771	0.680 – 0.683	1.77	1.79	1.74
0.771 – 0.774	0.683 – 0.686	1.72	1.74	1.70
0.774 – 0.776	0.686 – 0.689	1.68	1.70	1.66
0.776 – 0.779	0.689 – 0.691	1.64	1.66	1.62
0.779 – 0.781	0.691 – 0.694	1.60	1.62	1.58
0.781 – 0.784	0.694 – 0.697	1.56	1.58	1.54
0.784 – 0.786	0.697 – 0.700	1.52	1.54	1.50
0.786 – 0.789	0.700 – 0.702	1.49	1.50	1.47

Table 4

END

Includes:	All single and double rail 50Hz track circuits, VT1(SP) types
Excludes:	All other Track Circuit types

High voltages might be present on the terminals of capacitors in circuit at the feed or relay end of a track circuit, on impedance bonds and other track circuit terminals.

Always use an insulated spanner to turn the nuts of links connecting fixed or adjustable capacitors.

Links shall be held by their insulated knobs.

Capacitors disconnected from a circuit shall be discharged for safety by temporarily applying a short circuit to them (NR/SMS/PartC/TC00 (Track Circuits General) contains details of how to discharge a capacitor).

Damaged or disconnected red bonds, shall be reported to E.C.O. and the required actions taken.

A faulting guide and adjustment details for this type of track circuit can be found in NR/SMTH/Part10/FF07 (Faulting Guide: 50Hz AC Track Circuits).

Cut Section Track Circuits:

Each cut section shall be treated as an individual track circuit and record cards kept accordingly.

Bonding:

Damaged or disconnected bonds (other than red bonds, see ‘warning’), shall be investigated and actioned.

Before bonding is connected, all contact surfaces shall be wire brushed and a thin film of electrolytic paste applied.

Bonds across rail joints shall be of a low resistance as this can influence the characteristics of the track circuit.

Over Resonance (See Also Special Stagger Test)

Over resonance of impedance bond track circuits, or ‘Spanish Condition’, occurs when setting the relay end capacitor to over resonate combines with the inductance of the track to create a circuit that can resonate with applied 50Hz interference even when the track feed is shunted.

The usual cause is a high relay end capacitance (associated with an incorrectly phased relay end bond) and a failed IRJ. To prevent this, relay end capacitor settings above 9μF shall be avoided where possible or the Special Stagger Test carried out.

Layout Configurations

Where a short double rail track circuit (100m or less) with impedance bonds is required, the design normally employs a single rail feed transformer in reverse mode, with its low voltage winding feeding the track.

VT1(SP) Track Circuits:

The VT1(SP) track circuit has been designed to replace standard single rail 50Hz AC track circuits in limited situations where certain electric traction units have been authorised to run (e.g. class 373 trains).

The VT1(SP) track circuit uses the same principle of operation as the standard 50Hz type but has a delay unit attached to its adapted VT1 type relay by an interconnecting cable.

In this configuration, the clearing of the track circuit after removal of the train shunt is delayed by at least 2 seconds.

The VT1(SP) unit is also distinguished from the standard VT1 by having a revised small label at the bottom of its plug board and a large label at the top of its plug board.

The feed transformer is wired such that the primary and secondary windings are interchanged so as to achieve an output of 85V - 90V. A label shall be attached to the transformer to inform personnel that the primary and secondary connections have been wired in this way.

A 30μF - 60μF variable capacitor is used instead of the standard 20μF type at the feed end to increase current flow and rail voltage.

A 21Ω 15W variable resistor is added at the relay end to de-sensitise the relay end circuit and reduce the relay voltage to 1.5V +/- 0.5V.

A label should be attached to the resistor warning personnel not to change it or its adjustment setting.

Traction Spikes at Relay End

Double Rail Track Circuits:

This can be prevented by fitment of a transient suppressor unit with the permission of the Route Asset Manager (S&T).

Single Rail Track Circuits:

This can be prevented by fitment of an isolating transformer with the permission of the Route Asset Manager (Signals).

Installing Insulated Rail Joints: (IRJs)

When an IRJ is renewed, it shall be cleaned of any swarf and fully tested at the time of installation.

Check good electrical contact by scraping off rust down to bright metal before attaching test probes.

Glued IRJ's shall be tested with a 500V insulation tester before they are welded into place.

SGE AB711 Style Relay

There is a known failure mode with this type of track circuit, where the vane cuts a groove into the stop allowing it to become jammed. This can lead to a Wrong Side Failure, where the track circuit shows clear whilst occupied.

A workshop Instruction was issued to resolve the failure mode in 1962, but some of the unmodified relays are still in operational use.

When carrying out maintenance and an unmodified AB711 relay is found, report it to your SM(S).

1. Maintenance Test

Control Voltage, Phase Angle, and Stagger Tests

1.1 Measure the voltage across the control coil with the track circuit clear of trains and train shunt. Compare the results with the previous results.

The phase and stagger tests assume the use of the MK 4 direct reading phase angle meter (cat. no. 40/56014), if other test instruments are to be used for these, consult the relevant documentation since complex calculations can be required.

1.2 Connect the 'Local' and 'Control' as shown in Table 1 .

	Local BX		**Control BX**	
Relay	**Red Lead**	**Black Lead**	**Red Lead**	**Black Lead**
VT1 &VT1(SP)	7 or 1	8 or 2	5	6
G2/G4	Q1	Q2	R1	R2
CE391	Q1 or 7	Q2 or 8	R1 or 5	R2 or 6
AB401/AB402	Q1	Q2	R1	R2
L4	Q1	Q2	R1	R2
AB711	Q1	Q2	R1	R2

Table 1 - Phase Angle Measurement

1.3 Measure the phase angle with the switch in the “Phase Angle” position (Appendix A).

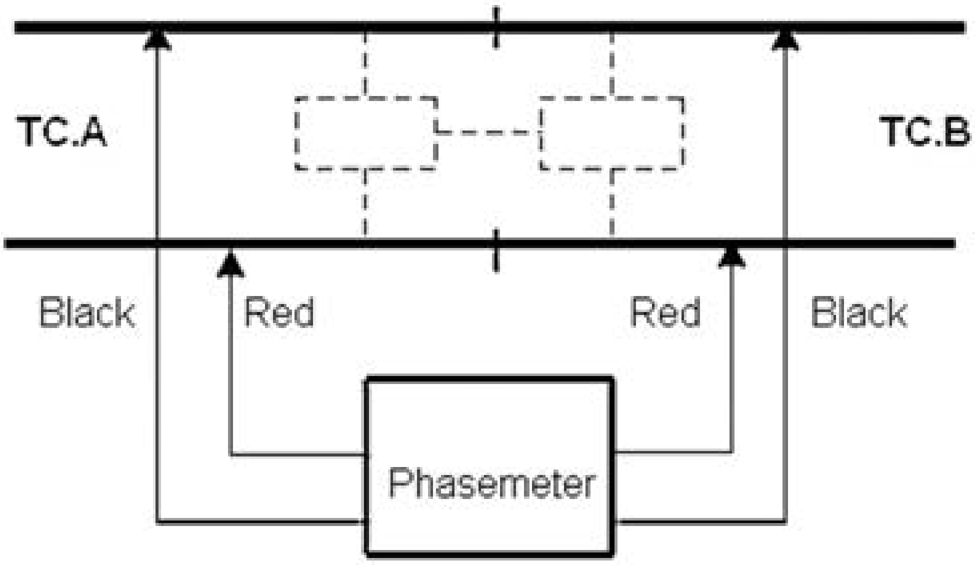
The ideal readings are, with the phase angle between 55º and 85º and the phase voltage 25% above the normal operating voltage given on the relay label.

1.4 Connect the meter as shown below and set the switch to “stagger”.

For the correct stagger the Mk4 meter needle shall be in the green sector with both green lights alight.

The needle just reaches the green sector (100º - 110º) for stagger between a double and single rail track circuit.

The needle should be well into the green sector (160º - 180º) for the stagger between two double rail track circuits.



To conserve the internal batteries, switch to PHASE (OFF) when readings are not being taken.

Drop Shunt Test

1.5 At the relay end of the track circuit, connect the train shunt box across the rails and drop shunt the track circuit.

Drop shunt values can be found in NR/SMS/PartZ/Z03 (Train Detection - Reference Values).

If a satisfactory drop shunt value is not obtained, fully check and re-test the track circuit according to the Full Test procedure (entering comment in the “Remarks” section of the record card).

Single Rail Track Circuits Only:

1.6 With the train shunt set to 0.5Ω apply the shunt across the rails at all 'stub end' extremities of the track circuit.

If the train shunt does not drop the relay, the bonding shall be investigated.

1.7 Assess the condition of the ballast.

Record all test results on the paper or digital record card. Compare the results with the previous results.

Significant changes in the drop away shunt value shall be investigated. (Any changed weather conditions that could affect the ballast resistance shall be taken into account).

2. Full Test

On installation and after alterations, e.g. relaying, ballast cleaning or insulation changing has taken place, apparatus has been changed, leads or jumpers have been renewed/repaired or settings have been changed, a Full Test shall be carried out. These tests assume the track circuit is not occupied by a train unless otherwise stated.

2.1 Examine in accordance with NR/SMS/PartC/TC08 (Track Circuits: AC 50Hz) Service A.

2.2 With the train shunt set to 0.5Ω, apply the shunt across the rails at all the extremities of the track circuit. Check that the track relay drops sharply.

3. Feed End

3.1 Measure the following voltages, adjusting as necessary.

a) Power supply - Acceptable value is 99V - 121V.

b) Across the feed links. Single Rail TCs.

c) Across Surge Arrester. Double Rail TCs.

d) Across the rails.

e) The capacitor and note the capacitor setting.

3.2 Measure the current to the track. Between 0.4A and 0.8A for standard type and between 0.4A and 1.4A for VT1(SP).

3.3 If applicable, carry out Feed End Impedance Bonds steps.

4. Relay End

4.1 Measure the following voltages, adjusting as necessary.

a) Across the rails.

b) Across the feed links. Single Rail TCs.

c) Across Surge Arrester. Double Rail TCs.

d) The track relay coil.

4.2 Measure the current from the track. Between 0.3A and 0.5A.

4.3 Record the approximate control resistor setting.

4.4 Measure the Control Voltage (Steps 1.1 and 1.2).

4.5 Measure the Phase Angle and carry out the Stagger Tests (Appendix A).

4.6 If applicable, carry out Relay End Impedance Bonds steps.

5. Local Policy Requirement

5.1 If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.

6. Feed End and Relay End Impedance Bonds

6.1 Check that terminal B of the capacitor is connected via terminal E of the surge arrestor to the rail, and not to the bond coil.

6.2 Measure the voltage across the rails and the capacitor. Note the capacitor setting.

Calculate the voltage ratio and compare with the values given in the Impedance Bond Voltage Ratio Table, (Appendix C).

If necessary, carry out remedial action in accordance with the notes in Appendix C.

6.3 Measure the voltage across auxiliary coil and check that the bonds are phased correctly.

The voltage from/to the track shall be equal to or greater than the auxiliary coil voltage plus the voltage across the rails. If not, the auxiliary coil connections shall be reversed and the track retested.

If the feed end bond auxiliary coil is reversed, then the feed end transformer secondary connection shall also be reversed to maintain the correct stagger.

If the relay end bond auxiliary coil is reversed, then the track relay control coil connection shall also be reversed to maintain the correct operation of the track circuit.

6.4 If applicable, with trains running, check the traction imbalance in each section between bonds.

Take readings with peak hold current clamp meters on each side lead and observe the balance is within 5%.

6.5 Check that all the rail connections and bonding are secure. If tightening is required, it shall be to the torque detailed in NR/SMS/PartZ/Z03 (Train Detection - Reference Values).

7. Relay End Impedance Bonds

In addition to the steps 2.13 to 2.17 above carry out the following steps.

7.1 If the relay end capacitor is set at more than 9μF, check that an intermediate bond nearer to feed end (if fitted) is not set above 9.3μF.

7.2 Check the relay stability by increasing and decreasing the setting of the relay end capacitor by 1μF (or 0.323μF if provided), in turn.

Withdraw and replace the relay fuse at each alteration and check that the relay re-energises each time.

If it does not, then fully check and re-test the track circuit.

7.3 If a relay end bond capacitor is set at more than 10μF carry out the Special Stagger Test (Appendix A).

For settings above 12μF, inform your SM(S) before proceeding.

8. Intermediate Bonds

8.1 Measure the voltage across the rails and the capacitor. Note the capacitor setting.

Calculate the voltage ratio and compare with the values given in the Impedance Bond Voltage Ratio Table, (Appendix C).

If necessary, carry out remedial action as directed by the notes in Appendix C.

8.2 If applicable, with trains running, check the traction imbalance in each section between bonds.

Take readings with peak hold current clamp meters on each side lead and observe the balance is within 5%.

8.3 Check that all the rail connections and bonding are secure. If tightened is required, it shall be to the torque detailed in NR/SMS/PartZ/Z03 (Train Detection - Reference Values).

8.4 Check that the voltage between the apparatus housing metalwork and the following terminals is less than 10V AC.

a) Relay capacitor terminal B.

b) Relay control resistor.

c) Surge arrestor terminal E.

This check is to determine that the relay capacitor terminal B is connected to the surge arrestor terminal E and NOT to the impedance bond coil.

If the result is greater than 10V AC then the wiring to the rails shall be reversed as follows:

If the tail cable core numbering on the surge arrestor conforms to the wiring diagram, then reverse the tail cable cores at the impedance bond.

If the tail cable core numbering on the surge arrestor does not conform to the wiring diagram, then alter the cable cores at the surge arrestor to correspond with the diagrams.

Where two single cores are used, reverse them at the surge arrestor as this avoids going onto the track and opening up the bond terminal.

9. Final Checks

These tests shall be undertaken when satisfactory setting values have been obtained:

Drop shunt values are in NR/SMS/PartZ/Z03 (Train Detection - Reference Values).

9.1 With the shunt box connected across the rails at the relay end, obtain the Pick-Up shunt value.

It should be approximately 25% above the drop shunt figure.

9.2 Check the voltages across the track relay control and local coils are still satisfactory.

9.3 Re-secure any capacitor switch locking bars provided.

9.4 Record the values and other details on the paper or digital record card.

APPENDIX A - Stagger Test

To prevent the feed of one track circuit incorrectly energising the relay of an adjacent track circuit when an IRJ fails, it is essential that the rails of these adjacent track circuits are of opposite polarities.

This is called the 'stagger' of the track circuits.

For 50Hz AC track circuits, correct stagger is maintained by verifying that adjacent track circuits are 'out of phase' with each other.

Important Notes

a) Phase angle is directly related to the phase angle of the supply derived from the grid feeder point.

b) Where substation switching causes the supply to be fed from a different grid point, the phase angle of each track circuit supplied from that point can change phase by 180º. This might lead to un-staggered tracks, particularly at the boundaries of the affected supply area.

c) To prevent this, it is essential that the stagger of all affected track circuits is checked where the supply has changed its grid feeder point – advanced warning should be provided by the Electrical Control Room for that area.

d) At some boundary sites, a special supply is fed from the adjacent substation area to supply one or more track circuits with a supply of the same phase as their opposite ends.

e) This supply busbar should carry an identifying label, and in no circumstances shall track circuits supplied by one supply be switched to the other supply.

Phase Test

Connect the MK 4 direct reading phase meter at the relay terminals or plug board to avoid case wiring errors and any traction suppressors.

The meter gives a phase angle of between 0ºand 180º. The phase lead or lag is indicated by red lights.

APPENDIX B - Special Stagger Test

Carry out this test whenever a relay end bond capacitor needs to exceed 10μF so as to obtain satisfactory operation of the track circuit.

Do not adjust the relay end capacitor above 12μF without the permission of the Route Asset Manager (Signals).

Use a MK 4 direct reading phase angle meter.

1. Connect the ‘local’ and ‘control’ as shown in Maintenance Test step 1.1.

2. Short out one relay end IRJ and observe the behaviour of the track relay during passage of an electric powered train over the track circuit under test.

   NOTE: *Any phase change or voltage rise on the direct reading meter.*

   If there is a tendency of the relay vane to lift off its backstop during the passage of a train, accompanied by a large swing in phase angle and a rise in control voltage, proceed to step 4.

3. Remove the short circuit from across the IRJ.

Track Circuit Fails Special Stagger Test

4. Check that tests in the FULL TEST up to 2.21 are satisfactorily completed.

5. Check there is no residual voltage across relay coil with feed fuse removed.

6. Check that relay phase angle inverts by about 180ºfrom its ‘TC clear’ position when shunted by a train.

7. Check the voltage across the feed capacitor equals voltage across surge arrestor plus voltage across transformer secondary winding.

8. Check the voltage across the relay capacitor equals voltage across surge arrestor plus the voltage across relay control coil.

9. Check the feed current falls when track circuit is occupied.

10. Check the feed capacitor is not set to a higher value than relay capacitor.

11. If, after any defects have been rectified and all checks satisfactory, relay end capacitor still set at over 10μF consult your SM(S).

APPENDIX C - Impedance Bond Voltage Ratio Table

Impedance Bond Style	Voltage Ratio	Approx. DC Auxiliary Coil Resistance
WH3 (Howells)	56:1	3.3Ω
WH3 (WRSL)	56:1	3.0Ω
MR	56:1	3.4Ω
S	56:1	3.0Ω
P3	45:1	2.5Ω
DE	40:1	5.5Ω
M	42:1	4.0Ω (T0/T3)
M2/5	42:1	3.48Ω (T0/T3)
DD	42:1	5.5Ω
B	45:1	5.0Ω
B (Kent Coast only)	66:1	5.0Ω

Table 2 - Impedance Bond Voltage Ratio Table

The combination of G4 track relay and type 2 or type 3 impedance bonds shall be avoided.

If the ratio is more than 10% lower than the value stated above, the bond is faulty. If the bond is type WH3, MR or S the entire bond shall be replaced.

For other bonds the fault might be further isolated by checking the auxiliary coil resistance.

If this is correct the traction coil is defective, and the bond shall be replaced. The auxiliary coil might be replaced as an interim measure and re-tested.

On site replacement of the auxiliary coil cannot guarantee the precise tuning of the air gap, which requires workshop test equipment.

Arrangements shall be made to replace the bond at the earliest opportunity.

END

Includes:	Overlay Rail Circuit equipment
Excludes:	All other Rail/Track Circuit types

1. Maintenance test

1.1 Check that the rail circuit relay is de-energised.

Run In End

1.2 Apply a 0.5Ω shunt across the rails at the remote end of the rail circuit and check that the rail circuit relay energises.

1.3 Measure and record the relay voltage. The voltage should be less than the saturation voltage level of the relay, if not readjust as a corrective maintenance item.

1.4 Measure and record, using two train shunt boxes in series increase the resistance until the rail circuit relay de- energises.

1.5 Measure and record the relay voltage.

The voltage should be equal to or less than the relay drop away voltage.

Run Off End

1.6 Apply a 0.5Ω shunt across the rails at the remote end of the rail circuit and check that the rail circuit relay energises.

1.7 Measure and record the relay voltage. The voltage should be less than the saturation voltage level of the relay, if not readjust as a corrective maintenance item.

1.8 Measure and record, using two train shunt boxes in series increase the resistance until the rail circuit relay de- energises.

1.9 Measure and record the relay voltage.

1.10 Check that the rail circuit relay is de-energised at the end of the tests.

1.11 Record all test results on the paper or digital record card. (SMS Part R Test 261-Overlay Track)

End

Includes:	Single Frequency DC Coded Tracks (Used on the Western Route)
Excludes:	All other DC Coded Tracks

For information on this type of Track see SMS Appendix 12

1. Maintenance Test

Feed End

1.1 Using a digital volt meter with a Min/Max facility. Set the DVM to DC Min/Max and measure the DC voltage across the rails, allowing a few cycles to capture the positive and negative impulses.

1.2 Note the (+/-) values and record the results on the record card.

Relay End

1.3 Using a digital volt meter with a Min/Max facility. Set the DVM to DC Min/Max and measure the DC voltage across the rails, allowing a few cycles to capture the positive and negative impulses.

1.4 Note the (+/-) values and record the results on the record card.

1.5 Connect a train shunt across the track links. Obtain a drop shunt value.

It can be difficult to ascertain exactly at which point a CFR is de energised and energised.

As the train shunt value is reduced, the CFR "beat" will slow as the incoming 75 cycles per minute are interrupted/ distorted, and the voltage across the CFR R1/R2 connection diminishes.

The CFR will eventually slow to a point where its front contacts will fully open. The CFR may still be observed to still "pulse" slightly whilst resting on its back contacts, but as long as the front contacts remain broken, this can be accepted as a successful shunt.

1.6 Record the values on the paper / digital record card.

1.7 With the train shunt still connected across the track links, obtain the pick-up value.

The pick-up is achieved by increasing the shunt value until the back contacts break, the front contacts make and the CFR starts to beat. At first the pulse will seem irregular. Continue to increase the shunt until the distinctive and regular "beat" can be observed and heard. The front and back contacts should now be open for an equal amount of time.

1.8 Record the value on the record card and disconnect the shunt box.

1.9 If the drop shunt is lower than the minimum value shown in NR/SMS/Part Z/03, assess the ballast/ground conditions. Compare the results with previous records for any significant variations. Where there is a significant variation in values, retest the track. If there are still variations then a full test should be carried out.

A variation in drop shunt value may be caused by variations in the equipment or the environment. In wet conditions a higher drop shunt value can be expected. In dry or icy conditions, a lower value may be obtained. Poor ballast conditions can also affect the value of the drop shunt (see NR/SMS/TC00).

2. Full Test

A full test should be carried out whenever alterations are made including relaying, lead/jumper renewal, equipment replacement / adjustment etc.

2.1 Examine the track in accordance with NR/SMS/TC05 service A.

Feed End

2.2 Measure and record the feed end voltages, resistor settings, and other parameters as shown on the full test paper or digital record card

Relay End

2.3 Measure and record the feed end voltages, resistor settings, and other parameters as shown on the full test paper or digital record card (NR/SMS/T262/DC Coded)

2.4 Measure and record the Min/Max +/- DC voltage on the CFR coil.

2.5 Connect a train shunt across the track links. Obtain a drop shunt value and pick-up values.

2.6 If the drop shunt lower than the minimum value shown in NR/SMS/Part Z the track should be regarded as "failed" and the cause investigated.

2.7 With the track shunt set at 0.5 ohms, apply the shunt across the rails at the extremities of the track circuit. Check the CFR ceases oscillating.

2.8 Assess the condition of the ballast/ground.

2.9 Compare the results with previous records for any significant variations. Where there is a significant variation in values these should be investigated.

Due to the design of this DC Coded Track Circuit no residual voltage testing is required

End

Includes:	EBI Track 400 Audio Frequency Track Circuit
Excludes:	All other Track Circuits

1. Maintenance Test A1

Feed (Transmitter) End

1.1 Check all rail connections and bonding are tightened to the correct torque (Appendix K of NR/SMS/Appendix/10).

1.2 Check the display for a steady 'RUN' indication. If one of these indications cycles with the indication 'ERR' then refer to NR/SMS/Appendix/10 and investigate the reason for the error. An 'ERR' state shall not be left without authority from the SM (S).

Impedance Bonds (where fitted)

1.3 Check the impedance bond for the following:

a) Bond Covers correctly fitted and not damaged.

b) Drain holes clear (on Howells & WH3 bonds).

It is necessary to drill drain holes if they are not present. (Pre installation check).

c) Tuning capacitor or tuning module connections.

1.4 Check all rail connections and bonding are tightened to the correct torque (Appendix K of NR/SMS/Appendix/10).

Relay (Receiver) End

1.5 Check all rail connections and bonding are tightened to the correct torque (Appendix K of NR/SMS/Appendix/10).

1.6 Measure the rail-to-rail voltage at the EBI Track 400 equipment rail connections (Pole) using a TTM/MTM Vp, (See NR/SMS/Appendix/10 for additional information). For consistency this measurement shall always be carried out at the rails.

1.7 Measure the rail current in the rail within 1 metre and on the track circuit side of the rail connections with a Rocoil.
For a Single Rail track circuit the measurement shall be made in the Signal rail.

1.8 Where a tuned circuit is involved, Measure using a TTM/MTM the rail-to-rail voltage at the companion TU rail connection (Zero) at the frequency of the track circuit under test. (Vz).

The voltage measured in 1.6 (Vp Pole) divided by the voltage at the companion TU (Vz Zero) gives the Tuned Zone ratio (Tzr) where Tzr = Vp/Vz.

Check the ratio against the detail found in NR/SMS/Appendix/10. If the ratio is below specification, the low result usually relates to badly dressed cables and or poor connections, therefore, Check that the cables are dressed correctly and that all Tuning units' connection are correct, clean and tight.

1.9 Where a tuned circuit is involved, Repeat steps 1.6 to 1.8 for the adjacent/abutting track at this tuned zone – This track is 'under test' for the purposes of these steps.

1.10 Check the display for a steady 'PICK' or 'drop' indication. If one of these indications cycles with the indication 'ERR' then refer to NR/SMS/Appendix/10 and investigate the reason for the error. An 'ERR' state shall not be left without authority from the SM(S).

1.11 Record the Ith Threshold using the display on the receiver and compare this reading against the Record Card.
The Threshold value should be identical to previous recorded values. If it is not, the track has been set up without being noted on the record card and a Full Test shall be carried out.

1.12 Record the Inow AV current using the display on the receiver and compare this reading against the Record Card.
If the obtained reading is not within 10% of the Record Card, the reason for the discrepancy shall be investigated.

The RX current is the best measure of the track circuits' stability. Significant deviations from previous readings shall be investigated.

A significant deviation is indicated if the change of track current is greater than:

- ±20% OR
- ±10mA.

1.13 Record the ballast and weather conditions on the track circuit Record Card.

1.14 Using a shunt applied to the rails between the RX tuning unit rail connections obtain a drop shunt value and a pick up shunt value.

Shunt values are detailed in NR/SMS/Part/Z03.

On the pick-up shunt, allow 2 seconds between each value to allow the slow to pick relay drive from the RX to operate.

A Station Area frequency track will pick up in 1 second.

The pick-up value should normally be 0.1Ω higher than the drop shunt.

1.15 Compare the results with previous records (if available) obtained under similar conditions. If the results are not within ±10% the cause shall be investigated and rectified as appropriate. A FULL TEST shall then be carried out.

2. Full Test

2.1 Examine the track circuit in accordance with NR/SMS/TC17 service A.

Feed (Transmitter/OM) End

2.2 Examine the TX unit case, connector and terminations and check the plug coupler is pushed fully home.

2.3 Examine the TX unit frequency key and check it is fully turned to the right and latched into the key holder.

NOTE: Unlatching the key or removing it will cause the Relay to be de-energised and the track show occupied.

2.4 Examine the OM unit case, connector and terminations and check the plug coupler is pushed fully home.

2.5 Measure the voltage on the 110V signalling supply to the PSU.

2.6 Measure the voltage from the PSU to the Transmitter/OM (Vpsu). It should be in the range of 46VDC to 50VDC.

2.7 Measure the DC current drawn by the equipment.

- Open Line Frequencies, >250m long : 1.5A to 5A
- Open Line Frequencies, <250m long : 0.2A to 1.5A
- Station Area Frequencies, 1.5A to 5A

2.8 Measure the TX output voltage across terminals TM1 and TM2 using a TTM/MTM.

It should be in the range of 32V RMS to 34V RMS.

2.9 Record the OM Step Setting and Resistor Setting.

- OM Step setting is in the range from 1 to 27
- OM Resistor setting for Open Line frequencies –set at 0R
- OM Resistor setting for Station Area frequencies set at
  48R for TC feed<750m
  0R for TC feed>750m to 2km

2.10 Record the OM output voltage (Vout).

2.11 For Open Line frequency tracks - Measure the LMU(TU) I/P Voltage.

It should be in the range of 50V to 148V RMS.

2.12 For Open Line frequency tracks - Measure the TX TU/ETU I/P voltage on terminals 4 & 5 (Meter).

It should be in the range of:

0.6V to 2.0V RMS for track lengths 20m to 250m
0.5V to 15.0V RMS for track lengths 250m to 1100m

For Station Area frequency tracks - Measure the TX SATU/CU I/P voltage on terminals LINE 1 & 2 (Meter).
A value of 95V RMS shall not be exceeded.

2.13 Measure the rail-to-rail voltage at the EBI Track 400 equipment rail connections (Pole) using a TTM/MTM (Vp, See NR/SMS/Appendix/10).
For consistency this measurement shall always be carried out at the rails.

2.14 Measure the rail current in the rail within 1 metre and on the track circuit side of the rail connections with a Rocoil.
For a Single Rail track circuit the measurement shall be made in the Signal rail.

2.15 Where a tuned circuit is involved, Measure using a TTM/MTM the rail-to-rail voltage at the companion TU rail connection (Zero) at the frequency of the track circuit under test. (Vz).

The voltage measured in 2.13 (Vp Pole) divided by the voltage at the companion TU (Vz Zero) gives the Tuned Zone ratio (Tzr) where Tzr = Vp/Vz.

Check the ratio against the details found in NR/SMS/Appendix/10. If the ratio is below specification, Check that the cables are routed correctly and that all Tuning Unit connections are correct, clean and tight.

Impedance Bond and Track Capacitors (Where fitted)

The impedance of an impedance bond can be checked by measuring the EBI Track 400 voltage across the bond and the current through it. To take the current measurements use a Rocoil connected to a TTM.

2.16 Check all rail connections and bonding are tightened to the correct torque (See Appendix K of NR/SMS/Appendix/10)

2.17 Check the security and the fixing of the Track capacitor.

2.18 Measure using a TTM/MTM the rail-to-rail voltage.

Clauses 2.19 and 2.20 are not applicable to B3 3000 and B3 500 bonds

2.19 Measure the voltage across the auxiliary coil or tuning module, Check it is in the correct ratio with the rail-to-rail voltage (See NR/SMS/Appendix/10). If it is not the impedance bond shall be investigated for a fault.

2.20 Apply a short circuit across the tuning capacitor/module, Check that the rail voltage falls then remove the short circuit and Check the voltage rises.

Clauses 2.21 to 2.25 are applicable to Intermediate bonds only.

2.21 Place the Rocoil over the rail 1 metre before the Bond (TX side) and note the reading on the TTM (= amps, I1).

2.22 Repeat the measurement 1 metre from the bond on the RX side (I2)

2.23 Subtract I2 from I1 thus obtaining the current through the bond at the EBI Track 400 frequency.

2.24 Measure the rail to rail voltage (V) across the impedance bond.

2.25 Divide the voltage (V) by the current calculated from 2.23 thus giving the impedance (Z), Z= V / (I1-I2).

This value should be greater than 8Ω. If less than 8Ω, Check for traction imbalance before remedial action is taken with the impedance bond.

Relay (Receiver) End

2.26 Examine the RX unit case, connector and terminations and check the plug coupler is pushed fully home.

2.27 Examine the RX unit frequency key and check it is fully turned to the right and latched into the key holder.

Unlatching the key or removing it will cause the Relay to be de-energised and the track show occupied.

2.28 Measure the voltage on the 110V signalling supply to the PSU.

2.29 Measure the voltage from the PSU to the Receiver.

It should be in the range of 46VDC to 50VDC.

2.30 Measure the DC current drawn by the equipment.

- Relay Up : 100mA to 150mA DC

2.31 Check the display for a steady ‘PICK’ or ‘drop’ indication. If one of these indications cycles with the indication ‘ERR’ then refer to NR/SMS/Appendix/10 and investigate the reason for the error. An 'ERR' state shall not be left without authority from the SM (S).

2.32 For Open Line frequency tracks - Measure the RX TU/ETU O/P voltage on terminals 1 & 2 (Meter).

It should be in the range of 0.3V to 1.7V RMS.

For Station Area frequency tracks - Measure the RX SATU/CU O/P voltage on terminals LINE 1 & 2 (Meter).

2.33 Measure the rail-to-rail voltage at the EBI Track 400 equipment rail connections (Pole) using a TTM/MTM (Vp, See NR/SMS/Appendix/10).
For consistency this measurement shall always be carried out at the rails.

2.34 Measure the rail current in the rail within 1 metre and on the track circuit side of the rail connections with a Rocoil.
For a Single Rail track circuit the measurement shall be made in the Signal rail.

Low rail volts or rail current could be due to ballast or other track equipment, as well as a fault at the TX end of the track.

2.35 Where a tuned circuit is involved, Measure using a TTM/MTM the rail-to-rail voltage at the companion TU rail connection (Zero) at the frequency of the track circuit under test. (Vz).

The voltage measured in 2.33 (Vp Pole) divided by the voltage at the companion TU (Vz Zero) gives the Tuned Zone ratio (Tzr) where Tzr = Vp/Vz.

Check the ratio against the details found in NR/SMS/Appendix/10. If the ratio is below specification, the low result usually relates to badly dressed cables and or poor connections, therefore, Check that the cables are dressed correctly and that all Tuning units' connection are correct, clean and tight.

2.36 Record the Inow AV current using the display on the receiver and compare this reading against the Record Card.

If the obtained reading is not within 10% of the Record Card, the reason for the discrepancy shall be investigated.

If adjustment is required an auto-set routine shall be performed.

The RX current is the best measure of the track circuits' stability. Significant deviations from previous readings shall be investigated.

A significant deviation is indicated if the change of track current is greater than:

- ±20% OR
- ±10mA.

2.37 Record the Ith current value using the display on the receiver and compare this reading against the Record Card.

The reading should be identical to the Record Card.

If the readings are not identical, the track has been adjusted without recording the event. A new auto-set routine shall be performed.

2.38 Record the Inow ITOT current using the display on the receiver and compare this reading against the Record Card.

If the obtained reading is not within 10% of the Record Card, the reason for the discrepancy shall be investigated.

This is usually because there is an external noise sources creating undesired wideband interference.

2.39 Record the Inow QUAL value using the display on the receiver and compare this reading against the Record Card.

Anything less than 100% shall be investigated for poor signal transmission along the track circuit.

2.40 Measure the voltage across the energised track relay coils.

- 48V to 52V DC for the RX MOD 2 or later.

2.41 Using a train shunt applied to the rails between the RX tuning unit rail connections obtain a drop shunt value and a pick up shunt value.

Shunt values are detailed in NR/SMS/Part/Z03.

On the pick-up shunt allow 2 seconds between each value to allow the slow to pick receiver relay drive to operate.

A Station Area frequency track will pick up in 1 second.
The pick-up value should normally be 0.1Ω higher than the drop shunt.

2.42 Compare the results with previous records (if available) obtained under similar conditions. If the results are not similar the cause shall be investigated and rectified as appropriate. The FULL TEST shall then be repeated.

2.43 Record the ballast and weather conditions on the track circuit Record Card.

Interference Test (Crosstalk and Feedthrough)

This test checks the levels of in band and traction interference present at the RX, and requires temporary disconnection of the TX.

Check the fusing arrangements before this test as more than one track circuit can be affected.

2.44 Remove the B48 fuse or switch off the MCB to the TX and Check that the correct track relay drops. Record the Inow AV value from the receiver.

Open Line Double Rail tracks: The Inow AV reading shall be less than 8mA.

Open Line Single Rail tracks with 30m bonding: The Inow AV reading shall be less than 3mA.

Readings greater than these values shall be investigated.

Station Area tracks : The Inow AV reading shall be:

- less than 10% of 'Ith' OR
- less than 20mA

whichever is the lower.

A higher level shall be investigated (look for disconnected cable screens, TU failure, etc.) The track circuit shall be signed out of use and your SM (S) informed.

Extremity Tests

2.45 For Open Line frequency tracks - Apply a shunt, using the minimum shunt values, at the extremities of the track circuit, in accordance with the track plan, and Check the track relay drops for each application.

Minimum Shunt values are detailed in NR/SMS/Part/Z03.

For Station Area frequency tracks – Set a shunt box to 0.2Ω and carry out a shunt test at the following points in the track circuit:

- TX Pole, Mid Point, RX Pole
- At any other ends in Points tracks.

The track circuit should drop and record the RX current for each location with the Shunt in place.

Station Area Frequency Tuned Zone Impedance

2.46 For Station Area frequency tracks with Tuned Zones – Measure and Calculate the Tuned Zone Impedance at the TX and RX ends.

At the TX end calculate TZimp: $\mathrm{TZimp} = \left(\frac{\mathrm{CT}}{\mathrm{Ish}} - 1\right)$

Where: CT = Receiver input current (Inow AV) Measured when track is clear
Ish = Receiver input current (Inow AV) measured when a 1Ω shunt has been applied at the Tx end rail connections.

At the RX end calculate TZimp: $\mathrm{TZimp} = \left(\frac{\mathrm{CT}}{\mathrm{Ish}} - 1\right)$

Where: CT = Receiver input current (Inow AV) Measured when track is clear
Ish = Receiver input current (Inow AV) measured when a 1Ω shunt has been applied at the Rx end rail connections.

Repeat the RX end calculation for any other RX Tuned Zones in the track circuit.

TZimp shall be > 0.4Ω in all cases.

End

Includes:	Unistar HR
Excludes:	IBCL, RCPL and All Powered Point Machines and Mechanical points

GENERAL

Before the FPL test is carried out, a safe system of work shall be established so that a Signaller cannot set a route over or control the points being tested. See NR/SMS/PartA/A04 (Method Statement Summary).

To avoid injury whilst placing and removing gauges, it is recommended that you use the hands-free gauges (ask your SM(S)) or hold the gauges with pliers or mole grips.

Observe the Lock Prism indicators through the windows on the DLD (Drive, Locking, Detection) unit lid, only remove the lid of the DLD unit if the detection requires to be adjusted, or the windows are obscured (e.g. by dirt/moisture).

All adjustments shall be recorded as corrective maintenance.

Confirm detection by connecting a meter to the outgoing KR circuit with a final check in liaison with the Signaller that indications are visible at the signalling control centre.

Confirm that detection is made and broken by referring to the meter only.

1. FPL Test

These steps shall be undertaken for both normal and reverse positions of the points.

Use the 3.5mm point checking gauge and a 1.5mm gauge for this test.

1.1 Place the points on manual.

For the TOE Drive Lock and Detect Unit (DLD):

1.2 Place the 3.5mm gauge between the switch and stock rail at a point midway between the Drive and Detection Rods (this is where the two switch rail connection brackets meet).

1.3 Manually operate the points to the closed position and check that Lock Prism Indicators fail to align.

a) Check that detection is broken.

b) If the lock prism fails to complete its travel and engage, then this is a pass. Record the result on the record card and proceed to Step 1.4.

c) If the lock prism completes its travel, then this is a failure, and the drive rod end requires adjustment.

Additional gauges shall be added in 0.5mm increments until the lock prism fails to complete its travel. If the lock is still made at 5mm, this shall be recorded, reported to Integrated Control Centre (ICC), and investigated.

Carry out remedial action, the drive rod end shall now be adjusted to bring the points back to a position where they fail the 3.5mm test.

When the lock fails at 3.5mm proceed to step 1.4.

1.4 Place the 1.5mm gauge between the switch and stock rail at a point midway between the Drive and Detection Rods (this is where the two switch rail connection brackets meet).

a) Manually operate the points to the closed position and check that the Lock Prism Indicators align.

b) Check that detection is made.

c) If the Lock Prism Indicators align but detection is not made, then the test shall be treated as a fail.

Carry out remedial action, the detector rod end shall now be adjusted to bring them back to a position where they pass the 1.5mm test.

This action will require the main lid of the DLD to be removed to verify the detector bar markings – refer to Figure 1.

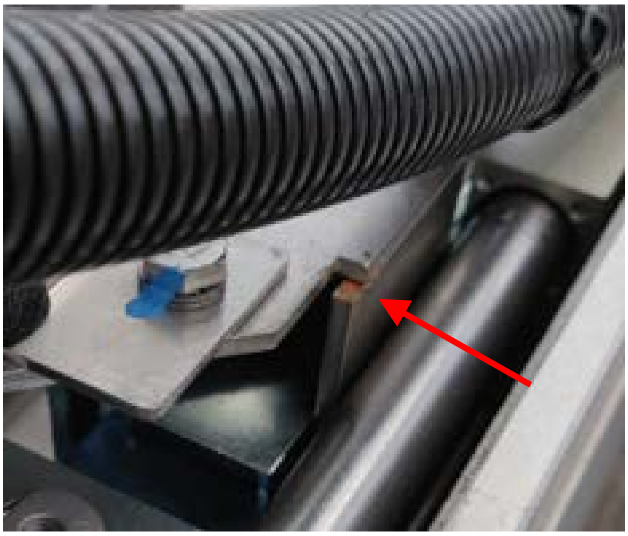


Figure 1 – Detector Bar Markings (indicated by arrow)

In wet or inclement weather the drying bags shall be removed and stored safely and the DLD body left open for the shortest possible time.

On completion of the work, any moisture shall be carefully removed, and the drying bags replaced before the lid is replaced.

When detection is made at 1.5mm you can proceed to step 1.5.

1.5 Repeat steps 1.2 to 1.4 for the opposite switch.

1.6 If it has been necessary to adjust either Drive or Detector rod ends, carry out NR/SMS/PartB/271 (Detector Test (Unistar)).

1.7 Restore the points to power.

1.8 Record the results of the FPL test on the record card.

1.9 Carry out a final check before completion of the work by asking the Signaller to operate the points to normal and reverse (twice if possible). Observe correct operation.

END

Includes:	Unistar HR
Excludes:	IBCL, RCPL and All Powered Point Machines and Mechanical points

GENERAL

Isolate the point machine by opening / turning the access lever on the hydraulic power pack. Select Normal or Reverse direction for manual operation. Disconnect the outgoing point detection from the DLD (Drive, Locking, Detection) unit or apply an alternative safe system of work (See NR/SMS/PartA/A04).

Gauges

a) 1.5mm & 3.5mm gauges for Toe drive positions.

b) 2mm & 4mm gauges for Supplementary drive positions.

1. DLD at Toe Position

1.1 Place the points on manual, and manually operate points to the normal position.

1.2 Check the correct voltage is present on the outgoing circuit (KR lines) for the closed switch on the links in the disconnection box.

1.3 Check the correct voltage is present on the outgoing circuit (KR lines) for the open switch on the links in the disconnection box.

1.4 Open the switch blade and insert the 3.5mm gauge between the stock and switch rail, aligned centrally to the detector rod at the normal position.

1.5 Manually operate the points and test that detection is broken, check that the witness marks on the detector plate are not visible.

1.6 Repeat using the 1.5mm gauge and test that detection is made, and the correct voltage is present.

1.7 Check that the witness marks on the Detector Plate are protruding such that the cover plate sits between the first and second witness mark. This equates to a detection position between 0mm and 2.5mm from switch closed position.

Where the witness marks (See Figure 1) indicate detection is being made between 2.5mm and 5mm (cover plate sits between second and third mark), adjust the detector bar to return the visible detection marks to sit between the first and second mark, equating to the 0mm to 2.5mm range.

Figure 1 - Detector Plate witness marks indicating optimal set up between marks for 0mm and 2.5mm

1.8 Repeat Tests 1.2 to 1.7 for reverse side.

1.9 If supplementary Drive DLDs are fitted, proceed to Step 2. Otherwise complete Step 3.

2. Supplementary Drive DLDs (if fitted)

2.1. Place the points on manual, and manually operate the points to the normal position.

2.2. Check that the correct voltage is present on the outgoing circuit for the closed switch.

2.3. Check that the correct voltage is present on the outgoing circuit for the open switch.

2.4. Open the switch blade and insert the 4mm gauge between the stock and switch rail, aligned centrally to the detector rod at the normal position.

2.5. Manually operate the points and check that detection is broken. Check that the witness marks on the Detector Plate are not visible.

2.6. Insert the 2mm gauge between the stock and switch rail, aligned centrally to the detector rod.

2.7. Check that the witness marks on the Detector Plate are protruding such that the cover plate sits between the first and second witness mark. This equates to a detection position between 0mm and 2.5mm from switch closed position.

Where the witness marks indicate detection is being made between 2.5mm and 5mm (cover plate sits between second and third mark), adjust the detector bar to return the visible detection marks to sit between the first and second mark, equating to the 0mm to 2.5mm range.

2.8. Repeat Tests 2.2 – 2.7 for the reverse position.

2.9. Repeat tests 2.1 to 2.8 for each supplementary drive DLD.

3. Final Checks

3.1 Replace all covers / lids and latch securely.

3.2 The final check before completion of the work is to restore the points to power and ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

END

GENERAL

The tasks and tests stated in this section are to be carried out on equipment after incidents of flooding. If a piece of equipment is not covered below, inform your SM(S).

Equipment types

1. Train Operated Points (Hydro-Pneumatic).
2. Machine Operated Points.
3. Pneumatic Point Machines & Train Stops.
4. HPSS Point Systems.
5. Rail Clamp Point Lock.
6. Electrical Detectors.
7. Mechanical Fittings and Points.
8. Trackside Apparatus Cases & Equipment Rooms.
9. Electronic Equipment.
10. Rail / Sleeper Attached / Mounted Equipment.
11. Electrically Lit Signals.
12. Semaphore Signal Machines.
13. Operational Telephones.
14. Lever Frames, Lever Locks & Circuit Controllers.
15. Hydraulic Trainstops.
16. Automatic/Manually Controlled Level Crossing Equipment.
17. Mechanical Gated Level Crossings.

1. Equipment & Associated Action Required

Train Operated Points (Hydro-Pneumatic).

These use a closed hydraulic system.

1.1 Check the integrity of seals.

1.2 Check electrical connections for corrosion, contamination, and damage. Rectify or renew as necessary.

1.3 Carry out NR/SMS/PartB/Test/018 (Train Operated Points Detection Test).

1.4 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

1.5 Test for correct operation and indication for normal & reverse positions.

2. Machine Operated Points

Includes:	HW, ML, MV- GRS Model 5, SGE HA, SGE HB, WBS 63, WBS M3 & M3A
Excludes:	All other Machine Operated Points

2.1 Clean and wipe contacts & terminal blocks.

2.2 Check electrical connections and terminal blocks for corrosion, contamination, and damage. Rectify or renew as necessary.

2.3 Clean and wipe parts that have a moving metal-to-metal contact surface (gear wheels etc) and apply new lubricant (oil or grease as approved).

2.4 Clean and wipe motor bushes and commutator operate point motors and check for any excessive noise/sparking/smell.

2.5 The electromagnetic clutch of HW2000s could have become blocked by silt. Attempting to operate the points might reveal any problems, renew as required.

2.6 Carry out NR/SMS/PartB/Test/001 (FPL Test Machine).

2.7 Carry out NR/SMS/PartB/Test/011 (Electrical Detection Test - Machine).

2.8 Carry out NR/SMS/PartB/Test/019 (Detection Loop Test).

2.9 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

2.10 Test for correct operation and indication for normal & reverse positions.

3. Pneumatic Point Machines & Train Stops

Includes:	Point machine types WBS EP&D, SGE VB
Excludes:	All other Pneumatic Point Machines & Train Stops

The air main pump is the responsibility of the Plant Engineer who should confirm that this part of the system is working correctly.

3.1 Clean and wipe contacts & terminal blocks.

3.2 Check seals/gaiters for damage.

3.3 Clean air filters & exhausts.

3.4 Renew damaged/corroded items as required.

3.5 Wash and wipe parts that have a moving metal-to-metal contact surface (gear wheels, lock bars etc) and apply new lubricant (oil or grease as approved).

3.6 Remove accumulated water from the air supply (including supply main valves).

3.7 Bleed points might be provided. High-pressure air systems are prone to rapid corrosion due to the high concentration of oxygen.

3.8 Clean the oil filter and renew the lubricant.

Point Machines Only:

3.9 Carry out NR/SMS/PartB/Test/001 (FPL Test - Machine).

3.10 Carry out NR/SMS/PartB/Test/011 (Electrical Detection Test - Machine).

3.11 Carry out NR/SMS/PartB/Test/019 (Detection Loop Test).

3.12 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

3.13 Test for correct operation and (point machines) indication for normal & reverse positions.

4. HPSS Point Systems

Includes:	ECU, LVDT, Motor & Brake
Excludes:	All other HPSS Point Systems

HPSS systems are designed to withstand submersion in up to one meter of water.

4.1 Check cable insulation, cable entry points, plug couplers and all electrical equipment for insulation damage and secure fitment.

4.2 Renew components as required.

4.3 Remove any obstructions on the torsion back drive.

4.4 Wash and wipe the nuts & thread on the lost motion drive if contaminated.

4.5 Carry out NR/SMS/PartB/Test/004 (FPL Test - HPSS).

4.6 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

4.7 Test for correct operation and indication for normal & reverse positions.

5. Rail Clamp Point Lock

These use a vented hydraulic system.

5.1 If it is suspected the water level has risen above reservoir fill-hole level renew the pump unit, drain the hydraulic system, and compress the actuators to expel any fluid.

5.2 Renew the hydraulic fluid NR/SMS/PartB/Test/015 (Clamp Lock: Test for air in the system).

5.3 Check the pump unit electrical connections, terminal blocks, and mechanical components for corrosion, contamination, and damage. Rectify or renew as necessary.

5.4 Check the microswitch assembles, if they are of the ITW type, no further action is required.

5.5 If they are of any other type (e.g. Dowty), renew the microswitch assembles.

5.6 If you are in doubt about the type of microswitches, ask your SM(S).

5.7 Clean and apply new lubricants to the following on the open switch:

a) Fixed & adjustable cams.

b) Lock arm.

c) Locking piece.

d) Lock arm pivot.

5.8 Manually pump across and repeat on the other switch.

5.9 Carry out NR/SMS/PartB/Test/003 (Facing Point Lock Tests - Clamp Lock).

5.10 Carry out NR/SMS/PartB/Test/013 (Detection Test – Clamp Lock).

5.11 Carry out NR/SMS/PartB/Test/019 (Detection Loop Test).

5.12 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

5.13 Test for correct operation and indication for normal & reverse positions.

6. Electrical Detectors

Includes:	BR998 type, Crewe type, LMS type, SGE type.
Excludes:	All other Electrical Detectors

6.1 Clean and wipe contacts & terminal blocks.

6.2 Check electrical connections and terminal blocks for corrosion, contamination, and damage. Rectify or renew as necessary.

6.3 BR998 detectors: Check the microswitch assembles; if they are of the ITW type, no further action is required.

6.4 If they are of any other type (e.g. Dowty), renew the complete detector.

6.5 If you are in doubt about the type of microswitches, ask your SM(S).

6.6 Wash and wipe parts that have a moving metal-to- metal contact surface and apply new lubricant (oil or grease).

6.7 As required, carry out :

a) NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests).

b) NR/SMS/PartB/Test/011 (Electrical Detection Test - Machine).

c) NR/SMS/PartB/Test/016 (Supplementary Detection Test).

d) NR/SMS/PartB/Test/019 (Detection Loop Test).

6.8 If not undertaken as part of the point actuator tasks.

6.9 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

6.10 Test for correct operation and indication for normal & reverse positions.

7. Mechanical Fittings and Points

Includes:	Wire/Rodding runs, Cranks, Semaphore, Signal fittings, Mechanical detectors, Mechanical back drives, Point fittings.
Excludes:	All other Mechanical Fittings and Points

7.1 Check wire/rodding runs are free from any obstructions. Check all foundations are stable. Check all pulley wheels/roller wheels are free to move.

7.2 Pulley wheels & roller wheels shall not be lubricated, unless using a dry film lubricate.

7.3 Clean, wash and wipe all cranks/semaphore signal fittings. Fill the bearings with new lubricant. Check the crank/fitting for security and freedom of movement.

7.4 New grease shall be pumped in to expel the existing grease in the bearing.

7.5 Clean the bearing surfaces on oil lubricated cranks and flood the bearing with new oil. Check any bearing covers (e.g. 'Top Hats') are replaced or renewed if missing.

7.6 Excess grease and oil shall be wiped away.

7.7 Clean, wash and wipe all mechanical detectors.

7.8 Apply new lubricant to the detector slide and rollers.

7.9 Carry out NR/SMS/PartB/Test/012 (Detection Test – Mechanical).

7.10 Brush and wash all exposed screw threads, then wipe clean.

Mechanical points as required:

7.11 Carry out a NR/SMS/PartB/Test/002 (FPL Test Mechanical).

7.12 Test by operation all signals and points that are mechanically operated. Check correct indications / detection are given for each operating position of the equipment.

8. Trackside Apparatus Cases & Equipment Rooms

Includes:	Disconnection boxes, Lineside & Tail Cables, Multicore, Twin & single core Cables, terminal blocks & links, Internal single core wires, Power supplies, Fuses and holders, Relays, Contactors.
Excludes:	All other Trackside Apparatus Cases & Equipment Rooms

8.1 Clean and wipe all racking, shelving, casings/walls.

All cables, Wires, and Terminals:

8.2 Examine insulation, terminations, terminal blocks, and links. clean and wipe terminal blocks and links, renew if necessary. Renew crimps or re-terminate as necessary.

Internal Wires:

8.3 Examine length of wire, renew if insulation has been damaged / degraded or if all the wire has been totally submerged.

Lineside and Tail Cables:

8.4 Carry out NR/SMS/PartB/Test/054 (Cable Insulation Test).

8.5 Fuses and Fuse Holders: Remove each fuse in turn and check to see if it has blown. Clean and wipe the fuse holder. Replace with new fuses only after the equipment it feeds has been checked.

Power Supplies:

8.6 Examine transformers & transformer/rectifiers (TJ) for evidence of water penetration. Clean and wipe terminals and terminal blocks.

If the TJ contains electronics replace unit. Renew primary and secondary cells if it is suspected that water has risen above the vent/filling caps.

Busbars fitted with ELDs:

8.7 Carry out NR/SMS/PartB/Test/053 (ELD Test & Calibration).

Busbars without ELDs:

8.8 Carry out NR/SMS/PartB/Test/051 (Bus Bar Earth Test).

Relays and Relay Bases:

8.9 Remove relay and spade connectors. Clean and wipe relay base and spade connectors, renew if necessary. Renew relay and test for correct operation.

Timer relays:

8.10 Check each relay using NR/SMS/PartB/Test/061 (Relay Timer Test).

Contactors:

8.11 Clean and wipe terminals and contact faces. Examine components for corrosion, contamination and damage. Rectify or renew as necessary.

9. Electronic Equipment

Includes:	TPWS modules, HABD scanners, Inverters, UPS, SSI modules, Axle counter evaluators & lineside junction boxes (EAK).
Excludes:	All other types of Electronic Equipment.

TPWS Modules:

9.1 Clean and wipe terminations.

9.2 Examine each module by tilting forwards and inspecting the front 'window'. If no water is seen, the module is OK for continued use.

If water is seen, the module shall be replaced.

Other Electronic/Computer Scanners/Modules/Units:

9.3 Examine equipment. If water is known or suspected of entering the equipment, it shall be replaced.

10. Rail / Sleeper Attached / Mounted Equipment

Includes:	Treadles, TC equipment, AWS, ATP, TPWS OSS & TSS, TASS Balise, Axle counter rail contacts, HABD Transducers.
Excludes:	All other Rail / Sleeper Attached / Mounted Equipment.

Mechanical Treadles:

10.1 Renew treadle.

Freddy Treadle:

10.2 Clean and wipe terminations, test by operation.

Track Circuit Tuning Units:

10.3 Renew equipment.

Track Circuit Connections and Bonds:

10.4 Clean and wipe the connections as necessary. Check the security of the connections and any clips or orange pipe used, renew if necessary.

Check if orange pipe is used that any accumulated water has drained off, rectify if necessary. Check the security of any fishplate bonds, renew if necessary. Check where any TC passes through a level crossing with Bomacs or other crossing surfaces.

Remove or flush out any trapped debris or other contaminates.

Older types of Bomacs have a metal band around them. Trapped metallic objects can easily short out the TC.

Insulated Rail Joints:

10.5 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Tests).

Impedance Bonds:

10.6 Check rail terminations, termination box and/or connection points. Clean and wipe as necessary. Test the bond as per Track Circuit Test (250 to 263) at NR/SMS/PartB/Index.

All Track Circuits:

10.7 Carry out a full Track Circuit Test (250 to 263) NR/SMS/PartB/Index.

AWS Equipment:

10.8 Clean and wipe as necessary.

10.9 Check the security of the magnets and ramp.

Check the termination box on the electro / suppressed permanent magnet, clean and wipe terminations and links.

Renew crimps and connections if necessary.

10.10 Carry out NR/SMS/PartB/Test 024 (AWS Tests).

ATP (GWML) Equipment:

10.11 Check the Beacon, infill loop and termination boxes for damage and security, clean and wipe terminations and links.

Renew crimps and connections if necessary.

Test the loop resistance, renew if necessary.

ATP (Chilterns) Equipment:

10.12 Renew the loop electronics unit. Check the loop and termination boxes for damage and security. Clean and wipe terminations and links.

Renew crimps and connections if necessary.

10.13 Carry out NR/SMS/PartB/Test/029 (ATP Equipment (Chilterns) Loop Test).

TPWS OSS & TSS:

10.14 Check the OSS and/or TSS loops and associated disconnection boxes for damage and security, renew if necessary.

Clean and wipe terminations and links.

Renew crimps and connections if necessary.

10.15 Carry out NR/SMS/PartB/Test/230 (Train Protection and Warning system (TPWS) Tests).

Balise (All types):

10.16 Check for damage and security.

10.17 Replace if necessary.

HABD Transducers:

10.18 Check for damage, security and alignment. Replace if necessary.

Axle Counter Rail Contacts (Count Heads):

10.19 Check for damage and security, carry out NR/SMS/PartB/Test/045 (Thales Axle Counters Dummy Wheel Test – AxLM & AzLE) or NR/SMS/PartB/Test/042 (Axle Counters Dummy Wheel Test - AzL 70, 70/30, 70/30S). Replace as necessary.

11. Electrically Lit Signals

Includes:	Ground mounted repeaters, Position light signals, Signal post replacement switches, Mechanical disc signals, Stencil indicators, Theatre indicators, Internally lit LOS signals.
Excludes:	All other Electrically Lit Signals

11.1 Clean and wipe interior of signal head, lamp holders, transformers, terminals, terminal bocks and links. Examine crimps and terminations, renew if necessary.

11.2 Remove lens(es)/stencil(s) (internal and external as applicable), Clean and wipe or renew as required.

11.3 Wash and wipe lamps, renew as required.

Signal post replacement switch (SPRS):

11.4 Clean and wipe interior, terminations and terminal bocks.

Examine crimps and terminations, renew if necessary.

11.5 Carry out NR/SMS/PartB/Test/023 (Other Signal Tests).

11.6 Renew EKR relay (if applicable).

11.7 Test as required:

a) NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests).

b) NR/SMS/PartB/Test/022 (Signal Lamp and Light Module Proving Tests).

12. Semaphore Signal Machines

Includes:	BP, GRS, SGE, WBS
Excludes:	All other Semaphore Signal Machines

12.1 Clean and wipe interior, circuit controller (if applicable) terminations and terminal blocks. Examine crimps and terminations, renew if necessary.

12.2 Wash and wipe surfaces that have a moving metal-to-metal contact surface (gear wheels, bearings etc) and apply new lubricant.

12.3 Clean and wipe motor bushes and commutator operate motor and check for any excessive noise/sparking/smell. Renew if necessary.

12.4 Check, if fitted, leather brake pads for condition. Renew if necessary.

12.5 Test for correct operation and indication for On, Off and Wrong positions.

13. Operational Telephones

Includes:	SPTs, Point zone telephones, Level crossing telephones, Lineside direct line telephones
Excludes:	All dial telephones and plug points connected to exchanges.

13.1 Replace telephone using the correct TMTH Test Plan.

13.2 Carry out NR/L3/TEL/30181/011 - Maintenance of Operational Telephones.

14. Lever Frames, Lever Locks & Circuit Controllers

Includes:	All types of mechanical locking signal box, ground frames, Electrical locks and combined locks, Circuit controllers.
Excludes:	All other Lever Frames, Lever Locks & Circuit Controllers.

14.1 If water has entered any locking boxes, report it to your SM(S).

The lids of any locking boxes are not to be removed unless you are requested to do so by your SM(S).

14.2 Wash and wipe frame structure, levers, catch handles, catch rods, and locking connections. Check all components are undamaged and secure.

14.3 Report any damage to your SM(S).

14.4 Wash and wipe exteriors of lever locks and circuit controllers.

14.5 Clean and wipe interior, terminations, and terminal blocks.

14.6 Examine crimps and terminations, renew if necessary.

14.7 Clean contact faces or bands/fingers in circuit controllers.

14.8 Wash and wipe surfaces that have a moving metal-to-metal contact surface and apply new lubricant.

14.9 Test by operation the electrical release(s) and mechanical interlocking of the lever frame.

Simple ground frames (i.e. 1 releases 2, 2 reverse locks 1) can be tested using the layout diagram or plate legends. Complex signal box frames require an experienced tester.

15. Hydraulic Trainstops

These use a vented hydraulic system.

15.1 If it is suspected the water level has risen above reservoir fill-hole level renew the pump unit, drain the hydraulic system and expel any fluid. Renew the hydraulic fluid.

15.2 Check the mechanical components for corrosion, contamination and damage. Rectify or renew as necessary.

16. Automatic/Manually Controlled Level Crossing Equipment

Includes:	AHBC, ABCL, AFBCL, AOCL, AOCL+B, AOCR, MSL, MCB, OCB, Rural Barriers, Boom gates, Hydraulic and mechanical barrier units.
Excludes:	All other Automatic/Manually Controlled Level Crossing Equipment

Hydraulic Barrier Units:

16.1 Clean and wipe interior of unit. If it is suspected the water level has risen above reservoir fill-hole level renew the pump unit.

16.2 Drain the hydraulic system and expel any fluid.

16.3 Check the condition of seals and gaiters on the rams.

16.4 Remove then wash and wipe ram pins.

16.5 Lubricate the ram pins and main bearings with new grease/oil.

16.6 Check the ram and boom for security and freedom of movement. Clean and wipe motor bushes and commutator.

16.7 Clean and wipe terminal blocks, renew if necessary. Renew crimps or re-terminate as necessary.

16.8 New grease shall be pumped in to the grease nipples to expel any existing grease.

BR 843 units are fully self-contained; renewing the unit by default, renews all the hydraulic and internal electrical components.

Mechanical Barrier Units:

16.9 Clean and wipe interior of unit.

16.10 Check electrical connections and terminal blocks for corrosion, contamination and damage. Rectify or renew as necessary.

16.11 Clean and wipe parts that have a moving metal-to-metal contact surface (gear wheels etc) and apply new lubricant.

16.12 Clean and wipe motor bushes and commutator. Renew crimps or re- terminate as necessary.

Boom Gates:

16.13 If it is suspected that the boom gate motor or gearbox has been partially or totally submerged, then the complete unit shall be changed.

16.14 Check electrical wiring and plugs for corrosion, contamination and damage. Rectify or renew as necessary.

16.15 Check clutch operates correctly, repack universal joints and wheel bearing with new grease.

16.16 If it is suspected that any limit switches in the hinge assembly might have been submerged, then change the limit switches.

16.17 Clean and wipe contacts & terminal blocks in hinge assembly. Re-grease hinge bearings.

16.18 If it is suspected that the control cubicle has been totally or partially submerged, then change the control plate.

16.19 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test). Not NER mechanical barrier units.

16.20 Test the sequence of crossing operation hand, local and automatic operation as applicable for automatic crossings.

16.21 Check hand, local and signal box operation as applicable for manual crossings.

17. Mechanical Gated Level Crossings

Includes:	Wheel operated, Hand operated, Gate locks, Wicket gates.
Excludes:	All other Mechanical Gated Leve Crossings.

17.1 Check rodding runs are free from any obstructions.

17.2 Check all foundations are stable. Check all roller wheels are free to move.

17.3 Clean, wash and wipe all cranks. Fill the bearings with new lubricant. Check the crank for security and freedom of movement.

17.4 New grease shall be pumped in to expel the existing grease in the bearing.

17.5 Excess grease shall be wiped away.

17.6 Clean and wipe gate locks interiors.

17.7 Care shall be taken when removing the covers of gate locks, components and springs might fly out.

17.8 Clean, wash and wipe wicket gate mechanisms.

17.9 Apply new lubricant to sides.

17.10 Clean, wash and wipe gate stops housings and internal mechanism. Lubricate with oil.

17.11 Check that all debris and contaminates are cleaned from around the top slots of the stops. Any small obstruction could cause the stops not to rise and fall correctly.

17.12 Test gate and locking operation to the Signaller’s satisfaction.

17.13 The final action for all equipment is to test for correct operation.

END

This test is solely part of a maintenance service and shall not be used in place of the token tests mandated under the provisions of NR/SMTH.

This test is to prove the integrity of an individual token system as a whole, whereas Services A&B are specific services on individual instruments.

In order to carry out this test it will be necessary to take possession of the system.

A token shall NOT be withdrawn for the purposes of any possession.

If the work is to be carried out on a line open for traffic, and working by Pilotman has been arranged, the Pilotman SHALL NOT BE GIVEN A TOKEN.

Access will not be available to sidings worked by a ground frame released by the token during the period of the test.

Staff will need to be positioned at each terminal instrument throughout the duration of the system test, and at each other instrument whilst that specific instrument is under test.

During testing of Intermediate/Auxiliary instruments, both galvanometers/indicators shall operate before when attempting to electrically withdraw a token. Failure to check this will invalidate the test.

One person on site shall take overall direction of the system test.

Steps 1.9 to 1.26 do NOT apply to systems which either (a) wholly use BR 930 series relays for polar functions, or (b) where the transmission between sites is by means of Reed Vital FDM equipment.

1. Test

1.1 Prove that the system is in phase by electrically releasing one token from the system.

1.2 Replace the token into the instrument.

1.3 Check that the correct number of tokens is present in the system.

1.4 Unlock each instrument and manually withdraw all tokens.

1.5 Check each token for correct colour and labelling.

1.6 Check the bearing faces and keyways of each token for excessive wear.

1.7 Replace all the tokens into the instruments from which they were withdrawn.

1.8 Prove that the system is in phase by electrically releasing one token from the system.

1.9 If the token system is NSKT with a diode is provided in series with the AZR at the remote end, arrange to have the diode strapped out for the duration of the testing.

From the signal box end controlling instrument Check that the strap is effective by electrically releasing a token, and then pressing and releasing the plunger, verifying that the galvanometer/indicator re-operates for a few seconds after the plunger has been released.

Replace the token into the instrument.

1.10 Designate one instrument as the instrument under test.

1.11 Arrange for an electrical release to be made to the instrument under test for steps 1.12 to 1.16.

If the system is NSKT, several successive releases might be needed to carry out the various tests

1.12 Check that the voltage on the lock relay coil (R1/R2) is between 12 – 16 volts. For Intermediate/Auxiliary instruments repeat for the other relay.

1.13 If a voltage in step 1.12 is in excess of 16 volts, inform your SM(S) to arrange for the insertion of suitable resistors in series with the relay coil. If the voltage is in excess of 24 volts, the relay must also be changed within 3 months.

1.14 Check that the voltage on the lock coil is between 12-15 volts.

1.15 Electrically withdraw a token from the instrument under test.

1.16 Check that another token cannot be electrically withdrawn from the instrument under test.

1.17 Replace the token into the instrument from which it was withdrawn.

1.18 Withdraw a token from another token instrument.

1.19 Check that another token cannot be electrically withdrawn from the instrument under test.

1.20 Replace the token into the instrument from which it was withdrawn. If the instrument under test is a terminal instrument go to step 1.24

1.21 Withdraw a token from a different instrument from that used in step 7.18, and which is in the towards the other end of the section beyond the instrument under test.

1.22 Check that another token cannot be electrically withdrawn from the instrument under test.

1.23 Replace the token into the instrument from which it was withdrawn.

1.24 Repeat steps 1.10 to 1.23 in turn for all other token instruments in the system.

1.25 Close and re-lock all instruments.

1.26 If a diode was strapped out as set out in step 9, remove the strap.

1.27 Check that a token can be released from an instrument.

1.28 Replace the token.

END

This check is not a full “Signal Sighting Inspection”, full signal sighting shall only be carried out by a person holding the appropriate competency.

If a visibility issue is recorded during a check that you are unable to rectify then your SM(S) shall be advised

The Formula for Speed & Distance Measurements can also be found in NR/SMS/PartZ/Z01 – Signal Reference Values.

The Signal Visibility Check is split into 4 Section’s use the flow chart in figure 1 to determine which test is required.

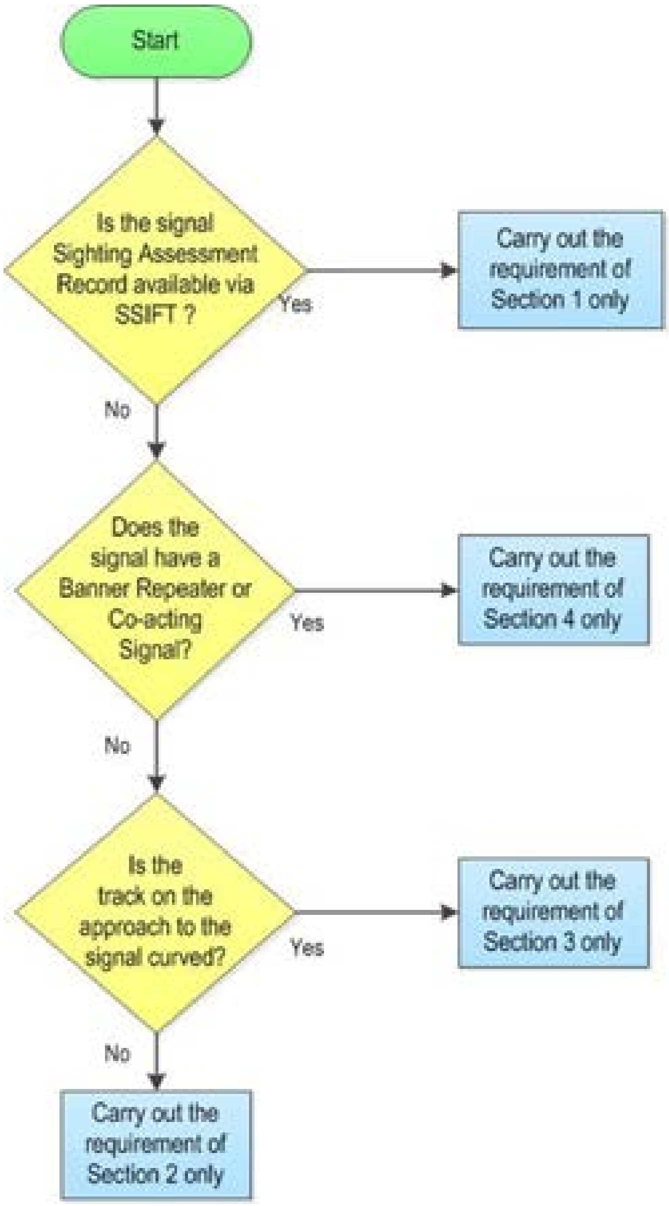


Figure 1 - Decision Flowchart

1. Signal Sighting Assessment Record (preferred option)

The contents of the latest “Signal Sighting Assessment Records” are now available to all via the SSIFT App.

1.1 Access the Signal Sighting details of the relevant signal via the SSIFT App.

1.2 Check the signal from the required reading distance detailed on the signal sighting assessment record and record the visibility on the record card.

1.3 The removal of small areas of vegetation, that are affecting the signal visibility of the signal aspects, are the responsibility of the signalling technician.

If the area to be cleared is more extensive, then the SM(S) shall be informed.

2. Signal Sighting Assessment Record Unavailable – Track approaching the signal is not curved

2.1 Identify the maximum line speed at which the signal can be approached.

2.2 Using Signal Visibility Chart (10 seconds) in NR/SMS/PartZ/Z01 – Signal Reference Values, work out the distance on the approach side of the signal at which the Viewing Point is located.

2.3 From a position in line with the right-hand edge of the signal head, observe there is no obscuration between your location and the Viewing Point.

If there are no obstructions between the signal and viewing distance, there is no requirement to walk out to the Viewing Point.

2.4 If there are any obstructions, the signal shall be viewed from the Viewing Point and the degree of those obstructions recorded on the record card. The SM(S) shall be advised.

2.5 The removal of small areas of vegetation, that are affecting the signal visibility of the signal aspects, are the responsibility of the signalling technician. If the area to be cleared is extensive, then the SM(S) shall be informed.

3. Signal Sighting Assessment Record Unavailable – Track approaching the signal is curved

3.1 Identify the maximum line speed at which the signal can be approached.

3.2 Using Signal Visibility Chart (10 seconds) in NR/SMS/PartZ/Z01 – Signal Reference Values, work out the distance on the approach side of the signal at which the Viewing Point is located.

3.3 Walk to the Viewing Point and observe there is no obscuration between your location and the signal.

3.4 The removal of small areas of vegetation, that are affecting the signal visibility of the signal aspects, are the responsibility of the signalling technician. If the area to be cleared is more extensive, then the SM(S) shall be informed.

4. Signal Sighting Assessment Record Unavailable – The Signal fitted with a banner repeater or co-acting signal. And at a banner repeater or co-acting signal

4.1 Identify the maximum line speed at which the signal can be approached.

4.2 Using Signal Visibility Chart (5 seconds) in NR/SMS/PartZ/Z01 – Signal Reference Values, work out the distance on the approach side of the signal at which the Viewing Point is located.

4.3 From a position in line with the right-hand edge of the signal head, observe there is no obscuration between your location and the Viewing Point.

If there are no obstructions between the signal and the Viewing Point, there is no requirement to walk out to the Viewing Point.

4.4 If there are any obstructions, the signal shall be viewed from the Viewing Point and the degree of those obstructions recorded on the record card. The SM(S) shall be advised.

4.5 The removal of small areas of vegetation, that are affecting the signal visibility of the signal aspects, are the responsibility of the signalling technician. If the area to be cleared is more extensive, then the SM(S) shall be informed.

END

Technical Instruction

Issue date: 16th November 2023
Compliance date: 16th November 2023
Expiry date: 15th November 2024

Technical Instruction TI 182 is attached to this standard/control document.

This Technical Instruction mitigates an urgent safety/asset/equipment risk that cannot await a full review of this standard/control document.

This standard/control document will be reviewed and reissued before the emergency change expires on 15th November 2024.

Jerry Morling

Network Technical Head Signalling

Technical Instruction

Issue date: 4th September 2023
Compliance date: 29th September 2023
Expiry date: 29th September 2025

Technical Instruction TI 184 is attached to this standard/control document.

This Technical Instruction mitigates an urgent safety/asset/equipment risk that cannot await a full review of this standard/control document.

This standard/control document will be reviewed and reissued before the emergency change expires on 29th September 2025.

Jerry Morling

Network Technical Head Signalling

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TC00	Track Circuits: General
TC02	Track Circuits: Overlay Track
TC03	Track Circuits: DC Low Voltage
TC04	Track Circuits: DC Medium Voltage
TC05	Track Circuits: DC Coded
TC06	Track Circuits: Reed Type RT
TC08	Track Circuits: 50Hz AC
TC09	Track Circuit: FS2600
TC10	Track Circuits: Aster SF15 / U Type
TC12	Track Circuits: HVI (High Voltage Impulse)
TC14	Track Circuits: Western Region Quick Release
TC15	Track Circuits: AC Rectified (Diode)
TC16	Track Circuits: EBI Track 200
TC17	Track Circuits: EBI Track 400
TC30	Track Circuits: Additional Bonding Check
TC91	Track Circuit Assister Interference Detector (TCAID)
TD00	Train Describers - General
TD11	Train Describer Electro-Mechanical
TD21	Train Describer Hewlett Packard 21MX Series

END

GENERAL

This apparatus forms part of the pilot scheme for Automatic Train Protection Systems.

Any maintenance or operating difficulties shall be reported to your SM(S) as corrective maintenance.

An ATP site can include:

a) ATP enclosure containing encoding equipment and ATP interface equipment, which is incorporated with existing signalling apparatus.

b) Beacon with disconnection box and cables.

c) Infill loop with TDA and RDA boxes and cables.

SERVICE A

1. ATP Enclosure

1.1 Remove any fire risks (e.g. oily waste, paper etc.) from the vicinity of the enclosure.

1.2 Check for security and signs of damage.

1.3 Dust and Examine interior.

1.4 Check the security of accessible terminals and cable glands and look for signs of water ingress.

1.5 Check the effectiveness of the door seal and ELDON latches and lock in keeping the door seal tight against the enclosure. Adjust as necessary.

1.6 Lubricate locks, latches & hinges.

1.7 Examine surge arrestors.

1.8 Examine earth connections. If in doubt, Test continuity and resistance.

1.9 Check the integrity of all lead seals and wire locking.

1.10 Check the two parameter plugs are securely chained to the enclosure.

2. Power Supply module

2.1 Check the green LED is lit on the front face of the power supply module.

This indicates that there is 110Vac input.

Any other indication means there is a fault condition and shall be investigated.

3. Beacon

3.1 Examine beacon, mounting and protection plate(s).

3.2 Remove any fire risks (e.g. oily waste, paper etc.) from the vicinity of the beacon, junction box and cables.

3.3 Check that the beacon and protection plate(s) are correctly aligned and positioned, Check that there is clearance between the protection plate(s) and the beacon.

3.4 Check all fixings for tightness.

3.5 Check the beacon disconnection box is properly fixed to the mounting stake and look for signs of water ingress.

3.6 Examine the terminals inside the disconnection box. Clean and Protect as necessary.

3.7 Examine cables and glands for security and damage.

3.8 Test the beacon signal level.

4. Infill Loop

4.1 Where practicable, Examine full length of loop cable. Pay attention to fixings and signs of stretching. Rectify minor sheath damage with self-amalgamating tape. Report damage that is more serious as corrective maintenance.

4.2 Remove any fire risks from the vicinity of the loop.

4.3 Examine the RDA and TDA boxes for damage, water ingress and security. Check the condition of the lid seal. Examine the terminals; Clean and Protect as necessary. Examine cable glands for security

4.4 At the TDA box, disconnect the loop cable from either t3 or t4 and measure the loop resistance. If the result is outside the range 340-400Ω, report it to your SM(S).

4.5 Test the loop signal level.

End

Includes:	ATP Fitted on the Chiltern Lines
Excludes:	ATP Fitted on the Great Western Main Line

General

Before removing any plug-in unit, anti-static precautions shall be taken. Either wear an approved earthing band or touch the bare metalwork of the associated rack or cabinet with your bare hands to discharge any static electricity within yourself.

When removing or inserting a board, do not touch the board, its tracking, or components.

Always use the handles provided. When not plugged into the operational ATP equipment, store boards in an anti-static bag or box.

An ATP site can include the following:

- Loop electronics unit (LEU).
- Loop.
- Simple signal interface or complex signal encoders, which are incorporated with the signalling apparatus.

SERVICE B

1. Loop

1.1 Remove any fire risks (e.g. oily waste, paper etc.) from the vicinity of the loop.

1.2 Remove vegetation as required.

1.3 Remove any metallic debris from the vicinity of the loop. Report any redundant rails in the 4ft, likely to damage the loop, for removal.

1.4 Examine full length of loop cable, paying particular attention to fixings, transposition covers and signs of chafing or damage.

1.5 Remove any ballast covering the loop.

2. Loop Electronics Unit (LEU)

All readings shall be taken using a digital voltmeter (DVM).

2.1 Examine the bonding connection between the LEU Housing and the signalling apparatus case and, if in doubt, test continuity and resistance using a DVM.

2.2 Remove any fire risks (e.g. oily waste, paper etc.) from the vicinity of the LEU.

2.3 Check the LEU for security and signs of damage. Report any damage as corrective maintenance.

2.4 Examine the cables and glands for security and damage.

3. Operational Checks

3.1 Observe the LEDs on the following boards; Check they are indicating as shown in Table 1:

Board	LED	State
Telegram Generator	1 and 2	Alternate Flashing
Telegram Generator TSR (if fitted)	1 and 2	Alternate Flashing
Modulator/Output	1	Steady illuminated

Table 1 - Indications

3.2 If the modulator/output LED is not illuminated or is flickering, then carry out NR/SMS/PartB/Test/029 (ATP Equipment (Chilterns) Loop Test) shall be carried out.

END

Includes:	AWS Permanent, Electro Magnets, Suppressed Magnets and PSR magnets maintained signal maintenance
Excludes:	Temporary ESR Magnets

General

If the AWS spark quench is fitted on the internal side of the electro-inductor feed links, check the electro-inductor is fully discharged before you touch the external side of disconnected links.

You can find more information about AWS equipment in NR/GN/SIG/19040.

SERVICE A

1. External Inspection

1.1 Remove debris from the area of the magnet and inductors.

1.2 Examine permanent magnets, electro-magnets and suppressor magnets for damage.

Arrange for repair or replacement where necessary as corrective maintenance.

1.3 Examine protection ramps and fixings. Components should be undamaged and secured to the sleepers.

1.4 Check the magnets are correctly aligned they should be approximately central to, and parallel with, the running rails.

1.5 Check the signal aspect is clearly visible from the magnet and is not being obscured (e.g. foliage).

1.6 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

1.7 If provided, check that the plug coupler is free from damage and securely latched.

SERVICE B

2. Full Inspection and Test

2.1 Examine the termination box and seal on electro- magnets and suppressor magnets.

2.2 Examine cable terminations. Clean and protect as necessary.

2.3 If a failure is reported with the AWS, check that the suppressed permanent and electro magnets are correctly wired for their relevant voltage operation as detailed in NR/SMS/PartZ/Z08 (Train Protection - Reference Values).

2.4 Check tail cable is not damaged and is securely terminated. Tail cables should be protected by orange pipe or secured to sleepers.

2.5 Gauge the top of the AWS magnet with respect to rail head (±12mm from rail level). This should be done by use of a line / bob weights and associated plastic gauge or rule.

2.6 Carry out NR/SMS/PartB/Test/024 (AWS Tests).

3. Disconnection Boxes (if Provided)

3.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

3.2 Refit the lid and (if provided) padlock, check they are fitted securely.

SERVICE RA Carry out service A of this SMS.

SERVICE RE Fix on failure.

END

Includes:	Vortok Depot Test Magnets
Excludes:	All other permanent magnets or electromagnets associated with automatic warning systems (AWS)

General

More information on this equipment can be found in the Vortok Depot Test Magnet Installation Manual.

Standard strength depot test magnets are coloured yellow. Extra strength depot test magnets are coloured green.

SERVICE B

1. Depot Test Magnet

1.1 Remove debris from the area of the magnet.

1.2 Examine the magnet for damage. Arrange for repair or replacement where necessary.

1.3 Examine the fixings. The equipment shall be secure.

1.4 Check the magnet is positioned correctly with respect to rail level.

1.5 Gauge the top of the magnet with respect to rail head (±1mm from rail level). This should be done by use of a line/bob weight and associated plastic gauge or rule.

To adjust the height of the magnet:

a) Loosen the magnet locking bolt.

b) Rotate the entire magnet assembly.

c) Tighten the locking bolt onto the nearest flat.

PERIODIC TASKS

2. Unit Calibration

2.1 Replace the magnet with a Vortok exchange unit.

Installation details are in the Vortok Depot Test Magnet Installation Manual

END

1. Working on Axle Counter Equipment

The Signaller at the monitoring signal box shall be informed before any work is done that affects the correct operation of the axle counter or can put it into a disturbed state.

For full evaluator testing, possession of the axle counter section and any signalling functions carried over the evaluator transmission links (if applicable) should be taken.

Results of all tests shall be recorded on the appropriate system's record card.

A standard Isolation/Re-set/Restoration form can be found under SMF/SG/0246.

2. Isolation of Axle Counters

Axle counters shall be isolated from the signalling equipment they are connected to before any work is carried out that disrupts their normal operation. This can only be done with the permission of the Signaller. Some systems might require the filling in of part A of the restoration form.

The isolation methods can vary depending on the type of axle counter; generally this is achieved by disconnection of the TPR link or data output from the evaluator.

The Signaller at the monitoring signal box is responsible for manual protection arrangements of the signalling during any period of isolation of the axle counter.

3. Re-setting and Restoration to Service of Axle Counters

This can vary depending on the type of axle counter system design but generally falls into four categories:

A. Technician
B. Co-operative
C. Signaller
D. Non co-operative (Scotland Only)

A: Technician

With this method, the Technician re-sets and restores to service the axle counter with permission of the Signaller. Some systems might require filling in of the restoration form.

B: Co-operative

With this method, the Technician re-sets and restores to service the axle counter in co-operation with the Signaller (both operating a function at the same time). Some systems might require filling in of the restoration form.

C : Signaller

With this method, the Signaller undertakes both re-setting and restoring the axle counter.

In all cases, the Signaller is responsible for confirming the axle counter section is clear before it is restored.

D : Non co-operative (Scotland Only)

Includes:	Newtonhill 113T, Dundee - Carnoustie 656T, 647T, Barassie Line 191T, Belmont - Kilkerran 669T
Exclude:	All Co-operative resets and other sites without co-operative resets

4. Release

4.1 Before starting work the Technician shall contact the Signaller and reach an agreement as to which track section he wishes to work on.

4.2 When the Signaller knows the track section to be clear and that no movement is authorised past the protecting signal, he can give authority to the Technician to work on axle counter.

4.3 On receipt of this authority, the Technician shall slip the disconnection link between the Axle Counter and the output TPR. This is to be recorded by both the Signaller and Technician.

5. Reset

5.1 Prior to final resetting of the axle counter the Technician shall obtain the assurance of the Signaller that the track circuit section is clear of traffic.

5.2 When the Technician has received verbal authority to reset the axle counter, he/she should follow the local procedure for resetting the axle counter evaluator. This normally requires the operation of a key operated switch and a push button switch.

5.3 Check the axle counter is fault free and can be Reset.

5.4 For AzL70 type axle counters, if the ‘G10’ LED is lit on the GRDFR card then press button T1 on this card, to extinguish the indication, before resetting is possible.

6. Adjustment

6.1 Usually, after the Axle Counter has been reset, the Technician then initiates restoration.

6.2 Before contacting the Signaller for permission to restore the track section, the Technician shall check that the axle counter is reset and in working order.

6.3 The Technician shall complete Part 3 of Form SMF/SG/0246 (Restoration of Axle Counter). This requires the Technician to give an assurance to the Signaller that the work is complete. The entry made shall be dictated to the Signaller, who will complete a similar form. The date and time of the message should be recorded.

6.4 The Technician shall contact the Signaller and request to carry out the restoration of the axle counter. The Technician should assist by establishing, where possible, that the section of line is clear.

6.5 The Signaller shall then complete Part 2 of his form and dictate this section to the Technician to restore the specified axle counter to permit movements over a specified section of line.

The Technician should record the dictated message in Part 2 of the form, noting date, time and the serial number that the Signaller has allocated to the form.

6.6 The Technician shall then restore the Axle Counter by reinstating the link between the Axle Counter and the output TPR.

6.7 When this is done, the Technician shall record on Part 3 of his form that the axle counter is restored, noting date, time and dictate the information to the Signaller. The Signaller should also make an entry in the Train Register at this stage.

6.8 During the restoration the Technician shall remain at the axle counter controls until advised by the Signaller that the equipment is properly returned to service.

6.9 The Technician's copy of the form shall be stored in a file adjacent to the axle counter equipment in the relay room. The Signaller's copy of the form should be sent to the Local Operations Manager.

6.10 The Serial Number allocated by the Signaller and details of the failure should be recorded on the Signalling Failure Report Form or given to Fault Control.

Form SMF/SG/0246 (Restoration of Axle Counter), is reproduced in Appendix A of this standard as specimen copies only:

Copies of Form SMF/SG/0246 (Restoration of Axle Counter) can be obtained, in book form.

Appendix B contains a process flowchart

7. Thales systems

On earlier Thales systems check after re-setting and restoration the ZIANZG card (if fitted) shows zero and the LED on the appropriate indicator shows ‘section clear’ (green).

If the evaluator-reset button is fitted with a lockable cover, it shall be fitted with a lock.

Information on co-operative isolation, re-setting and restoration of axle counters at particular locations can be found in NR/SMS/PartB/Test/30. Other equipment specific details can be found in NR/SMS/Appendixes.

8. Positioning of Rail contacts

The requirement is that whenever an axle counter head is being reinstated under SMTH and there is any possibility that the design parameters determining the required position have changed, or the position needs rechecking (e.g. after re-railing or slews), the necessary checks are carried out.

To determine the correct position, you shall be competent to read the signalling plan with respect to clearance requirements, overlap lengths, timing points, signal replacements etc, which might define the limitations of the acceptable area.

You shall know the technical constraints of the axle counter system unless these are determined by preformed cable lengths. You shall consult with the Track Engineer regarding any constraints resulting from welds, joints, or check rails.

You shall be competent to measure clearance points in accordance with GK/RT0011 Appendix A (1970mm between the running edges for the fouling point and 4880mm back to clearance unless it is a special, in which case there may be something in the records).

If you are in any doubt the position of rail contacts, ask your SM(S).

Appendix A: Forms

Network Rail

Axle Counter Isolation, Re-set and Restoration Form
SMF/SG/0246
Issue 1.0
June 2007

Standard Maintenance Form

PART ONE	
Isolation of Axle Counter System from the Interlocking	
Due to the named maintenance activity I require the axle counter system to be isolated from the interlocking	
Signal Technician (Name)	
Axle Counter System	
Affected Track Section(s)	
Maintenance Activity	
Interlocking	
Signal Box	
Signaller's Name	
Counter Number*	
Date	
Time	
Signed (Signal Technician)	
Comments	
*: If provided	

Page 1 of 3

Network Rail

Standard Maintenance Form

Axle Counter Isolation, Re-set and Restoration Form
SMF/SG/0246
Issue 1.0
June 2007

PART TWO	
Re-Set of Axle Counter System	
I have completed work on the axle counter system and require signaller permission to re-set as a precursor to restoration Note: A re-set of the axle counter system may be undertaken as part of preventative or corrective maintenance without restoration provided the system has been isolated from the interlocking	
Signal Technician (Name)	
Axle Counter System	
Affected Track Section(s)	
Maintenance Activity	
Interlocking	
Signal Box	
Signaller's Name	
Date	
Time	
Axle Counter Showing section(s) Clear?	
Signed (Signal Technician)	
Comments	

Network Rail

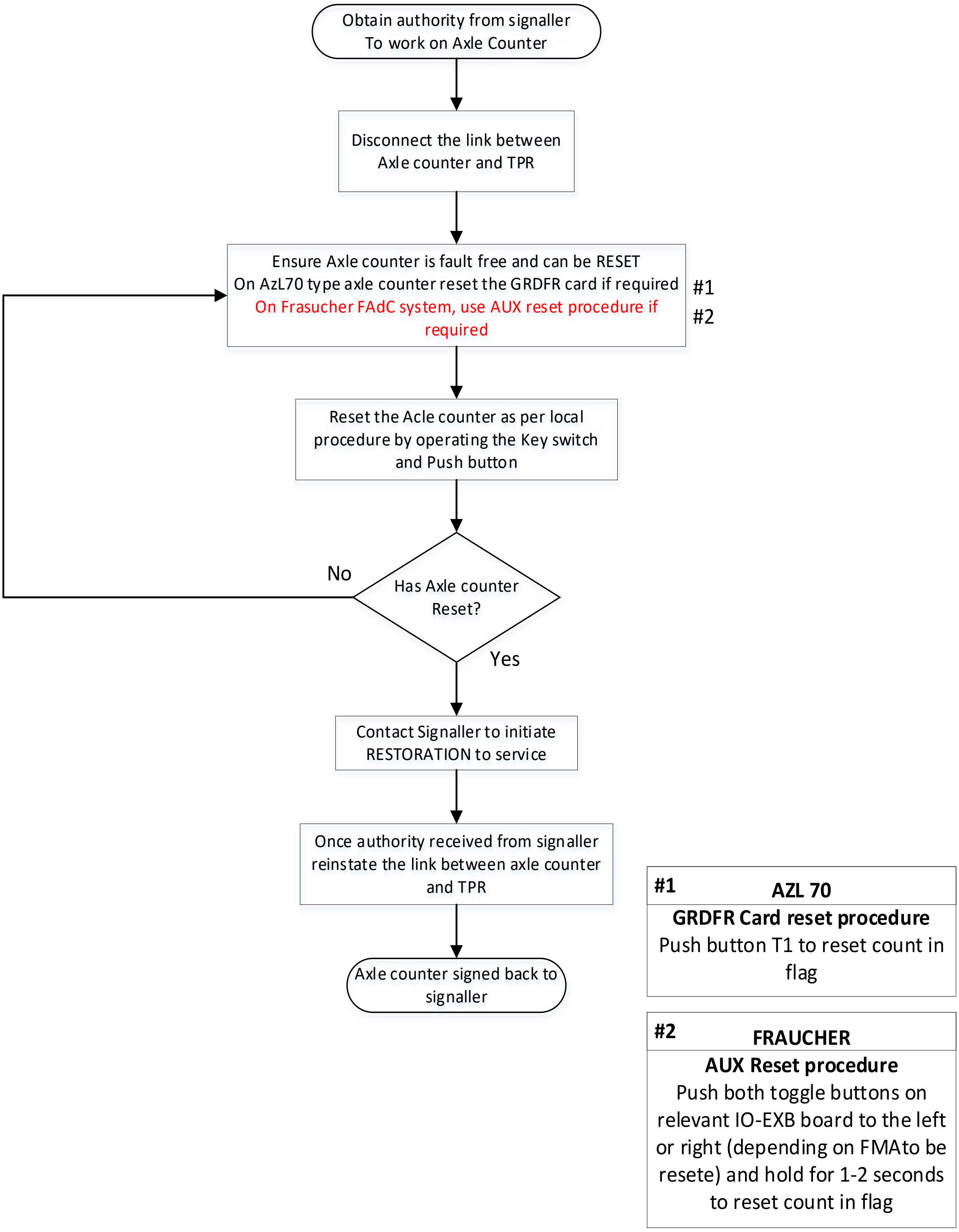
Axle Counter Isolation, Re-set and Restoration Form
SMF/SG/0246
Issue1.0
June 2007

Standard Maintenance Form

PART THREE	
Restoration of the Axle Counter System to the Interlocking	
I have completed work on the axle counter system, re-set the system to show track section(s) clear and now require signaller permission to restore the system. Before undertaking this process I have obtained assurance from the signaller that the track section(s) are clear of trains or vehicles	
Signal Technician (Name)	
Axle Counter System	
Affected Track Section(s)	
Maintenance Activity	
Interlocking	
Signal Box	
Signaller's Name	
Section(s) showing clear after restoration?	
Counter Number*	
Date	
Time	
Signed (Signal Technician)	
Comments	
*: If provided	

Appendix B: Flowchart

PROCEDURE FOR RESETTING AND RESTORING AN AXLE COUNTER WITHOUT CO-OPERATIVE RESTORE



END

Includes:	AzL70 Single Rail Contact 4 Wire TX System with EAK Lineside Junction Box and AzL70 Evaluator AzL70 Double Rail Contact 2 Wire TX System with EAK30 Lineside Junction Box and modified AzL70 Evaluator
Excludes:	All other types of Axle Counter

GENERAL

Make sure that metallic objects are kept away from the rail contacts as they can cause a false count.

Always take possession of the axle counter before adjusting the rail contacts.

If you have to reset the axle-counter, you shall follow the rules in NR/SMS/PartB/Test/030 (AzL Axle Counters : Isolate, Reset & Restore Procedures).

Measure and record all readings on the NR/SMS record card.

Always complete the tests on the lineside equipment before carrying out adjustments to the evaluator.

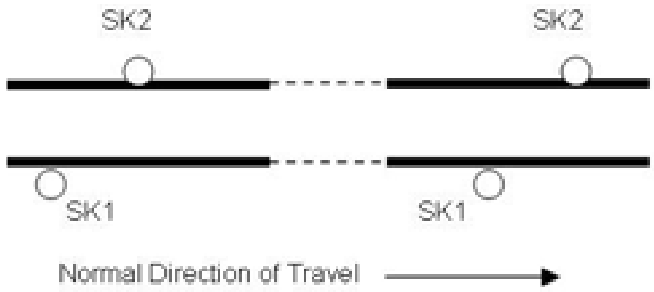


Figure 1 – Typical Layout of Single Rail Contact Type (SK11 Heads)

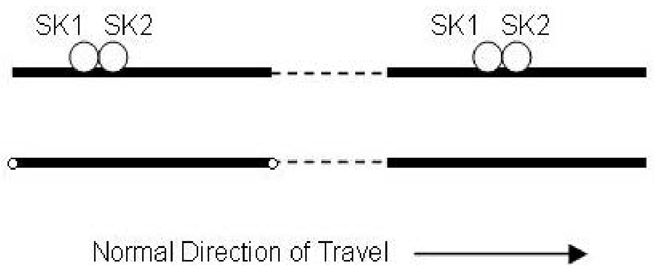


Figure 2 – Typical Layout of Double Rail Contact Type (SK30 Heads)

SERVICE A

1. Rail Contacts

1.1 Examine the count heads, rail insulations and bolts.

1.2 The TX head shall not touch the rail head. If a head or fixing is loose, check alignment NR/SMS/PartB/Test/042 (Axle Counters Dummy Wheel Test - AzL 70, 70/30, 70/30S) and tighten bolts NR/SMS/PartZ/Z03 (Train Detection - Reference Values).

1.3 Examine all tail cables, connections and clamps.

1.4 Check the protection plates and flux plates are tight, if fitted.

2. Lineside Junction Box (Types EAK and EAK30)

2.1 Examine the lineside junction box including all cables and connections.

2.2 Check all terminals are tight.

3. Evaluator

3.1 Examine evaluator and mountings.

3.2 Check all terminals are tight.

3.3 Check wiring and terminations.

3.4 Measure the DC evaluator supply voltage at the bus bar checking that it is 60V (Limits 55V to 65V).

3.5 Measure the DC stabilised supply on the SIPL card between the 0v and 20v jacks checking that it is 20V (limits 19V to 21V).

3.6 Measure using a meter the voltages on the BUPL card with the +ve lead of the meter in jacks 1a, 1b, 2a and 2b in turn and the –ve lead of the meter connected to the 0v jack on the SIPL card checking that it is 5V DC (limits 4.5V to 5.5V).

3.7 Observe that the ‘FM’ (green) LED on the SIPL card is lit if the axle counter section is clear; conversely confirm the ‘BM’ (red) LED is lit if the section is occupied.

3.8 Where a meter is provided on the battery charger check that the battery charging rate is approximately 200mA.

SERVICE B

Possession of the system shall be taken before undertaking any work. Check that the section TPR links are disconnected before work is started.

4. Rail Contacts

4.1 Check torque settings of fixings NR/SMS/PartZ/Z03 (Train Detection - Reference Values).

4.2 Single Rail Contacts Heads (SK11) Only:

a) Measure the distance between the count heads. Compare the distance with the last recorded.

4.3 If the distance has increased due to rail creep it shall be reported as corrective maintenance.

5. Lineside Junction Box – Type EAK (only)

5.1 Remove and examine cover, interior and connections. Do not remove cover if it is raining.

5.2 Check all terminals are tight.

5.3 Measure using a meter the voltages in Table 1:

Source	Meter +ve	Meter –ve	Volts	Limits
DC Supply	AL3/6	AL3/5	60V	55V to 65V
DC Stabilised	UG+	UG-	50V	48V to 54V
Signal Generator	AL1/3	AL2/2	75V	>75V
Channel 1 SK1	AL4/3	AL4/4	500mV	400mV to 600mV
Channel 1 SK2	AL4/1	AL4/2	500mV	400mV to 600mV

Table 1 – EAK Voltages

NOTE: *Adjustment of SK1 voltage can be achieved by R14 and SK2 by R2.*

5.4 Carry out NR/SMS/PartB/042 (Axle Counters Dummy Wheel Test - AzL 70, 70/30, 70/30S).

5.5 Grease fixing studs and replace cover.

5.6 Repeat sections 4 and 5 for each of the other count head(s) in the axle counter section.

6. Lineside Junction Box - Type EAK30 (only)

6.1 Remove and examine cover, interior, and connections. Do not remove cover if it is raining.

6.2 Check terminals are tight.

6.3 Check both green LEDs are illuminated.

6.4 Measure using the test switch box connected to the socket on the LtAnp board (plug goes in with cable entry at bottom) and a meter the voltages in Table 2:

Item	Meter Connection/ Switch Position	Voltage (DC)
Incoming supply	LTG1 yellow +ve, black –ve	+55V to 115V
Stabilised supply 1	red +ve, black –ve switch position. 3	+22V to +25V
Stabilised supply 2	red +ve, black –ve switch position. 4	+22V to +25V
MESSAB 1	red +ve, black –ve switch position. 10	+55mV to +200mV
MESSAB 2	red +ve, black –ve switch position. 12	+55mV to +200mV
PEGUE 1	red +ve, black –ve switch position. 11	+55mV to +200mV
PEGUE 2	red +ve, black –ve switch position. 13	+55mV to +200mV

Table 2 – LtAnp Board Voltages

6.5 Measure using a meter the transmitter outputs at terms 19/20 for SK1 and 21/22 for SK2:

a) SK1 35V to 49V AC @ 30 to 31.3kHz.

b) SK2 35V to 49V AC @ 27.4 to 28.6kHz.

6.6 Carry out NR/SMS/PartB/042 (Axle Counters Dummy Wheel Test - AzL 70, 70/30, 70/30S).

6.7 Disconnect the test switch box.

6.8 Grease fixing studs and replace cover.

7. Evaluator

7.1 Measure using a meter the voltages on the BUPL card with the +ve lead of the meter in jacks 1a,1b, 2a and 2b in turn and the –ve lead of the meter connected to the 0V jack on the SIPL card:

a) 5V DC (limits 4.5V to 5.5V).

If any BUPL card voltages in this test are below 4.5V with no wheel present, check the correct detection point equipment and line pair.

7.2 Adjust the BUPL card voltages (if necessary) by the top potentiometer on the ANP card for 1/2a and on the bottom potentiometer for 1/2b.

7.3 Check on the SIPL card that the FM (green) LED is illuminated. Using the test switch unit connected to test points 1a and 1b on the BUPL card and 0V on the SIPL card count in 10 axles.

7.4 Observe on the SIPL card that the ‘FM’ (green) LED is extinguished and the ‘BM’ (red) LED is illuminated and the TSR relay de-energises as soon as the first axle is counted in.

7.5 Observe on the FRMKTR card that the ‘EIN’ LED is illuminated and on the ZIANZG card ‘AUS’ LED is extinguished.

7.6 Change the connections on the test switch unit to test points 2a and 2b on the BUPL card leaving the other lead in the 0v on the SIPL card and count out 10 axles.

7.7 Observe on the ZIANZG card the ‘AUS’ LED becomes illuminated and on the FRMKTR card the ‘EIN’ LED is extinguished after the first axle is counted out.

7.8 Check the TSR relay remains de-energised and on the SIPL card the ‘BM’ (red) LED remains illuminated until the last axle is counted out.

7.9 When this has been achieved observe that on the SIPL card the ‘FM’ (green) LED illuminates as the ‘BM’ (red) LED extinguishes and the TSR relay energises.

7.10 If an oscilloscope is available check the interrogator signal on the BUPL card between the 3rd yellow jack (Abfr) and the 0V jack on the SIPL card. The signal appears as a square wave 10V to 12V amplitude with an equal mark-space ratio. The frequency is approx.1850Hz.

7.11 With a test lead (fitted with 4mm plugs at each end) connect jack 1a on the BUPL card to 0V jack on the SIPL card. Operate the reset plunger and observe that the system does not clear.

7.12 Remove the test strap and observe the system remains failed. Operate the plunger again and check the system clears. Repeat the test using the jacks 1b,2a and 2b on the BUPL card in turn.

7.13 Check the operation of the count indicator card (ZIANZG) by shorting together the test terminals. This causes all the segment displays to light (i.e. 888 is indicated).

7.14 Connect the counting test unit to jacks 1a and 1b on the BUPL card and the 0v jack on the SIPL card. Observe that the counter is reset, and the count is clear. Count in one axle and observe the following:

a) The TSR relay drops and the TZR relay picks.

b) On the SIPL card the green LED is extinguished, and the red LED is lit.

c) On the ZIANZG card LED's G1 and G3 are extinguished.

d) The total count shows 1.

7.15 Count in a further 9 axles and check the total count shows 10.

7.16 Transfer the test unit plugs to jacks 2a and 2b on the BUPL card leaving the other in the 0V jack on the SIPL card. Count out 1axle and observe the following:

a) The total count shows 9.

b) On the ZIANZG card LED G1 is illuminated.

7.17 Count out a further 9 axles and observe the following:

a) The total count is zero (display blank).

b) On the ZIANZG card all 3 LED's are lit.

c) On the SIPL card the green LED is lit, and the red LED is extinguished.

d) The TZR relay drops and the TSR relay picks.

e) The green 'Section Clear' indicator at the top of the rack is illuminated.

7.18 With the counter at zero briefly remove and replace the SVA card, observe the following:

a) The counter remains in a failed state and does not attempt to clear.

b) LED G12 on the UMO card is lit.

7.19 Operate the reset plunger and check the following:

a) The counter clears.

b) LED G12 on the UMO card is extinguished.

7.20 With the evaluator reset and showing clear disconnect the 110V supply to the BAUCH PSU, observe the system stays clear. Wait for two minutes and check the DC feed to the evaluator rack does not drop below 60V.

7.21 Reconnect the 110V supply and check that the DC feed to the evaluator rack rises and the system stays clear.

7.22 Check that all the covers are replaced on the front and back of the evaluator rack, locks are replaced on the reset buttons and the TPR links are restored.

7.23 After the axle counter is restored to the Signaller, if practicable observe the correct operation of the equipment with the passage of a train.

END

Includes:	AzL70/30 with EAK30 Lineside Junction Box and AzL70/30 Evaluator AzL70/30S with EAK30 Lineside Junction Box and AzL70/30S Evaluator
Excludes:	All other types of Axle Counter

GENERAL

Make sure that metallic objects are kept away from the rail contacts as they can cause a false count.

Always take possession of the axle counter before adjusting the rail contacts.

If you have to reset the axle-counter, you shall follow the rules in NR/SMS/PartB/Test/030 (AzL Axle Counters: Isolate, Reset & Restore Procedures).

All measurements shall be recorded on the record card.

Always complete the tests on the lineside equipment before carrying out adjustments to the evaluator.

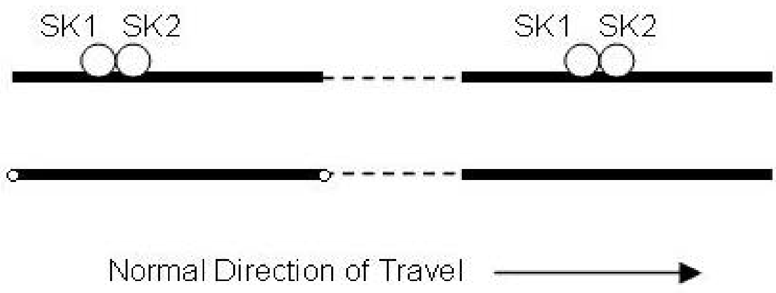


Figure 1 – Typical Layout of Double Rail Contact type (SK30 Heads)

SERVICE A

1. Rail Contacts

1.1 Examine the count heads, rail insulations and bolts. The Tx head shall not touch the rail head. If a head or fixing is loose, check alignment NR/SMS/PartB/Test/042 (Axle Counters Dummy Wheel Test - AzL 70, 70/30, 70/30S) and tighten bolts NR/SMS/PartZ/Z03 (Train Detection - Reference Values).

1.2 Examine all tail cables, connections, and clamps.

1.3 Check the protection plates and flux plates (if fitted) are tight.

2. Lineside Junction Box

2.1 Remove and examine cover, interior and connections. Do not remove cover if it is raining.

2.2 Check terminals are tight.

2.3 Check both green LEDs are illuminated (flashing on 70/30S).

2.4 Using a test switch box connected to the socket on the LtAnp board (plug goes in with cable entry at bottom) and a meter, measure and record the following voltages:

With the meter connected to LTG1 (yellow +Ve, black –Ve):

a) Incoming supply +55V to 115V DC.

With the meter connected to the switch position terminals (red +Ve, black –Ve) measure and record:

b) Stabilised supply 1 (switch pos. 3) +22V to +25V DC.

c) Stabilised supply 2 (switch pos. 4) +22V to +25V DC.

d) MESSAB 1 (switch pos.10) +55mV to +1000mV DC.

e) MESSAB 2 (switch pos.12) +55mV to +1000mV DC.

f) PEGUE 1 (switch pos.11) +55mV to +1000mV DC.

g) PEGUE 2 (switch pos.13) +55mV to +1000mV DC.

2.5 Measure and record using a meter the transmitter outputs at terms 19/20 for SK1 and 21/22 for SK2:

a) SK1 35 – 49V AC @ 30kHz.

b) SK2 35 – 49V AC @ 29kHz.

2.6 Disconnect the test switch box, grease fixing studs, and replace cover.

3. Evaluator

3.1 Examine evaluator and mountings.

3.2 Check all terminals are tight.

3.3 Check wiring and terminations.

3.4 Measure and record the DC evaluator supply voltage at the bus bar check that the voltage is 60V (Limits 54V to 72V).

3.5 Measure and record the DC stabilised supply on the SIPL card between the 0V and 20V jacks check that the voltage is 20V (limits 19V to 21V).

3.6 Measure and record using a meter the voltages on the BUPL card with the +Ve lead of the meter in jacks 1a,1b,2a,2b in turn and the –Ve lead of the meter connected to the 0V jack on the SIPL card, check that the voltage is 5V DC (limits 4.7V to 7V.

3.7 Check that the G1 (green) LED on the SIPL card is illuminated if the axle counter section is clear; conversely check the G2 LED (red) is illuminated if the section is occupied.

3.8 Check (where a meter is provided on the battery charger) that the battery charging rate is correct for the number of detection points being fed.

SERVICE B

Possession of the system is essential. Check that the section TPR links are disconnected before work is started.

4. Rail Contacts

4.1 Check torque settings of fixings NR/SMS/PartZ/Z03 (Train Detection - Reference Values).

5. Lineside Junction Box

5.1 Remove and examine cover, interior, and connections. Do not remove cover if it is raining.

5.2 Check all terminals are tight.

5.3 Measure and record using the lineside test switch box and a meter the incoming supply to terminals: LTG1 (yellow +Ve, black -Ve) check the voltage is +55V to +115V DC.

5.4 Measure and record the stabilised supplies (switch positions 3 and 4 on the lineside test switch box), check the voltage is +22V to +25V DC.

5.5 Measure and record the transmitter outputs at terms 19/20 for SK1 and 21/22 for SK2

a) SK1 35 – 49V AC @ 30kHz.

b) SK2 35 – 49V AC @ 29kHz.

5.6 Carry out NR/SMS/PartB/Test/042 (Axle Counters Dummy Wheel Test - AzL 70, 70/30, 70/30S).

5.7 Count Head Sites with Local Power Supply Only: Check that the evaluator is showing clear; disconnect the 110V supply to the BAUCH PSU and check that the system remains clear.

5.8 Wait approximately 2 minutes and measure the DC supply to the junction box. Check the reading is >60V.

5.9 Reconnect the 110V supply and check the DC supply to the junction box rises and the evaluator remains clear.

5.10 Grease fixing studs and replace cover.

5.11 Repeat steps 4 and 5 for the other count head(s) in the axle counter section.

NOTE: *The evaluator logic will now be out of step.*

6. Evaluator Voltages/Waveforms

6.1 Check that the counter is at zero and measure using a meter the DC voltage with the +Ve lead of the meter to the small yellow jacks on the BUPL card and the –Ve lead of the meter to the 0V jack on the SIPL card measure and record:

a) 2nd terminal (+7.5V) Limits +7V to +9V.

b) 4th terminal (Rel.F) Limits -13.5V to -16.5V.

c) 5th terminal (GR.2) Limits +19V to +21V.

d) 6th terminal (+5v) Limits +4.5V to +5.5V.

6.2 Measure and record using a meter the voltages on the BUPL card with the +ve lead of the meter in jacks 1a,1b, 2a,2b in turn and the –ve lead of the meter connected to the 0V jack on the SIPL card.

a) 5V DC (limits 4.7V to 7V)

Sections with 3 counting points, also measure 3a, 3b.

If any BUPL card voltages in this test are below 4.7V with no wheel present, check first the detection point equipment and line pair before adjusting the gain on the relevant LTV card.

Depending on the installation, if there are more than two Zp (e.g. one count in Zp and two count out Zp over a set of points) there will be a second LTV-A & DIS card for this Zp, see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

6.3 Adjust the BUPL card voltages (if necessary) by the S1 potentiometer on the LTV-E card for 1a/b and on the LTV-A card for 2a/b.

6.4 Check (if an oscilloscope is available) the interrogator signal on the BUPL card between the 3rd yellow jack (Abfr) and the 0v jack on the SIPL card.

The signal should appear as a square wave 10V to 12V pk-pk amplitude with a equal mark/space ratio. The frequency is approx.1850Hz.

7. Closed Loop Supervision Check

7.1 With a test lead, (fitted with 4mm plugs at each end) connect jack 1a on the BUPL card to 0V jack on the SIPL card.

7.2 Operate the reset plunger and observe that the system does not clear.

7.3 Check that the LED G2 on the DIS(1) card is illuminated.

7.4 Remove the test strap and observe the system remains failed. Operate the plunger again and check the system clears. Repeat the test using the jacks 1b, 2a, 2b on the BUPL card in turn noting the results are as follows:

a) Strap to 1b lights LED G1 on card DIS(1).

b) Strap to 2a lights LED G2 on card DIS(2).

c) Strap to 2b lights LED G1 on card DIS(2).

NOTE: *3a & 3b jacks if an extra LTV-A/DIS cards are fitted.*

8. Count Indication Card

8.1 If provided, check the operation of the count indicator card (ZIANZG) by shorting together the test terminals. This causes all the segment displays to light (i.e. 888 is indicated).

9. Evaluator Counting Check

The tasks in 9.1 to 9.4 require the use of a counting test unit, if this is not available tasks 9.5 to 9.8 shall be used (these require two test leads with 4mm plugs on each end). A ZIANZG card (if not fitted) is required for counting checking.

9.1 Connect the counting test unit to jacks 1a and 1b on the BUPL card and the 0V jack on the SIPL card. Observe that the counter is reset, and the count is clear. Count in one axle and observe the following:

a) The TSR relay drops and the TZR relay picks.

b) On the SIPL card the green LED is extinguished, and the red LED is illuminated.

c) The count direction indicator (LED G10 on the GRDFR card) lights after a short time.

d) On the ZIANZG card LEDs G1 and G3 are extinguished.

e) The total count shows 1.

9.2 Count in a further 9 axles and check the total count shows 10.

9.3 Transfer the test unit plugs to jacks 2a and 2b on the BUPL card leaving the other in the 0V jack on the SIPL card. Count out 1 axle and observe the following:

a) The total count shows 9.

b) On the GRDFR card LED G10 is extinguished.

c) On the ZIANZG card LED G1 is illuminated.

9.4 Count out a further 9 axles and observe the following:

a) The total count is zero (display blank).

b) On the ZIANZG card all 3 LEDs are illuminated.

c) On the SIPL card the green LED is illuminated, and the red LED is extinguished.

d) The TZR relay drops and the TSR relay picks.

e) The green 'Section Clear' indicator on the rack is illuminated.

9.5 Observe that the counter is reset, and the count is clear. Count in one axle by connecting the test leads to the listed plug points on the BUPL card in the following order:

Step	Action
1	Connect 1b to 0V
2	Connect 1a to 0V
3	Remove 1b from 0V
4	Remove 1a from 0V

Table 1 – Plug Points

9.6 Check the following:

a) The TSR relay drops and the TZR relay picks.

b) On the SIPL card the green LED is extinguished, and the red LED is illuminated.

c) The count direction indicator (LED G10 on the GRDFR card) lights after a short time.

d) On the ZIANZG card LEDs G1 and G3 are extinguished.

e) The total count shows 1.

9.7 Count in a further 4 axles using the steps described in 9.5 and check the count indicator in the ZIANZG card shows 5.

9.8 Count out one axle by connecting the test leads to the listed plug points on the BUPL card in the following order:

Step	Action
1	Connect 1a to 0V
2	Connect 1b to 0V
3	Remove 1a from 0V
4	Remove 1b from 0V

Table 2 – Plug Points

9.9 Check the following:

a) The total count shows 4.

b) LED G10 on the GRDFR card is extinguished.

c) LED G1 on the ZIANZG card is illuminated.

9.10 Count out the remaining four axles using the steps described in 9.8 then check the following:

a) The total count is zero (display blank).

b) On the ZIANZG card all 3 LEDs are illuminated.

c) On the SIPL card the green LED is illuminated, and the red LED is extinguished.

d) The TZR relay drops and the TSR relay picks.

e) The green ‘Section Clear’ indicator on the rack is illuminated.

10. Count Direction Memory Check

10.1 Using either the method listed in 9.1 (counting test unit) or 9.5 (test leads) count in 1 axle and wait until LED G10 on the GRDFR card lights.

10.2 Operate the reset plunger and check that the counter cannot be reset.

10.3 Press the small push button (T1) on the GRDFR card and observe that LED G10 extinguishes.

10.4 Operate the reset plunger and check that the counter resets and disconnect the counting test unit or remove the test leads.

11. Power Supply Interruption Check

11.1 With the counter at zero briefly remove and replace the SVA card, observe the following:

a) The counter remains in a failed state and does not attempt to clear.

b) LED G12 on the UMO card is illuminated.

11.2 Operate the GRDFR switch and the reset plunger, check the following:

a) The counter clears.

b) LED G12 on the UMO card is extinguished.

12. Standby Battery Check

12.1 With the evaluator reset and showing clear disconnect the 110V supply to the BAUCH PSU, observe the system stays clear.

12.2 Wait for two minutes and check the DC feed to the evaluator rack does not drop below 60V.

12.3 Reconnect the 110V supply and check that the DC feed voltage to the evaluator rack rises and the system stays clear.

13. Final

13.1 Check that all the covers are replaced on the front and back of the evaluator rack, locks are replaced on the reset buttons and the TPR links are restored.

13.2 Check with the Signaller that the axle counter is restored.

13.3 If practical, observe correct operation of the equipment with the passage of a train(s).

END

Includes:	Thales AzLM
Excludes:	All other Axle Counter types

GENERAL

The Earth bonding shall be visually inspected before commencing any task.

Metallic objects shall be kept away from the counting heads as they can cause a false-count.

One axle counter evaluator (ACE) can have up to 32 detection points, one or more of these detection points can be shared with another evaluator therefore two ACEs can be affected by tests on one rail contact.

The SK30H & SK30K set-up procedure causes the associated sections (s) to become disturbed.

Always take possession of the axle counter before adjusting the count heads.

A tested ESD strap shall be used to prevent damage to PCB's.

Check the configuration of the rail contacts before undertaking any preventative or corrective maintenance and arrange in liaison with the Signaller the necessary possession arrangements. If this cannot be arranged, inform your SM(S) of the situation.

The Signaller is responsible for resetting the axle counter section.

You should complete the tests on the lineside equipment before carrying out adjustments to the evaluator.

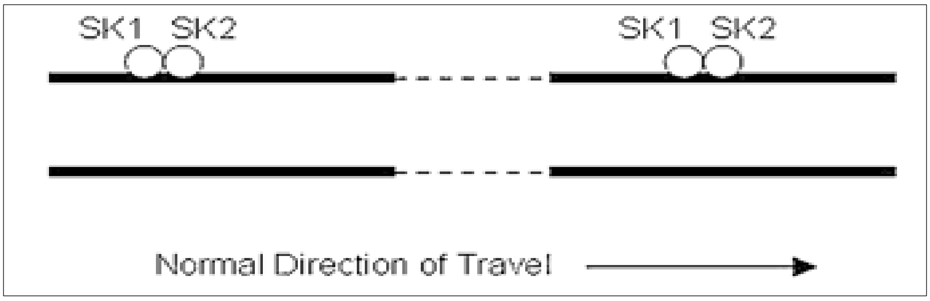


Figure 1 – Typical Layout of Rail Contacts (Type SK30H or SK30K)

Normally increasing Mileage (ARD Axle Counter Reference Direction), see Figure 1.

In the SK30K version the SK1 and SK2 is set via the ARD Plug in the EAK.
The molded TX cable is always connected to SK1 inside the rail sensor if the direction need to be change this can be achieved be adjusting the ARD plug (X600).

Test Equipment

German	English Translation	Part number	Spec
Prüfguppe bestehend aus: Prüfkoffer Messadapter mit diagno-sestecker Digitalvoltmeter	Test Unit consisting of: Test Case Test adapter with diagnostic plug Digital voltmeter	19982 28201	 0.00V to 300V ac/dc
Absenklehre	Dummy wheel	3JA 84532 AAAA	

Table 1 – Test Equipment Part Numbers

The dummy wheel 3JA 84532 AAAA is suitable for all rail contacts, Sk30, Sk30H and Sk30K.

The former dummy wheel 19982 3100x is **NOT** suitable for Sk30K rail contacts.

SERVICE A

1. Diagnostic System

This can be done either at the ACE or remotely.

1.1 Perform a diagnostic download from the system.

A download of the last 24 hours indicates if any other tests are necessary, particularly any data line quality tests.

1.2 Report any fault messages or alarms:

Drift warnings recorded by diagnostics can indicate movement of the rail contact.

1.3 Store the downloaded data separately from the computer. This can be done using an authorised NR memory stick or a CD / DVD. The files and device shall be suitably tagged / labelled and kept for a minimum of five years.

SERVICE B

2. Diagnostic System

This can be done either at the ACE or remotely.

2.1 Perform a diagnostic download on the system.

A download of the last 24 hours indicates if any other tests are necessary, particularly any data line quality tests.

2.2 Report any fault messages or alarms:

Drift warnings recorded by diagnostics can indicate movement of the rail contact.

2.3 Store the downloaded data separately from the computer. This can be done using an authorised NR memory stick or a CD / DVD. The files and device shall be suitably tagged / labelled and kept for a minimum of five years.

2.4 If no train has passed over each detection point during the previous 365 days. Carry out NR/SMS/PartB/Test/031 (Thales Axle Counter Reference Direction Function Test).

The rest of this service need not be completed if the requirements in Section 2 have been successfully completed. If the requirements have not been met then you shall continue with the remaining steps of this service.

3. Rail Contacts SK30H (if fitted)

3.1 Examine the rail contacts, rail insulations, mounting brackets and bolts for security and damage.

The TX head shall not touch the railhead.

If a head or fixing is loose, check the alignment, see NR/SMS/PartB/Test/045 (Thales Axle Counters Dummy Wheel Test (Azlm)) and tighten bolts, see torque values in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

Drift warnings recorded by diagnostics can be an indication of movement, see NR/SMS/PartB/Test/045 (Thales Axle Counters Dummy Wheel Test (Azlm)) for details of how to set up and adjust the count heads if drift warnings are received.

3.2 Examine all tail cables, connections, rail clamps (if fitted), and brackets for security and damage.

3.3 Check that the cables are clear of any heavy obstructions and protection arrangements are sufficient.

3.4 Check the Pirelli Python' shall be used to protect the cable from the rail contacts to the EAK.

3.5 Check the bung is fitted between the Pirelli Python and cable.

3.6 Check that the labelling on the cables is legible, secure, and intact.

3.7 Check the protection plates and flux plates (if fitted) are tight.

3.8 Check that pads and clips for three sleepers either side of the rail contacts are not damaged or missing.

Damaged or missing items might cause incorrect operation, report defects as corrective maintenance.

3.9 Check the area around the rail contacts (within 2m), check it is free of the following items:

a) P/way defects.

b) New/Scrap rails in the four/six foot or cess.

c) Metallic debris.

d) Traction bonds.

e) Excessive ballast.

Any problems that cannot be rectified shall be reported as corrective maintenance.

3.10 Measure using a approved meter the resistance between the Rx rail contacts and the running rail/M12 bolts. The reading shall be >2MΩ.

If the obtained reading is <2MΩ, the rail mountings will require cleaning or replacing as necessary.

4. Rail Contacts SK30K (if fitted)

4.1 Examine the rail contacts and bolts for security and damage.

If a head is loose, check the alignment, see NR/SMS/PartB/Test/045 (Thales Axle Counters Dummy Wheel Test (Azlm)) and tighten bolts, see torque values in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

Drift warnings recorded by diagnostics can be an indication of movement, see NR/SMS/PartB/Test/045 (Thales Axle Counters Dummy Wheel Test (Azlm)) for details of how to set up and adjust the count heads if drift warnings are received.

4.2 Examine all tail cables, connections, clamps, and brackets for security and damage. Check that the cables are clear of any heavy obstructions and protection arrangements are sufficient.

4.3 Check the 'Pirelli Python' shall be used to protect the cable from the rail contacts to the EAK.

4.4 Check that the labelling on the cables is legible, secure, and intact.

4.5 Check the protection plates and flux plates (if fitted) are tight.

4.6 Check that pads and clips for three sleepers either side of the rail contacts are not damaged or missing.

Damaged or missing items might cause incorrect operation, report defects as corrective maintenance. If the head is mounted over the sleeper this pad needs to be checked as well.

4.7 Check the area around the rail contacts (within 2m), check it is free of the following items:

a) P/way defects.

b) New/Scrap rails in the four/six foot or cess.

c) Metallic debris.

d) Traction bonds.

e) Excessive ballast

Any problems that cannot be rectified shall be reported to your SM(S).

5. Lineside Junction Box (EAK)

5.1 Examine the following items:

a) Clear Vegetation.

b) Security of the cover.

c) Earth bonding. If necessary, check against the signalling bonding plan.

d) Cable entries, glands, and ties. Unused cable entry points shall have blanking plugs fitted.

e) Cables connections, clamps brackets and protection. 'Pirelli Python' shall be used to protect the cable from the EAK to the rail contacts.

f) EAK identification.

5.2 Check all cables to and from the EAK are undamaged and clear of any heavy obstructions. E.G. new/scrap rails lying across the cable.

6. Axle Counter Evaluator (ACE)

6.1 Check the ACE diagnostics for potential failures or irregularities.

A 24 hour history download will determine if any other tests are necessary, particularly any data line quality tests.

6.2 Check the following for security and signs of damage:

a) PDCU and terminals.

b) DC/DC converter and terminals.

6.3 The ACE cabinet doors shall be left open (if fitted).

PT – PERIODIC TASK

7. Rail Contact Clamp (if fitted)

7.1 Check and examine the clamp is undamaged, correctly fitted and secure.

7.2 Visually check the “norlock” washers are fitted.

If the clamp is found to be loose the “Norlock” washers are possibly incorrectly installed.

When these are fitted correctly installed the chamfered faces face towards each other as shown in Figure 2.

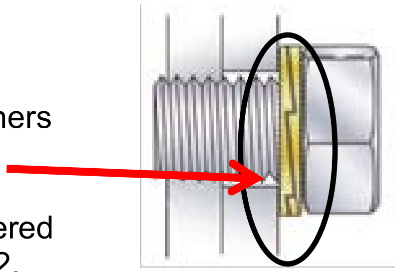


Figure 2

END

Includes:	Siemens AzS ZPD 43 trackside connection box DEK43 double wheel detector
Exclude:	Siemens AzS ZP43 V trackside connection box (see NR/SMS/PartC/AX29), ACE equipment and all other types of wheel detectors

GENERAL

Possession of the relevant track sections of the axle counter shall be taken before adjusting the connection box test levels.

A potential miscount or disturbance to the associated track sections could occur.

Keep switched on mobile phones and metallic objects away from the counting heads whilst undertaking maintenance as they can cause false counts/readings.

If you have to reset the axle counter, follow the appropriate resetting procedure with the Signaller.

More information on the outdoor equipment for Siemens axle counters can be found in NR/SMS/Part/Appendix/01.

SERVICE A

1. Double Wheel Detector (DEK 43)

1.1 Examine the wheel detector count heads, reduction plates and bolts for security and damage.

Reduction plates are fitted both sides of the rail for all types of flat bottom rail.

Only one reduction plate is fitted the receiver side for all types of bull head rail.

1.2 Check that the M12 securing nuts are tight by using the relevant torque wrench tool.

Item	Socket Side	Torque
Wheel detectors	19mm	40Nm to 50Nm

1.3 Check the area around the rail contacts (within 2m) is free of the following items:

a) P/way defects.

b) New/Scrap rails in the four/six foot or cess.

c) Metallic debris.

d) Traction bonds.

e) Excessive ballast.

Report any problems that cannot be rectified.

1.4 Examine all tail cables (protective flexible tubing), connections and clamps for security and damage.

1.5 If practical, observe the passage of a train across the wheel detector and report any excessive deflection in the rail as corrective maintenance.

Excessive deflection in the rail at the point where the wheel detector is fixed to the rail can cause damage to the wheel detector.

SERVICE B

2. Trackside Connection Box

The cover of the trackside connection box shall not be removed during wet conditions unless an alternative suitable cover is available.

Possession of the relevant track sections of the axle counter shall be taken before taking any reading and adjusting the connection box test levels.

If any values are found to be out of tolerance, there might be a fault. This shall be investigated and rectified before any adjustments are carried out.

2.1 Check the area around the trackside connection box is clear of excessive foliage or obstructions.

2.2 Check that the labelling on the trackside connection box is legible, secure, and intact.

2.3 Remove the trackside connection box cover and examine the interior and connections for damage or signs of moisture ingress. Rectify or report.

2.4 Check that all terminals and cards are undamaged and secure.

2.5 Check that both LED's labelled as LED3 are flashing and that no other LED's are illuminated or flashing.

2.6 Using a Fluke (compatible with TPWS) capable of measuring true RMS voltage and frequency, measure the readings at test points specified on the record card NR/SMS/PartR/AX28/RC/01.

If the readings are outside range in 2.9 to 2.11, calibration is required. (See Appendix A).

Any adjustment at the ZP43 shall be followed by adjustment at the Axle Counter Evaluator.

One wheel detector can affect more than one section.

2.7 Measure the incoming DC voltage.

Name	Terminals	Value	Range
Supply voltage	NS + & -	60V DC	30V to 72V

2.8 Measure the AC voltage.

Name	Terminals	Value	Range
Output voltage	NS + & -	Min 1.0V AC	0.48V to 1.8V

2.9 Set the meter for AC voltage and frequency, measure TX 1 & TX 2.

Name	Terminals	Value	Range
Frequency TX 1	6 & 7	43kHz	41.5kHz to 44.5kHz
Frequency TX 2	8 & 9		

2.10 Set the meter for mV AC voltage, measure receiver voltage UE1 & UE2.

Name	Terminals	Range	Comment
Receiver voltage	1 & 2	60mV to 150mV	For very small rail profiles, up to 200mV
Receiver voltage	3 & 4		

2.11 Replace the desiccant bag, replace the cover.

APPENDIX A - ZPD 43 Calibration Procedure

1. Make arrangements with the Signaller for possession of the relevant axle counter sections.

   One wheel detector can affect more than one section.

2. Check that DEK43 is idle and that there are no wheels or other metallic objects in its proximity.

3. Check that switch S1 is set to "FR".

4. Press the T3 and T4 "KAL" buttons at the same time and hold until the L4 LED for each channel lights up, then release both buttons.

   The L3 LEDs will illuminate immediately.

5. After a few seconds the L4 LEDs extinguish, and the L3 LEDs start to flash.

   This indicates that calibration has been completed.

6. Conduct Steps 2.6 to 2.11 above.

7. A delay of 10 seconds is required before attempting re-calibration, if the LED display in Clause 5 indicates that calibration was not successful.

8. If any adjustments are made at the ZP43 wheel detection equipment the VESBA card values for the effected sections at the Axle Counter Evaluator shall be checked

END

Includes:	Siemens AzS ZP43 V trackside connection box, DEK43 double wheel detector
Exclude:	Siemens AzS ZPD 43 trackside connection box (see NR/SMS/PartC/AX28), ACE equipment

GENERAL

Possession of the relevant track sections of the axle counter shall be taken before adjusting the connection box test levels.

A potential miscount or disturbance to the associated track sections could occur.

Keep switched on mobile phones and metallic objects away from the counting heads whilst undertaking maintenance as they can cause false counts/readings.

If you have to reset the axle counter, follow the appropriate resetting procedure with the Signaller.

More information on the outdoor equipment for Siemens axle counters can be found in NR/SMS/Part/Appendix/01.

SERVICE A

1. Double Wheel Detector (DEK 43)

1.1 Examine the wheel detector count heads, reduction plates and bolts for security and damage.

Reduction plates are fitted both sides of the rail for all types of flat bottom rail.

Only one reduction plate is fitted the receiver side for all types of bull head rail.

1.2 Check that the M12 securing nuts are tight by using the relevant torque wrench tool.

Item	Socket Side	Torque
Wheel detectors	19mm	40Nm to 50Nm

1.3 Check the area around the rail contacts (within 2m) is free of the following items:

a) P/way defects.

b) New/Scrap rails in the four/six foot or cess.

c) Metallic debris.

d) Traction bonds.

e) Excessive ballast.

Report any problems that cannot be rectified.

1.4 Examine all tail cables (protective flexible tubing), connections, and clamps for security and damage.

1.5 If practical, observe the passage of a train across the wheel detector and report any excessive deflection in the rail as corrective maintenance.

Excessive deflection in the rail at the point where the wheel detector is fixed to the rail can cause damage to the wheel detector.

SERVICE B

2. Trackside Connection Box

The cover of the trackside connection box shall not be removed during wet conditions unless an alternative suitable cover is available

Possession of the relevant track sections of the axle counter shall be taken before adjusting the connection box test levels.

If any values are found to be out of tolerance, there might be a fault. This shall be investigated and rectified before any adjustments are carried out.

2.1 Check the area around the trackside connection box is clear of excessive foliage or obstructions. Rectify or report as corrective maintenance.

2.2 Check that the labelling on the trackside connection box is legible, secure and intact.

2.3 Remove the trackside connection box cover and examine the interior and connections for damage or signs of moisture ingress. Rectify or report.

2.4 Check the cable entries and glands. Unused cable entry points shall have blanking plugs fitted.

2.5 Check that all terminals and boards are undamaged and secure.

3. Setting up and adjustment of ZP43 V wheel detector equipment

3.1 Both switches on the band-pass filter board shall be set to on. See Figure 1.

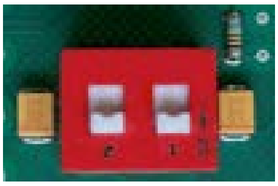


Figure 1

All measurements and any adjustments made shall be recorded on the record card.

3.2 Details of the PEGA test box can be found in NR/SMS/Part/Appendix/01.

If the readings are outside range, adjust as required.

Any adjustment at the ZP43 shall be followed by adjustment at the Axle Counter Evaluator.

3.3 Check that there are no wheels or other metallic objects in the proximity of the wheel detectors.

3.4 Set the switch on the ZP43 V adapter to ZP43E/M and connect it to the PEGA 1211 test box.

3.5 Insert the ZP43 V adapter into slot 2 of the trackside connection box.

3.6 Turn on the PEGA 1211 test box and select operating mode ZP 43 with the mode button and confirm with the OK button.

3.7 Select all further test options using the arrows and the OK button.

3.8 Select U60 on the test box and measure the incoming DC voltage.

Name	Function	Value	Range
Supply voltage	U60	60V DC	30V to 72V

3.9 Select U24 on the test box and measure the operating DC voltage.

Name	Function	Value	Range
Operating voltage	U24	22V DC	21.3V to 22.4V

3.10 Select FS on the test box and measure the frequency.

Name	Function	Value	Range
Wheel detector frequency	FS	43kHz	42.8kHz to 43.2kHz

If the frequency is not within the range adjust the rotary switch on the backplane until the frequency is within range.

3.11 Select UE1 on the test box and measure the receiver voltage 1 then select UE2 and measure the receiver voltage 2.

Name	Function	Range	Comment
Receiver voltage	UE1 & UE2	60mV to 150mV	For vary small rail profiles, up to 200mV

If the receiver voltages are out of range and there is not excessive rail wear the wheel detector might require replacement.

3.12 Select UR1 on the test box and measure the standard voltage.

Name	Function	Value	Range
Standard voltage 1	Ur1	5.5V DC	5.3V to 6.0V

If the voltage is not within the range adjust the potentiometer on the bottom of the generator board until the voltage is within range.

3.13 Select UR2 on the test box and measure the standard voltage.

Name	Function	Value	Range
Standard voltage 2	Ur2	5.5V DC	5.2V to 5.9V

If the voltage is not within the range adjust the potentiometer on the top of the generator board until the voltage is within range.

3.14 Select F1 on the test box and measure the frequency F1

Name	Function	Value	Range
Frequency F1	F1	3.60kHz	3.55kHz to 3.65kHz

If the frequency is not within the range adjust the potentiometer on the bottom of the generator board until the frequency is within range.

3.15 Select F2 on the test box and measure the frequency F2

Name	Function	Value	Range
Frequency F2	F2	6.52kHz	6.42kHz to 6.62kHz

If the frequency is not within the range adjust the potentiometer on the top of the generator board until the frequency is within range.

3.16 Select UL on the test box and measure the output voltage.

Name	Function	Value	Range
Output voltage	UL	Min 1.0V AC	0.48V to 1.8V

3.17 Replace the desiccant bag, replace the cover.

3.18 If any adjustment are made at the ZP43 wheel detection equipment the VESBA card values for the effected sections at the Axle Counter Evaluator shall be checked

END

Includes:	AzSM (E) ACE equipment
Exclude:	DEK43 double wheel detector and trackside connection box (see NR/SMS/AX29)

Possession of the relevant track sections of the axle counter shall be taken before adjusting the connection box test levels.

Make sure switched on mobile phones and metallic objects are kept away from the counting heads whilst undertaking maintenance as they can cause false-counts/readings.

If you have to reset the axle counter, you shall follow the appropriate resetting procedure with the signalman.

More information on the outdoor equipment for Siemens axle counters can be found in NR/SMS/Part/Appendix/01

SERVICE B

1. Evaluator Computer

1.1 Examine evaluator computer and cabinet earthing for damage and security.

1.2 Examine the connection of cable shields to earth for security.

1.3 Check that the fan the operating voltage is present.

The green LED at the front of the fan should be illuminated.

1.4 Check the fan speed is O.K.

The red LED at the front of the fan should be extinguished.

1.5 Check that when the blue button is pressed, the red LED illuminates. Check that the fan fault has been registered on the S&D computer and then clear the appropriate fault from the log.

1.6 Check and if necessary clean or exchange the filter mats.

1.7 Measure using the PEGA 1121 test box in turn, ZAN card values between jacks (with heads fitted):

- Voltage U1 = 3.0 V DC ± 0.10 V DC (socket 5 & 7)
- Frequency f1 = 3.60 kHz ± 0.05 kHz (set at the counting head) (socket 4 & 6)voltage
- Voltage U2 = 3.0 V DC ± 0.10 V DC (sockets 12 &14)

- Frequency f2 = 6.52 kHz ± 0.10 kHz (set at the counting head) (sockets 11 & 13)

All Zero volt jack sockets are common across all ZAN cards. Use a Zero volt jack socket that is not next to the jack socket from which the reading is required.

If any value is found to be out of tolerance, there could be a fault with the cable system or the ZAN card and this should be investigated/rectified before any adjustments are carried out.

1.8 Check that there are no permanently illuminated RED LEDs on any of the Evaluator core components.

End

Includes:	AzS 350U ACE equipment
Exclude:	Siemens AzS ZP 43 V trackside connection box, Siemens AzS ZPD 43 trackside connection box, DEK43 double wheel detector

GENERAL

Possession of the relevant track sections of the axle counter shall be taken before adjusting VESBA card levels.

When inserting and removing test probes from the U, F and 0V test sockets on the VESBA card care shall be taken to avoid contact between the probe and the metal front plate or any other connected test probe.

Take care not to inadvertently press on the red push button on either VAU card, as this will reset the processor, which will place all sections to occupied.

A potential miscount or disturbance to the associated track sections could occur.

Keep switched on mobile phones and metallic objects away from the counting heads whilst undertaking maintenance as they can cause false-counts/readings.

If you have to reset the axle counter, follow the appropriate resetting procedure with the Signaller.

Before measuring or adjusting any VESBA card values the ZP 43 V or ZPD 43 wheel detection equipment values shall be checked (see NR/SMS/PartC/AX28 (Siemens AzS ZP 43 D Wheel Detector Equipment) or NR/SMS/PartC/AX29 (Siemens AzS ZP 43 V Wheel Detector Equipment).

If any value is found to be out of tolerance, there could be a fault with the cable system or the VESBA card.

Investigate this possibility as corrective maintenance before any adjustments are carried out.

More information on the outdoor equipment for Siemens axle counters can be found in NR/SMS/Part/Appendix/01.

SERVICE B

1. Evaluator Computer

1.1 Examine evaluator computer and cabinet earthing for damage and security.

1.2 Examine the surge arrester earthing.

1.3 Using a Fluke (compatible with TPWS) capable of measuring true RMS voltage and frequency, measure in turn the VESBA card values between the test points specified on record card NR/SMS/AX31/RC01.

a) Set meter for DC Voltage measurement (Ur1):

- Meter +ve to U (top right test point).
- Meter -ve to 0V(either in middle row).

Name	Function	Value	Range
Standard voltage	Ur1	3V DC	2.9V to 3.1V

If the voltage is not within range, adjust using the upper potentiometer.

b) Set meter for Frequency measurement (F1):

- Meter +ve to F (top left test point).
- Meter -ve to 0V (either in middle row).

Name	Function	Value	Range
Frequency	F1	3.60kHz	3.55kHz to 3.65kHz

If the frequency is not within range, the ZP 43 V or ZP D 43 wheel detection equipment values shall be checked (see NR/SMS/PartC/AX28 (Siemens AzS ZP 43 D Wheel Detector Equipment) or NR/SMS/PartC/AX29 (Siemens AzS ZP 43 V Wheel Detector Equipment).

c) Set meter for DC Voltage measurement (Ur2):

- Meter +ve to U (bottom right test point).
- Meter -ve to 0V (either in middle row).

Name	Function	Value	Range
Standard voltage	Ur2	3V DC	2.9V to 3.1V

If the voltage is not within range, adjust using the lower potentiometer:

d) Set meter for Frequency measurement (F2):

- Meter +ve to F (bottom left test point).
- Meter -ve to 0V (either in middle row).

Name	Function	Value	Range
Frequency	F2	6.52kHz	6.42kHz to 6.62kHz

If the frequency is not within range, the ZP 43 V or ZP D 43 wheel detection equipment values shall be checked (see NR/SMS/PartC/AX28 (Siemens AzS ZP 43 D Wheel Detector Equipment) or NR/SMS/PartC/AX29 (Siemens AzS ZP 43 V Wheel Detector Equipment).

1.4 Check that there are no permanently illuminated red LEDs on either of the VAU boards.

END

Includes:	Frauscher RSR 123 wheel sensors used in both the Frauscher Advanced Axle Counters and for Supplementary Train Position Axle Counter Sections
Excludes:	All other applications of the RSR 123 wheel sensors

General

More information on the outdoor equipment for Frauscher Advanced Axle Counters can be found in NR/SMS/Appendix/07 (General Information on the Frauscher Advanced Axle Counter).

Information relating to fault finding and fault codes can be found in NR/SMTH/Part10/FF10 (Faulting Guide: Frauscher Advanced Axle Counter).

East Suffolk Line (Only)

On the East Suffolk Line, the supplementary axle counters are uniquely identified on site with the AEB cards fitted with magenta labels (shown circled red in Figure 1).

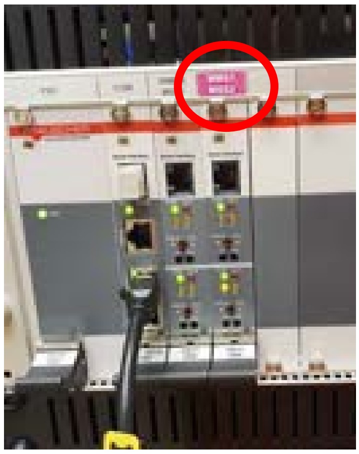


Figure 1 – Magenta Labels

They are configured with Supervisor Track Sections (STS) and Count Head Check (CHC).

The main interlocking control axle counting sections are acting as STS to the train position axle counter sections for the level crossings. The CHC is set to 100.

A record card is available, but completion of a card might not be required if the system being maintained has built data recording capabilities.

PERIODIC TASK 1

1. Alerts and Alarms

1.1 Review all alerts and alarms generated where FAMS is fitted. Arrange for corrective actions to be undertaken and inform your SM(S) of actions which require immediate and 28-day interventions.

1.2 Where FAMS is not available, review the errors generated within FDS and report any issues identified to your SM(S).

PERIODIC TASK 2

2. Remote Occupancy Detection Test

Observe that all sensors in the system have been traversed by a track vehicle or a PB200 testing plate within the last two years.

This can be verified by looking at the FDS or FAMS or equivalent downloads. Where the download does not prove the successful passage of an on-track vehicle, a work order shall be raised to carry out NR/SMS/PartB/Test/037 – Frauscher: RSR123 Wheel Sensor Occupancy Detection Capability Test, for each of the sensors which have not been traversed.

PERIODIC TASK 3

Rail Sensor Height Check

3. Mechanically

3.1 Measure the distance between the wheel sensor top surface and top of rail (distance "A" as shown in Figure 2). This shall be between 40 and 45mm. Adjust height if required. The measurement shall be consistent along the entire length of the wheel sensor.

It is recommended to adjust measurement A between 43 and 45 mm (optimal range).

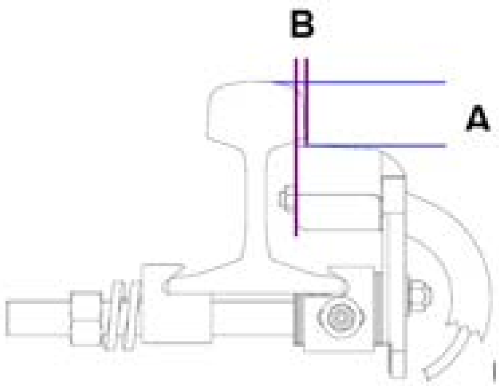


Figure 2 – Maintenance Measurements

NOTE: *Measurement "B" is not checked during maintenance, but only after replacement or installation of a wheel sensor*

3.2 Measure the distance between the wheel sensor inside edge and inside edge of the of rail head (distance "B" as shown in Figure 2). The wheel sensor is positioned slightly below and under the head of the rail. The measurement shall be between 0mm and 6mm. Adjust as required. The measurement shall be consistent along the entire length of the wheel sensor.

If the position of the RSR123 has been changed it shall be electrically re-calibrated using the correct SMS Part B Test.

END

Includes:	Frauscher wheel sensor RSR123
Excludes:	All other types of wheel sensor

A record card is available, but completion of a card might not be required if the system being maintained has built data recording capabilities.

SERVICE B

1. Wheel Sensor Calibration Checks

If RSR123 sensors are used for axle counter applications then carry out one of the methods in Clauses 1.1, 1.2 or 1.3.

1.1 Frauscher Diagnostic System (FDS) or Frauscher Active Monitor System (FAMS)

a) If required, start the web browser on the laptop, enter the IP address and log in.

b) Using the FDS, check the status of the life-signals for both wheel sensor systems are received. Figure 1 shows the life-signal ok (ringed in blue) Figure 2 shows the life-signal failed (ringed in red)

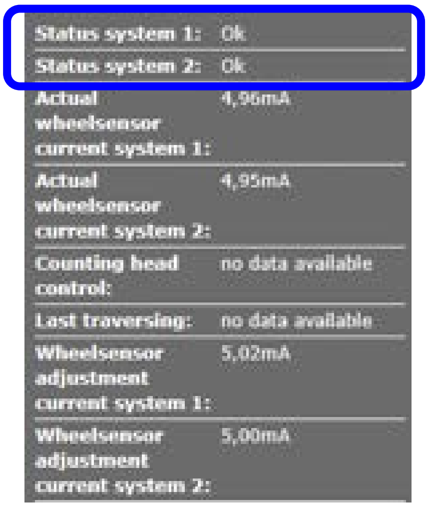


Figure 1 - life-signal ok

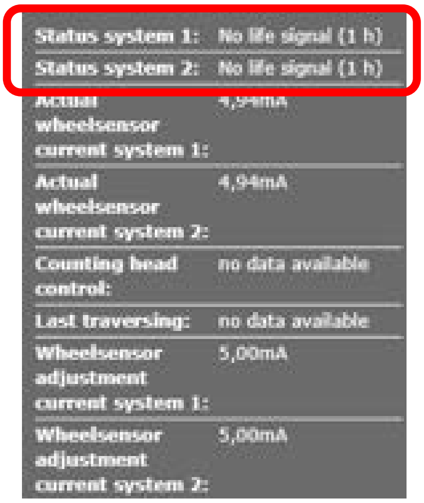


Figure 2 - life-signal failed

c) Check that the readings are within the range.

- *System 1: 5mA ± 5% (4.75mA to 5.25mA).*
- *System 2: 5mA ± 5% (4.75mA to 5.25mA).*

d) If the life-signals are missing and/or the voltages are out of range, this shall be reported to Fault Control.

1.2 Advanced Service Display (ASD)

Use only the correct, isolated and undamaged Advanced Service Display cable. There is no galvanic separation and no protection against overvoltage between the Serial Interface of the AEB and the electronics of the AEB board.

Before checking the sensor system currents with the indoor equipment, confirm that the associated mounted wheel sensor is in an undamped state.

a) Connect the laptop to the AEB by using the serial interface between the AEB and the USB port, with the advanced service display cable.

b) Check if the life-signals for both wheel sensor systems are received.

c) Check the current on the AEB for wheel sensor system 1.

d) Check the current on the AEB for wheel sensor system 2.

e) Check that the readings are within the range:

- *System 1: 5mA ± 5% (4.75mA to 5.25mA).*
- *System 2: 5mA ± 5% (4.75mA to 5.25mA).*

f) If the values are not within the stated range check position of the wheel sensor RSR123 as described in NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) - Periodic Task 3.

g) If the position of the RSR123 is correct, adjust wheel sensor as described in NR/SMS/PartB/Test/040 (RSR123 Wheel Sensor Adjustment - associated with AEB Boards).

h) Recheck if the life-signal and currents as per steps b) to e).
i) If the life signal is still missing and/or the currents are out of range, replace the wheel sensor as described in NR/SMTH/Part04/AX40 (Replace a Frauscher wheel sensor RSR123).

1.3 Advanced Evaluation Board (AEB)

a) Plug the multi-meter into the 2mm test sockets on the AEB and check if the life-signals for both wheel sensor systems are received.

NOTE: *The voltage should alternate from 0.5 V for 4 seconds to 0.51 V for 2 seconds. If the voltage is constant at 0.5 V no life-signal is present.*

b) Measure the voltage on the AEB for wheel sensor system 1.

c) Measure the voltage on the AEB for wheel sensor system 2.

d) Check that the readings are within the range:

- *System 1: 500mV ± 5% (475mV to 525mV).*
- *System 2: 500mV ± 5% (475mV to 525mV).*

NOTE: *The measured voltage complies with the wheel sensor system current via a 100 Ω shunt (100 mV therefore complies with 1 mA wheel sensor system current).*

e) If the values are not within the stated range check position of the wheel sensor RSR123 as described NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) - Periodic Task 3.

f) If the position of the RSR123 is correct, adjust wheel sensor as described in NR/SMS/PartB/Test/040 (Frauscher : RSR123 Wheel Sensor adjustment – associated with AEB Boards).

g) Recheck if the life-signal and voltages as per steps a) to d).
h) If the life signal is still missing and/or the voltages are out of range, replace the wheel sensor as described in NR/SMTH/Part04/AX40 (Replace a Frauscher wheel sensor RSR123).

PERIODIC TASK 1

2. Mechanical and visual check of wheel sensor RSR123

2.1 Examine the wheel sensor mounting plates and bolts for heavy soiling, security and external damage.

2.2 Check the area around the rail contacts (within 2m) are free of such items as:

- Visible P/way defects.
- Metallic debris.
- New/scrap rails in the four/six foot or cess.
- Traction bonds.
- Excessive ballast.

Any problems that cannot be rectified shall be reported as corrective maintenance.

2.3 Observe exposed tail cables (protection tube), plug couplers and connections for security and damage.

PERIODIC TASK 2

3. Head Sensor Security

There are two variants of the Frauscher Rail Claw, confirm which is fitted before proceeding.

GS02 Rail Claw Only

3.1 Check the rail sensor securing nuts are tightened to correct torque values using an approved torque wrench tool as follows:

a) Figure 3 Allen Screws to 25Nm

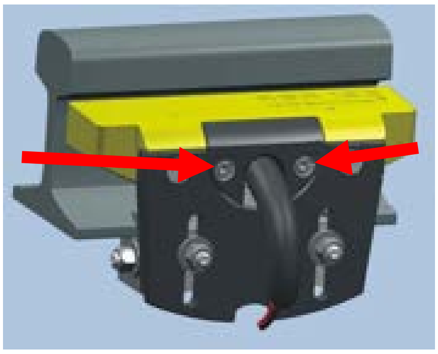


Figure 3 - Allen Screws

b) Figure 4 M10 nuts to 15Nm (Checked during installation/replacement only)

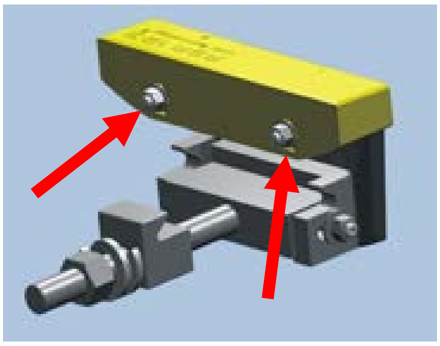


Figure 4 - M10 Nuts

c) Figure 5 M12 nuts to 40Nm.

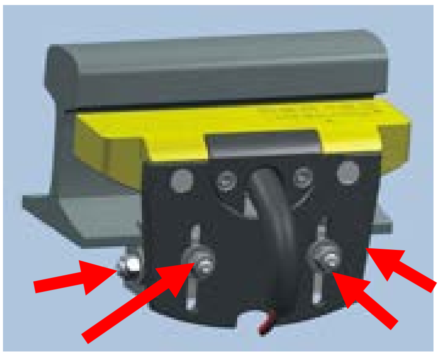
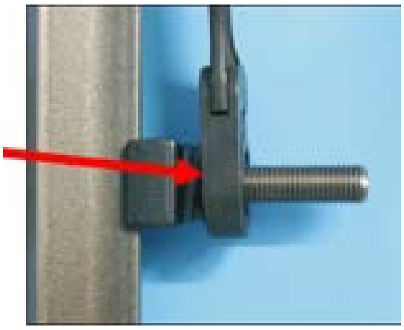


Figure 5 - M12 Nuts

Figure 6 – Rail Claw Nut

d) Figure 6 The Rail claw nut shall be tightened until the ends of the spring washer touch the main body of the washer, at this point the nut shall be tightened a further 360°.



GS04 Rail Claw Only

3.2 The GS04 Rail Claw has GS04 marked in the centre of the mounting plate for identification purposes.

3.3 Check the rail sensor securing nuts are tightened to correct torque values using an approved torque wrench tool see Figure 7 for details.

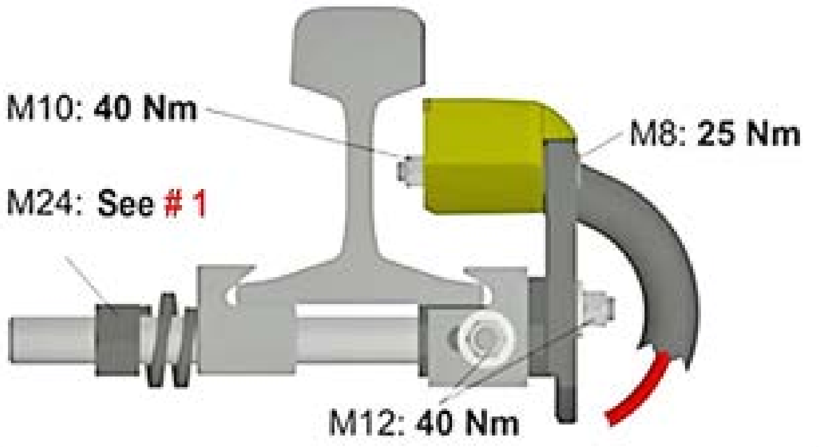


Figure 7 – Rail Claw Torque Values

#1 The rail claw nut shall be tightened until the ends of the spring washer touch the main body of the washer, at this point the nut shall be tightened a further 360°.

END

Includes:	Input / Output Extension Board IO-EXB used for data transmission with DUAL inputs
Excludes:	Input / Output Extension Board configured with QUAD outputs

This check is not necessary if QUAD outputs are used.

This test is required when using the IO-EXB for data transmission.

The responsible designer, who configures the IO-EXB, has to provide information as to whether the check is carried out automatically by the system, or whether the check has to be carried out by the maintenance personnel.

In this case, the designer has to give proper instructions how the check shall be carried out.

SERVICE C

1. Input / Output Extension Board (IO-EXB)

Provide switching states for both of the inputs used as shown in the Table 1.

Input 1	Input 2	Output 1	Output 2
HIGH	HIGH	HIGH	HIGH
LOW	HIGH	LOW	LOW
HIGH	LOW	LOW	LOW
LOW	LOW	LOW	LOW

Table 1 – Input / Output Extension Board (IO-EXB)

Providing of the switching states as described above guarantees that both inputs are operating correctly.

It is also necessary to check each of the two outputs used, to determine whether it is able to enter failsafe state.

END

Includes:	ACM 100 (ACM module and WSD wheel detector)
Excludes:	All other Axle Counter systems

Do not remove the ID-Plug unless faulty or replacing the ACM100 module.

Do not press any buttons on the front of the ACM100 module without permission from the signaller.

Keep switched on mobile phones 3m away from the counting heads whilst undertaking maintenance as they can cause false-counts/readings.

Keep metallic objects at least 20cm away from the counting heads. The movement of metallic objects including tools, steel toe-cap boots and jewellery across the upper surface of the counting heads can cause occupation of the track sections.The wheel detector is very sensitive.

If you have to reset the axle counter, the appropriate resetting procedure with the signaller shall be followed.

All wires of the connecting cable to the wheel detector can be subject to interference voltages. Do not touch live parts. This is particularly to be observed when working on the junction box (attaching wires, performing checks).

SERVICE B

1. Wheel Detector (WSD)

1.1 Examine the WSD, mounting plates and bolts for security and damage.

1.2 Check that the M12 securing nuts are tight (45 Nm) by using the appropriate torque wrench tool with 19mm socket.

1.3 Clean any loose metallic and other deposits from the surface of the WSD.

1.4 Check the area around the rail Wheel Sensor (within 2 m) is free of the following items:

a) P/way defects.
b) New/scrap rails in the four/six foot or cess.
c) Metallic debris.
d) Traction bonds.
e) Ballast in contact with the plastic housing of the wheel sensor.

1.5 Examine all tail cables (protective flexible tubing), connections, and clamps for security and damage. Resecure or replace as required.

1.6 Check that the distance from the top of the rail head and the top surface of the wheel sensor is 45mm (tolerance +0mm/-2mm) using the adjustment gauge as shown in figure 1. If the distance is outside of this tolerance, adjust the height of the wheel sensor to the correct value.

The adjustment gauge shall be placed on the wheel sensor with the green steel plate upper most. Otherwise the track sections might become occupied.

For an accurate measurement, place a straight edge across both the rail head and adjustment gauge.

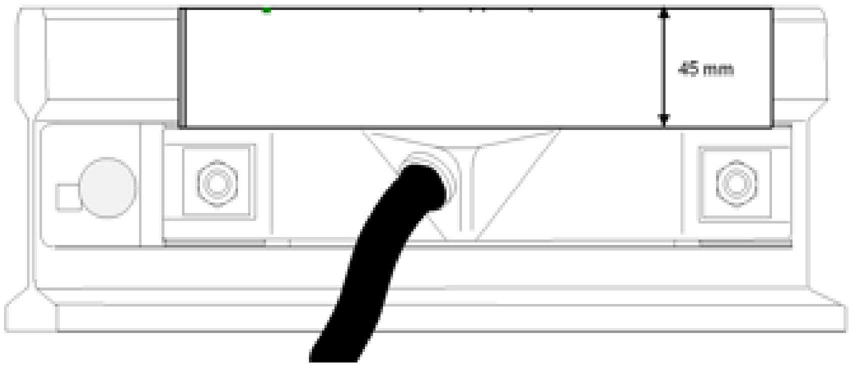


Figure 1 – Gauge position to check the WSD height

1.7 If using a rail clamp rather than rail web mounting, also check the distance from the rail (see figures 2, 3 and 4).

Figure 2 – Too close to the rail

Figure 3 – Too far away from the rail

Figure 4 – Correct position

If the distance is out of this range, adjust the position to the correct distance as shown in Figure 4.

1.8 Recalibrate and test the wheel sensor [Test038]

1.9 If practical, observe the passage of a train across the wheel detector and report any excessive deflection in the rail as corrective maintenance.

Excessive deflection in the rail at the point where the wheel detector is fixed to the rail can cause damage to the wheel detector.

2. ACM Module, PSU, UPS and Ethernet Switch

2.1 Examine the components for damage or signs of moisture ingress. Rectify or report as corrective maintenance.

2.2 Check that all connections to the ACM100 module, PSU, UPS and Ethernet Switch are undamaged and secure.

2.3 Check for RED or flashing LEDs on ACM100, PSU and UPS modules. Refer to NR/SMS/Appendix 13 for LED normal and fault state details. In case of any LED fault indication status, rectify or report as corrective maintenance.

End

Includes:	Siemens - RSE Wheel detector (TETS System Richmond only)
Excludes:	All other types of wheel detector and sensor

Protection / Possession arrangement shall be taken before commencing work on any track sections

System Description

The Siemens Wheel Detector is a switching device which responds to the presence of wheel flanges of passing trains. It is used within the speed control system at Richmond as part of the LUL Trains Entering Terminal Stations system it consists of the following parts:

- A sensing head / tail cable assembly which is mounted to the inside web of one of the rails, known as the RSE Wheel Sensor (Fig 1)
- Disconnection box mounted in the cess, known as the Cable Junction Box.
- An evaluator interface PCB which is installed in the relay room, known as the ARS4.
- A power supply unit.

Fig 1 – RSE Wheel sensor

The rail mounted sensor and its control circuitry are connected via the cable junction box by a single twisted pair, screened cable.

Maintenance equipment

- M13 Ring spanner
- Flat-bladed Screwdriver (large)
- M13 Torque Spanner (range 70-80Nm)
- Adjustable Sliding Set Square
- Multimeter with voltage internal resistance greater than 50Kohms per volt.

SERVICE B

1. RSE Wheel sensor Assembly

1.1 Remove all fire risks, e.g. waste paper, oily rags, etc. from the vicinity of the sensing head and the tail cable.

1.2 Remove any metallic or other conductive debris from the vicinity of the sensing head.

1.3 Check that the sensing head and mountings are clear of the ballast and check that no other obstacles are able to foul the space between the top of the sensing head, and the position of the wheel flanges of passing trains.

1.4 Check that where the tail cable is routed underneath the sensor, that it does / will not get trapped between the sensor and ballast during the passage of traffic.

1.5 Clean the sensing head of dirt and debris particularly any build-up of brake dust or rail swarf with the relevant approved cleaning agent.

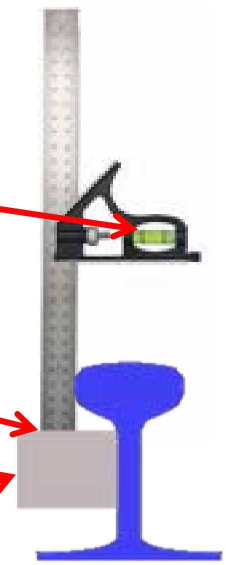
1.6 Examine the sensing head fixings to the rail. Check that they are secure and that there is no evidence of movement/vibration.

1.7 Examine the sensing head for damage (damage can indicate an incorrect height setting of the sensor), Damage, which is assessed as being able to affect the functionality or reliability of the equipment, shall be reported to your SM(S) who shall arrange for the replacement of the sensing head.

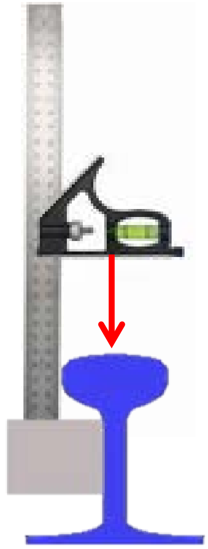
1.8 Check the height setting of the sensing head with the use of an adjustable sliding set square as follows:

> At locations where conductor rails are in use an insulated shield shall be placed over the live rail adjacent to the Sensor head before checking the sensor head height.

- Keeping the bubble level
- Place the end of the rule square down onto the sensing head



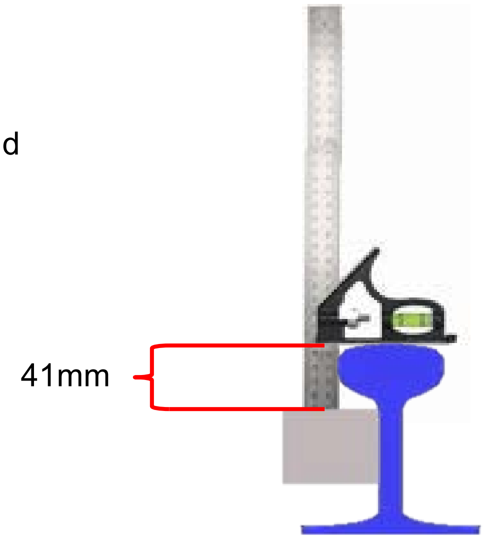
Sensor Head



- Slide the body of the square down onto the rail head.

- Measure the vertical height from the top surface of the sensing head to the top of the rail at both ends of the sensing head

- The sensing head should be positioned parallel to the rail top and the height dimension at either end should be 41mm +/-1mm.



1.9 If the sensor height setting requires adjustment, then this shall be undertaken as follows:

- At the outside web of the rail slacken the two M13 fixing nuts which secure the sensing head to the rail.

- On the sensing head, slacken the two M13 adjusting nuts which secure the sensing head to the circular adjustable cams.

- By using a flat bladed screwdriver into the slots provided on the ends of the adjusting bolts on the sensor, turn the bolts slightly until the sensing head is adjusted to the correct setting.

- If the adjusting bolts (or the fixing bolts) turn continuously in the anti-clockwise direction, without the height setting being changed, then stop.

This means that the bolts are unscrewing from the circular adjusting cams and will eventually come out. To remedy, re-tighten all the bolts .and adjust the sensor height by hand and proceed as follows.

- Tighten all the nuts and recheck the height position at both ends of the sensing head. Adjusting nuts and fixing nuts shall be tightened to a torque of 70-80Nm Where separate locking nuts are used, screw them down by hand and then using a spanner give a further quarter to half turn. Where self-locking nuts are used e.g. Nylocs, or spring/crinkle washers, these shall be replaced with new items when adjustments are made and shall not be used more than once.

1.10 Examine the tail cable and gland to the sensor for general condition and security. Check that the tail cable is routed and secure in order to be clear of the rails and to prevent damage by passing traffic or on-track maintenance machines.

* 1.11 Check the operation of the wheel sensor by placing a metal spanner close to the running edge of the rail above the middle of the sensor head or await the passage of a train over the sensor and check that:

- Either, the current through the sensor measured at the ARS4 board reduces from the undamped value (between 5.5 - 8.0mA) to the damped value (between 0.0 - 1.0mA) and subsequently returns to its previous value upon removal of the switching medium.

- Or, the applicable LED on the ARS4 front panel indicates (by extinguishing / darkening) that the wheel detector has correctly operated.

1.12 Check the condition of the rail at the sensor mounting position for the following:

- Excessive burring of the rail top over onto the running edge of the rail; this can permanently activate the sensor.

- Excessive side wear (max. 15mm) of the running edge, this may allow the wheel flange to pass to the side of the wheel detector and not be detected.

A Permanent Way “053 Gauge” can be used for this purpose

- The condition of the area adjacent to the mounting holes in the rail web for corrosion and cracking.

1.13 Any deficiency shall be reported to the SM(S)

2. Cable Junction Box

2.1 Check the cable junction box for general condition and damage and that all mountings are secure.

2.2 Check that the connecting cables to the junction box are secure and that they are properly supported. Check the security of protective hose cable clips.

2.3 Check the lid fastening and seal arrangement and clean the interior of tl1e junction box. Check the terminations for security and evidence of corrosion and protect if necessary.

2.4 Clean the outside of the cable junction box.

3. ARS 4 Evaluation Unit

The evaluation unit PCB's are static sensitive devices and should be handled accordingly.

3.1 Check the PCB's for general condition and security within the holder. Defects shall be reported to the SM(S) who shall arrange for replacement.

3.2 For each wheel detector controlled by the ARS board measure and record the following checks on the appropriate record card:

- Press the relevant test button (marked T1, T2,T3, T4) and check that the applicable LED (marked L1, L2, L3, L4) on the ARS 4 front panel indicates (by extinguishing/darkening) that the circuitry has tested satisfactorily (see Fig 4b.).

- Press the relevant test button (marked T1, T2, T3, T4) and check the switching of the output voltage (1.5 - 4.5V DC) to the follower relays as the test button is pressed. (See fig 4a).

Channel 1 – Measure the voltage across terminals B2 and B6, then press the test button T1 and measure the voltage across terminals B4 and B6. The voltage seen on the second set of terminals should be same as that on the first set.

Channel 2 - Measure the voltage across terminals Z10 and Z14, then press the test button T2 and measure the voltage across terminals Z12 and Z14. The voltage seen on the second set of terminals should be same as that on the first set.

Channel 3 - Measure the voltage across terminals B18 and B22, then press the test button T3 and measure the voltage across terminals B20 and B22. The voltage seen on the second set of terminals should be same as that on the first set.

Channel 4 - Measure the voltage across terminals Z26 and Z30, then press the test button T4 and measure the voltage across terminals Z28 and Z30. The voltage seen on the second set of terminals should be same as that on the first set.

For details of terminal locations see fig 4a - ARS 4 Terminations.

3.3 Alternatively, if the relevant track circuit can be "dropped', check that the follower relay operates when the relevant test buttons are pressed.

Termination	Points		
B2	Z2		D2
B4	Z4		D4
B6	Z6		D6
B8	Z8		D8
B10	Z10		D10
B12	Z12		D12
B14	Z14		D14
B16	Z16		D16
B18	Z18		D18
B20	Z20		D20
B22	Z22		D22
B24	Z24		D24
B26	Z26		D26
B28	Z28		D28
B30	Z30		D30
B32	Z32		D32

(Termination points are located at the base of the card)

Fig 4a - ARS 4 Terminations

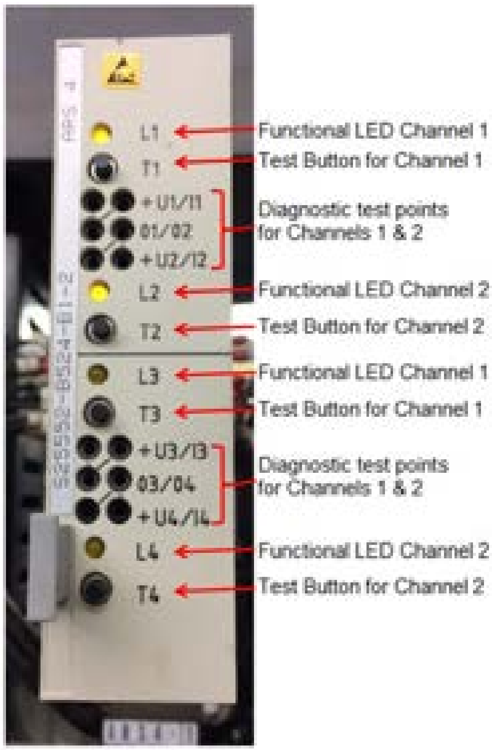


Fig 4b - ARS 4 Front Panel

4. Power Supply

4.1 Dust and examine the power supply unit.

4.2 Examine earth connections checking they are in good working order.

4.3 Examine terminations, clean and protect as necessary.

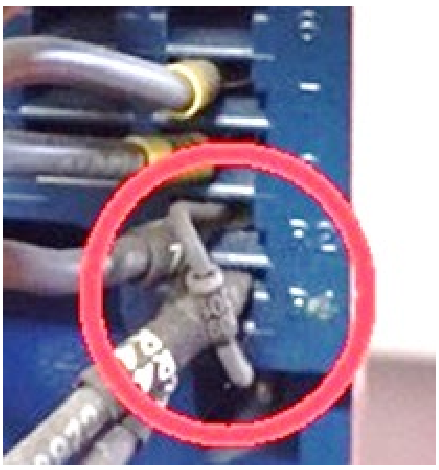
4.4 Examine cable and wiring to the power unit for general condition and for protection along its route.

4.5 Measure the 50VDC (nominal) supply voltage to the evaluation unit (ARS 4).

This should measure between 45-72VDC.

5. Diode

5.1 Check local diagrams to identify any relays fitted with diodes (as shown in the diagram to the right). Visually examine the diode across the interface relay coil to check that it appears to still be connected.



END

Includes:	TASS Balise and Balise Mounting Assembly
Excludes:	Any other type of Balise

A damaged or displaced balise assembly which is affecting the safe passage of trains, or a risk to personnel, shall be removed immediately to a secure location and the Signaller advised.

If the bracket is damaged, then protective gloves shall be worn when removing the item.

Figure 1 - TASS Balise assembly installed using the rapid fixing kit

TASS is an abbreviation for 'Tilt Authorisation and Speed Supervision'. It consists of trainborne equipment and Balises (trackside TASS beacons).

The Balise and Mounting Bracket assembly shall be exchanged for a completely new unit when Balise replacement is required.

Such units shall be assembled in a controlled environment away from the trackside and issued to site as required.

Balises have been manufactured to withstand extreme conditions and the electronics inside are sealed to protect them from the environment, thus improving reliability.

During maintenance visits, if damaged units are found, they are to be removed and returned to the supplier.

Under no circumstances should any type of repair to a Balise and Mounting Bracket assembly be attempted on site.

Replacement of the Mounting Bracket assembly as a component separate from the Balise is permitted if this is necessary to make good any minor damage or to facilitate a change of track fastening type.

There is no need to periodically check the Balise with the Telegram Reading Tool.

A Balise failure affecting the telegram data is identified and protected by the trainborne TASS system and reported by the driver.

SERVICE B

1. Balise Assembly

1.1 Check that the Balise and fastenings are securely positioned.

If the balise is displaced or if fastenings are loose or are becoming loose, report it as corrective maintenance.

1.2 Remove metallic and other debris and combustible material from the proximity of the Balise.

1.3 Remove any ballast that is impacting on the Balise. Especially underneath, to prevent the unit being put under mechanical stress, which can result in cracking or de-lamination?

1.4 Check the 14 character identifier is intact on both the Balise and mounting assembly and that the two identifiers are identical and correct and match the Balise records.

If defaced, illegible or incorrect, report it as corrective maintenance.

1.5 Examine the Balise assembly. If any signs of damage, tampering, or vandalism are visible report it as corrective maintenance

1.6 Examine the Balise connector cover. If missing or any signs of tampering or vandalism report it to your SM(S).

END

Includes:	Ansaldo Eurobalise
Excludes:	TASS Balise and all other Balises

General

There is no requirement to periodically check the Balise with the Telegram Reading Tool if a JRU train download is scheduled. Any issues are identified and recorded by the train borne equipment.

This excludes locally controlled level crossing & Temporary Speed Restriction (TSR) Balises.

This record of failure is also reported via the Radio Block Centre to SAM, as an ERROR.

DAILY SERVICES

1. Messages

1.1 Check SILAM for any Balise "ERROR" messages received from trains during the previous 24 hours or since the last check.

1.2 Where a Balise or Balise group display an ERROR message the actions in Table 1 shall be taken.

Some Balise groups are likely to display ERROR messages routinely due to their positioning in relation to shunting, reversing and terminating moves.

Where this is suspected to be the cause of an ERROR message, inform the SUPERVISOR who shall decide what action is to be taken.

Balise	ERROR	Action
Odometry and Awakening	2 or more messages in any 24-hour period 3 or more failures in any 7-day period 7 or more failures in a 28-day period	Report as a failure of equipment
Text Message Balise Odometry Balise with a Text Message	Single failure to read. *Note: - when a driver fails to receive a message from a Balise he is required to report this failure to the Signaller.*	Inform the Signaller
Stop Balise	A Balise containing stop data is linked to others in the group, should a single Balise fail to be read the train is tripped automatically. If more than one Balise in the group fails, this should be found using the daily service.	The cause of the train being tripped shall be investigated. Inform the Signaller who should report the failure.

Balise	ERROR	Action
Automatic Wheel Diameter Calibration Balise	Packet 4 using M_ERROR to show a “Balise consistency linking” error. (O)	Report as an equipment failure
All Balise Groups	Where errors of more than one Balise group are associated with a particular Engine NID number and all other trains read the Balise correctly	Report the event as an on-board failure to the ICC including details of the location of the Errors, the Engine NID, the Unit or Locomotive Number and the service Headcode.

Table 1 - Balise Group Error Messages

REGULAR TASK

2. JRU download

2.1 Perform a JRU train download for analysis.

SERVICE B

3. Llanbadarn Locally Controlled Level Crossing Balise

3.1 Check with the Balise Programming Tool that each Balise in the group is operating correctly by reading the stored message over the air gap.

END

Includes:	KVB Balise (Contrôle de Vitesse par Balises) Used in Ashford, Kent.
Excludes:	All other types of Balise

GENERAL

Obtain the Signallers permission for work which interferes with the signalling equipment.

Details of the use of the KVB tester can be found in SMS Appendix 23.

SERVICE B

1. REB/Location Case Checks (Switchable Balises Only)

1.1 Check LED indications are correct on both the microprocessor and power supply cards as follows:

a) Green LED on AHT card, normally illuminated, indicates presence of 5V power supply.

b) Green LED on UCS card, normally illuminated, indicates card working correctly.

c) The yellow LED on the UCS card is normally not iluminated unless indicating “presence train “ or initialization under way following a rack re-energisation. In initialization stage is within 30 seconds.

1.2 With the UCS maintenance card connected verify that that no errors are present in the encoder memory record log.

All faults shall be investigated. Details of each fault shall be passed to the SM(S).

Additional information on fault finding can be found in NR/SMTH/Part10/FF26 (Faulting Guide : KVB Balise).

1.3 Erase the “Failure Memory”.

Additional information on the KVB test set can be found in SMS Appendix 23.

2. Trackside

2.1 Check the balise (signal and marker) are in good condition (e.g. no sign of impacts or damage).

2.2 Check that the balise and support plates are securely fixed and free from damage.

2.3 Check distribution boxes are secure, free from damage and water ingress.

2.4 Check ballast clearance under the balise is between 5 and 10cm.

2.5 Remove all debris, fire risks and potential hazards.

2.6 Check the BCB encoding plug (fixed signal balise) or the cable plug coupler (switchable signal balise) is securely fixed and free from damage.

2.7 Carry out NR SMS/PartB Test 209 Section 1 – Balise Test.

2.8 Carry out NR SMS/PartB Test 209 Section 2 – Presense Train Test

PERIODIC TASK

3. Replace BCC Plug

3.1 Swap the in service BCC plug of the encoder rack with a correctly coded replacement.

This task shall be carried out using NR/SMTH/Part04/BA13 – Replace a KVB Encoding Plug.

3.2 With the UCS maintenance card connected verify that that no errors are present in the encoder memory record log.

All faults shall be investigated. Details of each fault shall be passed to the SM(S).

Additional information on fault finding can be found in NR/SMTH/Part10/FF26 (Faulting Guide : KVB Balise).

END

Includes:	All Swing Bridges listed in the table
Excludes:	Banavie (Canal) See BR12

GENERAL

The Signal Engineer is responsible for the Signallers panel. This incorporates controls and indications for the Bridge operation. The signalling interlocking also has inputs and outputs to and from the Bridge control gear. There is always some control and indication circuitry that involves both plant and signalling responsibility and a suitable boundary point for those circuits will have been agreed.

Swing Bridges are located at:

Goole	Swing
Hull River	Swing Bridge
Keadby (Canal)	Draw Bridge
Keadby (River)	-
Selby	Swing Bridge
Oulton Broad	Swing Bridge
Reedham (River)	Swing Bridge
Somerleyton (River)	Swing Bridge

Keadby (River) Bridge is also known as King George V Bridge, Althorpe. This used to be a drawbridge but is now permanently fixed. While there is no rail alignment detection at this bridge, the Signal Engineer is responsible for the navigation lights which are light proved and indicated in Keadby Gate Box. At all other bridges, the navigation lights are a plant responsibility.

Signallers of Swing bridges have the following indications of the state of the bridges:

GREEN: Bridge Home, Bridge Bolts in, Rail Alignment Detected.
YELLOW: Bridge Home, Bridge bolts in, but no Rail Alignment Detection.
RED: Bridge Not Home (Bridge Open).

The Rail alignment Detection is proved in all signals leading over the bridge. It is more sensitive than the bridge bolts and there might be cases where the bridge bolts can go home but Rail Alignment cannot be obtained. Where rail alignment detection cannot be obtained, but the Plant Engineers bolts have been detected home, a yellow indication is given to the Signaller. Local instructions generally allow trains to pass over the bridge at low speed after cautioning.

Oulton Broad, Reedham (River), Somerleyton (River) have “Spagnoletti needle” indicators in the Signal box/cabin (see Appendix B).

SERVICE A

1. Point Machine and Fittings

1.1 Carry out maintenance to the point machine driving the rail Alignment Detection in accordance with the relevant NR/SMS/PartC/PCxx series Service A, for hydraulic machines use NR/SMS/PartC/PB11 Service A. Also see NR/SMS/PartC/PA01 & NR/SMS/PartC/PF02 for the rodding and cranks.

2. Rail Alignment Detectors

(Goole, Keadby Canal, Hull & Selby) - refer to Appendix A.

(Oulton Broad, Reedham, & Somerleyton) - refer to Appendix B.

2.1 With the detector blade normal, gauge the tolerance between each side of the blade and inner faces of the detector block, the total of which shall not be more than 8mm (5/16”), if a limit switch is provided or 12mm (1/2”) without.

2.2 Gauge the blade width to confirm wear is not taking place on the blade. The width shall be 25mm (1”) (Goole, Keadby Canal, Hull, & Selby)or 70mm (2 3/4”) (Oulton Broad, Reedham & Somerleyton), the acceptable tolerance being 3mm (1/8”). If these tolerances are exceeded advise your SM(S) as the blade requires replacing.

2.3 Gauge rail ends with a straight edge, measure any misalignment and record.

2.4 Where provided, measure the distance between the limit switch operating arm roller (at the point of contact with the detector blade) to the unoperated central position:

If these measurements are not within ± 4mm (5/32”) then the roller has worn excessively below its normal 19mm (3/4”) diameter and the lever arm shall be renewed.

If subsequently the settings above are not obtainable the complete switch and existing arm shall be replaced.

2.5 With the detector plunger reversed (withdrawn) check that the limit switch operating lever (if fitted) has self-restored to the un-operated centre position at 90° to the plane of the detector blade (0° to the switch).

2.6 If fitted, examine limit switch contact assembly, special attention being given to the moving contact tension springs. Excessive wear of the contact requires the fixed and moving contacts to be replaced with new assemblies.

2.7 If a limit switch is fitted, operate lever arm with the detector blade and observe the contact assembly for correct operation and engagement of the lever arm in the blade bevel. Confirm that the roller rotates.

2.8 Examine terminations clean and protect as necessary.

2.9 Examine cables to limit switches and confirm they are not chafing at gland entries.

2.10 Lightly lubricate moving parts and bearings of limit switch (if fitted) with mineral oil. Confirm correct tension is available upon the operating lever whilst observing the operation, by hand, of the mechanical linkage.

2.11 Test for correct operation of 'IN' and 'OUT' indications by operation from the cabin. The 'coarse' normal and reverse proving of the blade shall make within 12mm (1/2") of the end of the travel. The blade shall not be withdrawn to a position further than flush with the detector side edge of the first guide block on the adjacent bridge mounting.

2.12 Apply lithium-based grease to grease nipples and detection plunger.

2.13 Apply mineral oil to stud connections, screw threads, and lid fixing screws.

2.14 Repeat 2.1 to 2.13 for all remaining detectors.

2.15 Test by operation from bridge cabin or signal box.

3. Bridge Indications

(Goole, Keadby Canal, Hull, Selby Oulton Broad, Reedham & Somerleyton).

3.1 In the Signal box, if practical, observe the Bridge indications through a complete opening and closing cycle of the bridge. If it is not practical to observe a complete cycle, then function test the rail alignment detection and check that the signalling interlocking releases and subsequently locks the bridge operating controls and the indications for those parts of the cycle are correctly displayed.

3.2 The Anglia bridges have an indication "bridge home". In addition to 3.1 examine the brass rod, internal contacts and springs on the bridge and check they are operating correctly. Clean as necessary.

4. Navigation Lights

(**Keadby River Bridge Only)**

4.1 Test operation of lamp proving by making a disconnection. Check Signal Box receives "light out" alarms and correct indications.

SERVICE B

5. Point Machines and Fittings

Carry out maintenance to the point machine driving the rail Alignment Detection in accordance with the relevant NR/SMS/PartC/PCxx series Service B, for hydraulic machines use NR/SMS/PartC/PB11 Service B. Also see NR/SMS/PartC/PA01 & NR/SMS/PartC/PF02 for the rodding and cranks.

6. Wedges

(Goole, Hull & Selby Oulton Broad, Reedham & Somerleyton Only)

6.1 Function Test the operation of each limit switch on the bridge by monitoring with an AVO meter on the limit switch circuit while the bridge is operated.

6.2 If any adjustment, repair, or renewal of a limit switch is required it shall always be done in conjunction with the E&P Engineer.

7. Emergency Release

7.1 Where provided, test operation of emergency release and key token pilot working facilities.

8. Electrical Disengager (Goole only)

Electrical Disengagers are unique to Goole Swing Bridge. They are large plug and socket connectors mounted on the open edge of the bridge carrying the Signalling controls and indications to adjacent signals and signal boxes. They are required to disengage and separate before the bridge can move.

When the Disengagers separate, electrical power is maintained on the bridge by a UPS that is provided by the E&P Engineer.

8.1 Wipe and examine disengager and mechanical connections.

8.2 Examine bearings, turned pins and spilt pins in disengager mechanical connections for excessive wear or slackness.

8.3 Examine cables and confirm that they are not chafing, especially at gland entry.

8.4 Clean and examine individual contact pins.

8.5 Lubricate with contact fluid.

8.6 Apply mineral oil sparingly to disengager guide pins, disengager slides and mechanical connections. Remove any surplus.

8.7 Apply lithium-based grease to grease nipples.

8.8 Test Disengagers from the Signal box for correct operation.

9. Overhead Cable Route

9.1 Examine suspender fastenings as necessary.

9.2 Lubricate centre pin and shackles on swing span termination with mineral oil.

9.3 Examine cable sheath for signs of chafing.

APPENDIX A - Goole, Keadby Canal, Hull & Selby

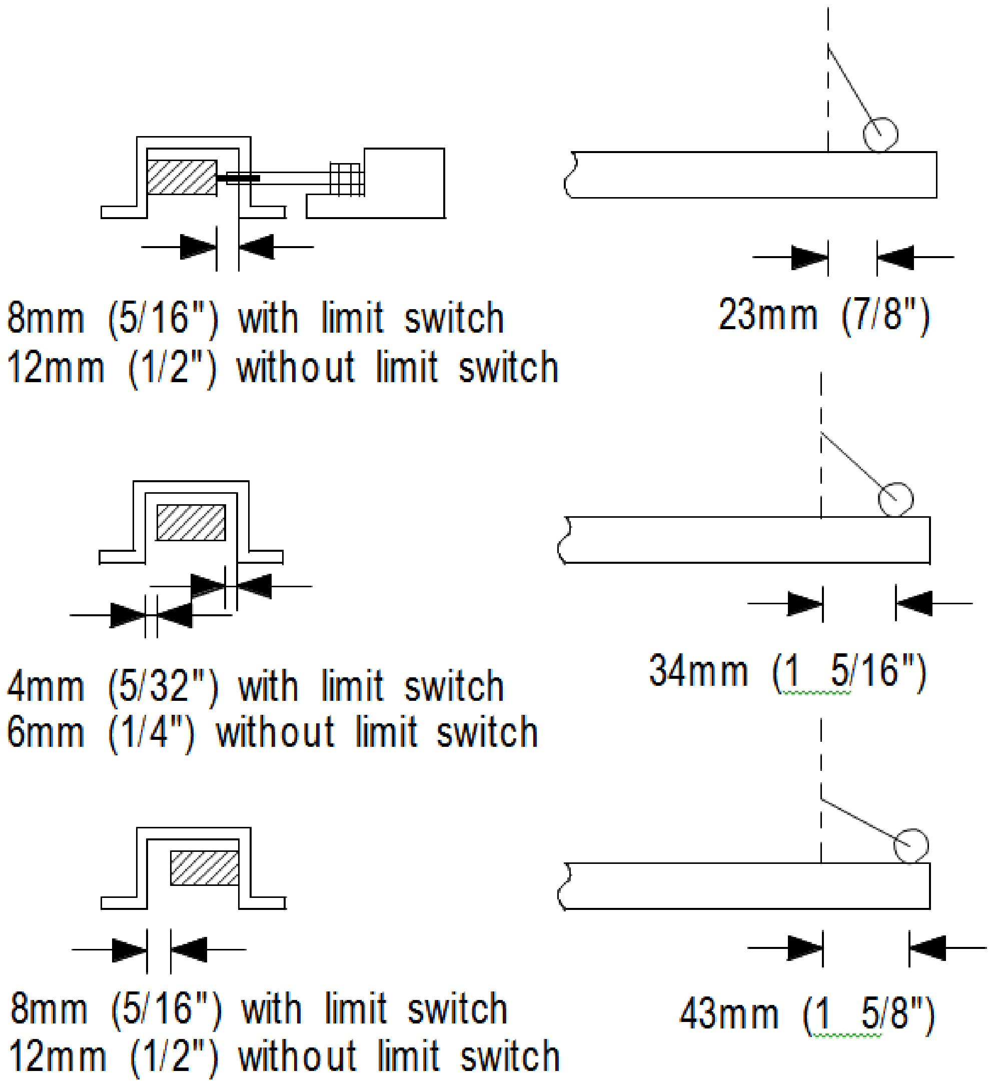


Figure 1 – Limit Switch Measurments

APPENDIX B - Oulton Broad, Reedham, & Somerleyton

Figure 2 – Typical Indications

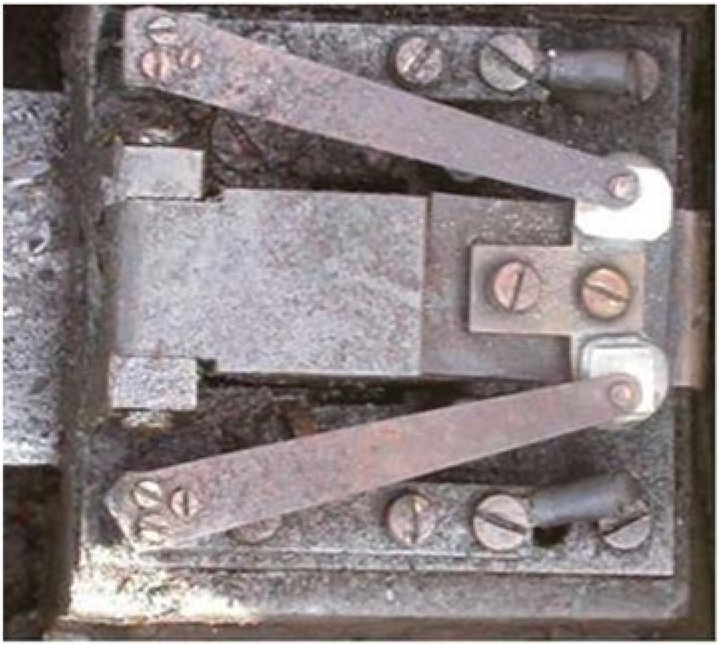


Figure 3 – Bridge Bold Detection

END

Includes:	Banavie (Canal) Swing Bridge
Excludes:	All Other Swing Bridges

GENERAL

The Signal Engineer is responsible for the Signallers panel. This incorporates controls and indications for the Bridge operation. The signalling interlocking also has inputs and outputs to and from the Bridge control gear. There is always some control and indication circuitry that involves both plant and signalling responsibility and a suitable boundary point for those circuits will have been agreed.

Signallers of Swing bridges have the following indications of the state of the bridges:

GREEN:	Bridge Home, Bridge Bolts in, Rail Alignment Detected.
YELLOW:	Bridge Home, Bridge Bolts in, but no Rail Alignment Detection.
RED:	Bridge Not Home (Bridge Open).

The Rail alignment Detection is proved in all signals leading over the bridge. It is more sensitive than the bridge bolts and there may be cases where the bridge bolts can go home but Rail Alignment cannot be obtained.

Where rail alignment detection cannot be obtained, but the Plant Engineers bolts have been detected home, a yellow indication is given to the Signaller. Local instructions generally allow trains to pass over the bridge at low speed after cautioning.

SERVICE A

1. Point Machine and Fittings

1.1 Carry out maintenance to the point machine driving the rail Alignment Detection in accordance with the relevant NR/SMS/PCxx series Service A, for hydraulic machines use NR/SMS/PB11 Service A.

1.2 Carry out NR/SMS/PA01 & PF02 for the rodding and cranks

1.3 Carry out NR/SMS/LV31 for the circuit controllers.

2. Rail Alignment Detectors

Refer to Appendix A

2.1 With the detector blade normal, gauge the tolerance between each side of the blade and inner faces of the detector block, the total of which shall not be more than 8mm (5/16”), if a limit switch is provided or 12mm (1/2”) without.

2.2 Gauge the blade width to confirm wear is not taking place on the blade. If these tolerances are exceeded advise your SM(S) as the blade requires replacing.

2.3 Gauge rail ends with a straight edge, measure any misalignment and record.

2.4 Where provided, measure the distance between the limit switch operating arm roller (at the point of contact with the detector blade) to the unoperated central position:

If these measurements are not within ± 4mm (5/32”) then the roller has worn excessively below its normal 19mm (3/4”) diameter and the lever arm shall be renewed.

If subsequently the settings above are not obtainable the complete switch and existing arm shall be replaced.

2.5 With the detector plunger reversed (withdrawn) check that the limit switch operating lever (if fitted) has self-restored to the un-operated centre position at 90° to the plane of the detector blade (0° to the switch).

2.6 If fitted, examine limit switch contact assembly, special attention being given to the moving contact tension springs. Excessive wear of the contact requires the fixed and moving contacts to be replaced with new assemblies.

2.7 If a limit switch is fitted, operate lever arm with the detector blade and observe the contact assembly for correct operation and engagement of the lever arm in the blade bevel. Confirm that the roller rotates.

2.8 Examine terminations clean and protect as necessary.

2.9 Examine cables to limit switches and confirm they are not chafing at gland entries.

2.10 Lightly lubricate moving parts and bearings of limit switch (if fitted) with mineral oil. Confirm correct tension is available upon the operating lever whilst observing the operation, by hand, of the mechanical linkage.

2.11 Test for correct operation of ‘IN’ and ‘OUT’ indications by operation from the cabin. The ‘coarse’ normal and reverse proving of the blade shall make within 12mm (1/2”) of the end of the travel. The blade shall not be withdrawn to a position further than flush with the detector side edge of the first guide block on the adjacent bridge mounting.

2.12 Apply lithium-based grease to grease nipples and detection plunger.

2.13 Apply mineral oil to stud connections, screw threads, and lid fixing screws.

2.14 Repeat 2.1 to 2.13 for all remaining detectors.

2.15 Test by operation from bridge cabin or signal box.

3. Bridge Indications

3.1 In the Signal box, if practical, observe the Bridge indications through a complete opening and closing cycle of the bridge. If it is not practical to observe a complete cycle, then function test the Rail Alignment detection and check that the signalling interlocking releases and subsequently locks the bridge operating controls and the indications for those parts of the cycle are correctly displayed.

SERVICE B

4. Point Machines and Fittings

4.1 Carry out maintenance to the point machine driving the rail Alignment Detection in accordance with the relevant NR/SMS/PartC/PCxx series Service B, for hydraulic machines use NR/SMS/PartC/PB11 Service B.

4.2 Carry out NR/SMS/PartC/PA01 & NR/SMS/PartC/PF02 for the rodding and cranks.

4.3 Carry out NR/SMS/PartC/LV31 for the circuit controllers.

5. Overhead Cable Route

5.1 Examine suspender fastenings as necessary.

5.2 Lubricate centre pin and shackles on swing span termination with mineral oil.

5.3 Examine cable sheath for signs of chafing.

APPENDIX A - Rail Alignment Detector Tolerances

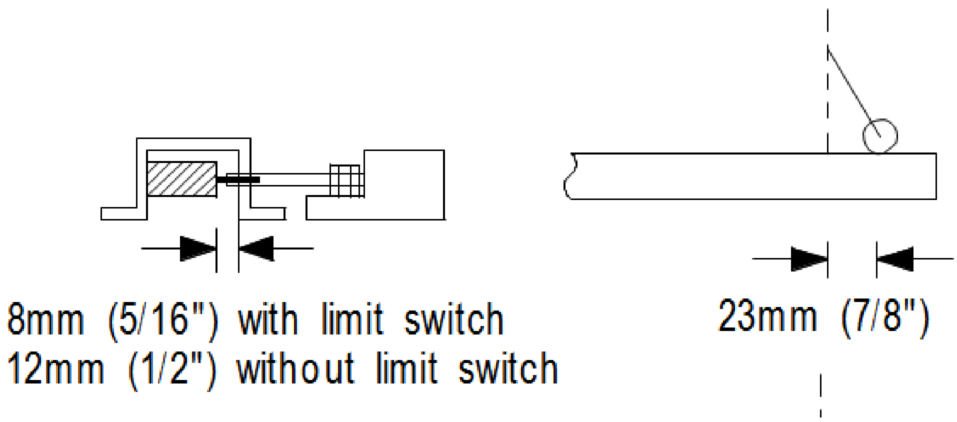


Figure 1 – Rail Alignment Detector Tolerances

END

Includes:	Keadby - King George IV Bridge
Excludes:	All other Navigation Lights (Lanterns)

GENERAL

The Navigation lights are manufactured by Pelangi, Part No PA2835 DRG PL2212 Assembly.

All Navigation lights are LED lanterns manufactured by Pelangi Type No PL83.

There are eight lanterns on the bridge:

There are six duplicated LED units on (NE)Red, (NC)Green, (NW)Yellow, (SE)Red, (SC)Green, (SW)Yellow [all with “TOP” and “BOTTOM” lanterns], and two single LED units for (NORTH)Yellow, (SOUTH)Yellow navigation lanterns.

SERVICE B

1.1 Check that the light unit is undamaged, secured to the bridge structure and correctly aligned.

1.2 Examine the tail cable and cable entry glands.

1.3 Examine the internal wiring and terminations. Protect as necessary inclusive of disconnection boxes.

1.4 Check that all the LED’s are lit and visually check the quality of the aspect corresponds to the diagrams.

1.5 Record all LED voltages at the corresponding disconnection boxes NR/SMS/PartR/T021/RC05 (Signal – LED).

1.6 Clean the exterior of the LED light units.

1.7 Disconnect each LED in the control case and check the corresponding LED extinguishes and the NAV LIGHTS ECR de-energises check the functionality of the NAV LIGHTS EK with monitoring SB, repeat all other LED’s (Due to the restricted access on the bridge it is acceptable to disconnect the individual LED’s in the signalling location).

END

Includes:	Main Air Systems
Excludes:	All other Air Systems

The air main pump is the responsibility of the Plant Engineer and falls within the scope of the legislation on pressure vessel testing. Staff required to work on this equipment shall be specially authorised.

Air mains for point operation typically operate at 60 psi (Bar 4.14). Care should be taken when connecting or adjusting sections of pipe / hose.

The air main for the section concerned shall be isolated before replacement parts are fitted.

SERVICE A

1. External

1.1 Inspect the visible air main throughout the full length, including cross track routes and connections.

a) Check pipes, joints, supports and fixings.

b) Remove, where practicable, fire risks, physical obstructions.

c) Check cover plates and air main protection. Repair leaks where practicable (e.g. tighten joints).

1.2 Report outstanding defects as corrective maintenance, e.g.

a) Subsidence, collapses.

b) Outstanding leaks.

c) Mechanical damage.

1.3 Release fluid contaminants using the air main bleed point (where provided).

END

SERVICE A

1. Primary Cells (if Fitted)

Carry out NR/SMS/PartB/Test/058 (Primary Cell Test).

Continually loaded cells should be replaced if their obtained readings indicate they can fail before the next maintenance visit. See NR/SMS/PartC/EL00 (Electrical Equipment – General).

1.1 Check the number of cells is correct.

2. Secondary Cells (if Fitted)

NOTE: *This service is not required if the batteries are "Maintenance Free"*

2.1 Clean and examine all exteriors and cases.

2.2 Check the level of electrolyte - top up with distilled/ionised water as necessary.

NOTE: *This task should be completed after Clause 4.1 if being done together with a SERVICE B.*

SERVICE B

3. Batteries & Cells – General (Includes "Maintenance Free" Batteries)

3.1 Check warning signs (e.g., No Smoking) and P.P.E. signs (Goggles, Gloves etc).

3.2 Clean and examine batteries, cells, straps and terminations (use insulated box spanner).

3.3 Protect terminations as necessary.

Arrange for defective cells to be replaced. If a cell in a crate is found to be faulty, replace the whole crate.

4. Lead Acid Cells (If Fitted)

4.1 Test the specific gravity on each cell is a minimum of 1.220.

Specific gravity measurements are to be taken before any top up of the cell with distilled water, as this could give a false reading.

Readings below this value can indicate that the cell is reaching the end of its life and should be reported to your SM(S).

5. Secondary Cells

5.1 Check that there is enough ventilation over the top of the cells.

5.2 Check that the correct number and type of cells along with the correct charger are fitted according to the diagram.

Changes might have been made during corrective maintenance. More details are in NR/SMS/PartC/EL00 (Electrical Equipment – General).

5.3 Carry out NR/SMS/PartB/Test/055 (Secondary Cell Test).

6. Final Checks

6.1 Before leaving site, check that covers, doors and locks are properly fitted and secure.

END

Includes:	TEML41, when configured as Remote Control System, Panel Multiplexer, Train Describer, Fault Reporting System or Network Interface Processor Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other TEML 41 configurations and Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

NOTE: *DC voltages can still be present on internal and external connections with the 110v supply turned off.*

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

Remote Control System

The Remote Control System is typically is made up of 4 sub-systems:

- Remote Interlocking Indications Processor (RIIP).
- Remote Interlocking Controls Processor (RICP).
- Panel Processor (PP).
- Signal Controls Processor (SCP).

The RIIP and RICP are located at the field (Interlocking), and the PP and SCP (Office) at the Control Centre.

The SCP send controls to the RICP, the RIIP sends indications to the PP. The PP also send indications to the SCP and Train Describer.

Panel Multiplexer (PMUX)

A PMUX forms the interface between Signaller’s controls and an SSI interlocking.

Train Describer (TD)

A TD provides the Signaller with train identification information and passes this information to interested systems (SMART and other TD’s).

Fault Reporting System (FRS)

An FRS provides centralised fault reporting for a number of systems.

Network Interface Processor (NIP)

A NIP provides the interface between a Train Describer and an Automatic Routing System (ARS).

Power Supplies

Most power supplies are duplicated, and when in normal service perform 'Power Sharing'. The power supplies are 'diode fed' to parallel them together.

This is achieved on the back plane for the 5V logic and communications supplies, and on the distribution blocks for the Input/Output supplies.

To correctly test the power supply levels, only one supply shall be turned on when testing the voltage level, this also makes sure that a single power supply can operate the system if one of a duplicated pair fail.

Voltage tests shall be carried out on the Backplane for 5v levels and distribution blocks for Input/Output supplies.

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Power Supplies

7.1 For systems with A and B supplies measure the DC output from each PSU unit, if the measured voltage is out of tolerance it shall be adjusted or replaced.

Supply	Volts	Limits	Ripple	Test Point	Systems
Logic 'A'	+5V	5.1V to 5.25V	< 50mV	5V1 and 0V1	ALL
Logic 'B'	+5V	5.1V to 5.25V	< 50mV	5v2 and 0V2	ALL
Comms 'A'	+5V	5.1V to 5.25V	< 50mV	5CB1 and 0V1	ALL
Comms 'B'	+5V	5.1V to 5.25V	< 50mV	5CB2 and 0V2	ALL
Alarm 'A'	+24V	23.5V to 24.5V	< 50mV	Alarm Common Terminals	ALL
Alarm 'B'	+24V	23.5V to 24.5V	< 50mV	Alarm Common Terminals	ALL

Supply	Volts	Limits	Ripple	Test Point	Systems
Input ‘A’	+24V	23.5V to 24.5V	< 50mV	Input Common Terminals	RIIP, PP, SCP, FRS
Input ‘B’	+24V	23.5V to 24.5V	< 50mV	Input Common Terminals	RIIP, PP, SCP, FRS
Output ‘A’	+12V	11.5V to 12.5V	< 50mV	Output Common Terminals	SCP & PP
Output ‘B’	+12V	11.5V to 12.5V	< 50mV	Output Common Terminals	SCP & PP
Output ‘A’	+50V	11.5V to 12.5V	< 50mV	Output Common Terminals	RICP
Output ‘B’	+50V	11.5V to 12.5V	< 50mV	Output Common Terminals	RICP
Modem ‘A’	-5V	-5.1V to -5.25V	<50mV	-5CB1 and 0V1	RIIP, RICP, PP, SCP, TD
Modem ‘B’	-5V	-5.1V to -5.25V	<50mV	-5CB2 and 0V1	RIIP, RICP, PP, SCP,TD

Table 1 – Voltage Limits

8. Fault Terminal

For systems with an FRS:

8.1 Enter ‘PFLTS’ <RTN> and investigate any reported faults. Also look at the FRSPC fault history and assess any ‘recurring’ faults.

For systems with dedicated fault terminals:

8.2 Enter ‘PFLTS’ <RTN> on each Technicians Terminal and investigate any reported faults.

9. General Observations

9.1 Check the Processor ‘Active’ LED has a discernible ‘flicker’.

9.2 Check the Active Communications channels Red/Green LED’s active during message transmission.

9.3 Check the Status Card ‘Flash’ LED pulsing 1sec on, 1 sec off.

10. Final

10.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

10.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

11. Equipment Cubicles

11.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

12. Control and Interface Equipment

12.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

12.2 If provided, disconnect and clean all keyboards as necessary.

12.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

12.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

12.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

12.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

13. System Change – Over

This test shall be carried out during ‘Engineering’ hours.

13.1 Ascertain which system is ‘Master’ by looking at the Status Card.

13.2 Turn the changeover key towards the ‘Slave’ indication on the status card.

13.3 Verify the system is fully operational (Communications, Input and Outputs).

13.4 Check that No Faults are reported on FRS or connected Technicians Terminal.

14. Line Protection and Route Selection

14.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

14.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

15. Spares

15.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

15.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

16. Final

16.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

16.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications

System Status Panel (RIIP, RICP, PP, SCP)		
LED	**Normal State**	**Failed State**
SPA Fail	Extinguished	System Processor 'A' Failed
SPB Fail	Extinguished	System Processor 'B' Failed
Comms A Fail	Extinguished	Communications channel 'A' failed between Interlocking and Control Centre
Comms B Fail	Extinguished	Communications channel 'B' failed between Interlocking and Control Centre
TEML41 Fault	Extinguished	System Fault – See Technicians Terminal or FRS

Table 2 - System Status Panel (RIIP, RICP, PP, SCP) Indications

System Status Panel (FRS)		
LED	**Normal State**	**Failed State**
SPA Fail	Extinguished	System Processor 'A' Failed
SPB Fail	Extinguished	System Processor 'B' Failed
Comms A Fail	Extinguished	Communications channel 'A' failed between FRS and FRS PC
Comms B Fail	Extinguished	Communications channel 'B' failed between FRS and FRS PC
TEML41 Fault	Extinguished	System Fault – See Technicians Terminal or FRS

Table 3 - System Status Panel (FRS) Indications

System Status Panel (PMUX, TD, NIP)		
LED	**Normal State**	**Failed State**
SPA Fail	Extinguished	System Processor 'A' Failed
SPB Fail	Extinguished	System Processor 'B' Failed
TEML41 Fault	Extinguished	System Fault – See Technicians Terminal or FRS

Table 4 - System Status Panel (PMUX, TD, NIP) Indications

END

Includes:	DM11 systems configured as a TDM remote control system or a panel / train describer multiplexer. Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

A remote-control system involves the transmission of data between locations called office and field.

An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications.

A panel/train describer multiplexer forms either the interface between the Signaller’s controls and a SSI interlocking or an interface between a relay interlocking and a train describer.

The DM11 in either TDM or PMUX/TDMUX configurations consists of a 38U high cubicle incorporating a 6U high TDM or PMUX/TDMUX rack, dual auxiliary AC to DC power units and internal cabling.

The processor modules operate in a control and standby configuration, the changeover and alarm unit that is either on the Signaller’s panel or in the cubicle controls this.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians’ terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. DM11 Cubicle (TDM & PMUX/TDMUX)

10.1 In liaison with the Signaller, force a changeover to the standby processor using the switch on the changeover and alarm panel.

a) Check that the standby processor is now in control and the previous control processor is in standby by observing the ‘Sel’ LEDs on the 68P processor modules.

b) Return the changeover switch to the middle (Auto) position on systems that have an automatic changeover facility.

10.2 Check that any alarms raised have been cleared and no faults have been introduced to the system.

a) LED indications shall be as in Appendix B (Table 2).

b) The audible alarm needs to be acknowledged by means of the acknowledgement switch on the changeover panel.

10.3 Measure using a meter and/or oscilloscope the following DC voltages and AC ripple on the 6PP power supply test points as detailed in the Table 1 below:

Supply	Volts	Limits	Ripple
Logic	5V	4.7V to 5.5V	<50mV
Logic	7V	6.5V to 7.5V	<50mV
Interface	12V	11.5V to 12.5V	<50mV

Table 1 - DC Voltages

10.4 Plug a Technicians terminal or laptop PC into the engineering port of the processor module (Port A) and check the external channel ‘ack’, ’nak’ and ‘no-response’ counts using the PCCZ (Print Channel Count & Zero) command.

a) Check that the sum of the ‘nak’ and ‘no-response’ counts is less than 10% of the ‘ack’ count.

b) If the count is greater, this could be an indication of a problem on the telecoms line. A note should be made of this so that trends can be analysed.

11. DM11 Cubicle (TDM Only)

11.1 Measure using a meter the modem Tx and Rx levels: -35dBm.

a) Check the obtained level against those previously obtained.

Investigate any significant variations.

11.2 Check that the spare program proms and database disks are available and current for all the systems.

11.3 Measure using an oscilloscope the 48V DC output to the TDM power supplies.

11.4 Check that the obtained waveform is as in Appendix A (Figure 1). If the lower limit of the waveform is less than 38V, replace the PSU.

12. Line Protection and Route Selection

12.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

12.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

13. Spares

13.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

13.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

14. Final

14.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

14.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - Waveform

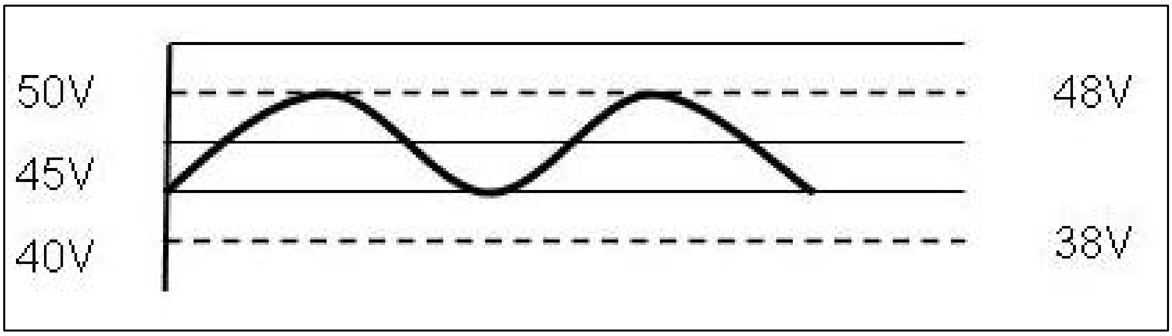


Figure 1 - Waveform Example of PSU Output

APPENDIX B - LED Indications

Indication	Location	State
Interface	6PP Power Supplies	Illuminated
Logic		
Watchdog 'WD'	68P Processor Modules	Illuminated
Available 'Av'		
Selected 'Sel'	68P Processor Modules	Illuminated (Controlling processor)
		Extinguished (Standby Processor)
Scan (x2)	6SI Configured I/PModules	Flashing
Scan	6S0 Configured O/P modules	Flashing (Controlside)
		Extinguished (Standby side)

Table 2 - LED Indications

END

Includes:	Delphin 1024 and 256 systems configured as a remote control TDM system (RC/TDM), a panel and interlocking interface unit (PIIU), a panel multiplexer (PMUX), a crossing interface processor (XIP), or a train describer multiplexer (TDMUX), Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

System Configurations

The remote-control time division multiplexer (RC/TDM) system is used in applications requiring a one to one relationship between inputs and outputs at each end of the system.

The panel and interlocking interface unit (PIIU) is used in applications that require indications meshing and/or route ring processing between a control centre and an interlocking.

The panel multiplexer (PMUX) system forms the interface between the Signaller's controls and an SSI interlocking.

The crossing interface processor (XIP) forms the interface between level crossing controls/indications and the computer based interlocking driving the level crossing control relays.

The train describer multiplexer (TDMUX) system forms the interface between an interlocking and a train describer.

Always check you know the configuration of the Delphin 1024 system you are working on, see the notes on system types in NR/SMS/PartC/IC00 (VDU Based Control Systems General) & NR/SMS/PartC/SB00 (Signal Box Control & Operating Systems General).

Not all of the tests in this SMS can be relevant for each system configuration therefore only the tasks relevant to system configuration should be undertaken. If you are in doubt, ask your SM(S).

Delphin 1024

The Delphin 1024 system consists of an 8U high EMC sub rack incorporating a 6U high euro rack.

Each controller crate is fitted with dual power supplies and processor modules (CMP-A/B) that can access/scan common input modules, (CMI) and common output modules (CMO).

On the RC/TDM and PIIU configurations each processor module is fitted with a serial link to communicate with its corresponding field/office counterpart.

The processor modules operate in a control and standby configuration, the changeover and alarm module (CCO-A /CCO-B) controls this.

The CCO-A/CCO- B provides both an automatic and manual changeover along with (where implemented) an equipment fault alarm (EFA).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians’ terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians’ Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Visual Checks

In cases where a single PIIU is used as an interface between a Crossing Control Panel or a Mimic Control Panel and a Modular Control System (MCS), carry out task 7.1 to 7.10 and 9.

However, in cases where two PIIUs are used as an interface between a Control Panel and an interlocking, follow tasks 8.1 to 8.9 and 9.

For system indications refer to Appendix A.

7.1 Check that the interface and logic indication LEDs on the CPW power are lit.

7.2 Check that all module power (Pwr) indication LEDs are lit. This should be checked for all of the following modules:

a) CMP-P1.

b) CCO.

c) CMM-A.

d) CMI.

e) CMO.

7.3 Where fitted, check that the power LEDs on the modems is lit.

7.4 Where fitted, check that the DCD LEDs on the modems are lit.

7.5 Check that the Watchdog (WD) LED is flashing and Available (Av) LED is lit on both CMP-P1 modules.

One of these modules shall be selected as being in control and this can be indicated by the ‘Sel’ LED being lit on the selected module.

7.6 For PIIUs with a field end, check that the same CMP-P1 module is in control at both the office and the field. (Field/Office PIIU only).

7.7 Check that both the scan LEDs are lit on all configured input modules.

7.8 Check that the scan LED representing the CMP-P1 selected as being in control is either on or flashing on the configured CMO modules. Note: either state is acceptable, both scan LEDs off is not.

7.9 Check that the power LED’s are lit for any other external power supplies where these have been supplied.

7.10 Where fitted, check status of surge protector units and take action as follows:

a) Green lit only – Full protection – No action.

b) Green and Red lit – Reduced protection – Replace unit within one week.

c) Red lit only – No protection – Replace unit immediately.

7.11 Where modems are fitted, plug a Technician’s terminal or laptop into the engineering port of the ‘online’ processor module (RS232C Port ‘A’ on the front of the CMP-P1) running ‘monitor’ program, or run hyper terminal set-up to 4800baud, no parity, 8 data bits and 1 stop bit.

7.12 Check the external ‘ack’, ‘nak’ and ‘no response’ counts using the PCCZ (Print Channel Count and Zero) command.

7.13 Check that the sum of the ‘nak’ and ‘no response’ counts is less than 10% of the ‘ack’ count. If it is greater, this points to a telecoms problem.

7.14 Record this detail on the record card, so that the trend can be analysed.

7.15 Update the date and time by using the DATE and TIME commands.

8. System Status (RC/TDM & PIIU systems only)

For system indications refer to Appendix A.

8.1 For systems that have office and field units, these tests are to be carried out on both units.

8.2 Where modems are fitted, plug a Technician's terminal or laptop into the engineering port of the 'online' processor module (RS232C Port 'A' on the front of the CMP-P1) running 'monitor' program, or run hyper terminal set-up to 4800baud, no parity, 8 data bits and 1 stop bit.

8.3 Check the external 'ack', 'nak' and 'no response' counts using the PCCZ (Print Channel Count and Zero) command.

8.4 Check that the sum of the 'nak' and 'no response' counts is less than 10% of the 'ack' count. If it is greater, this points to a telecoms problem and should be reported to your SM(S) as corrective maintenance.

8.5 Record all details on the record card.

8.6 If required, update the date and time by using the DATE and TIME commands.

9. System Changeover (all systems)

Liaison with the Signaller.

9.1 Before proceeding, check for faults by ensuring the fault light on either processor is not illuminated.

9.2 At the office end, force a changeover to the standby CMP-P1 module using the 'Auto' switch on the front panel of the CCO module.

9.3 Check that the standby CMP-P1 module is now in control by ensuring that the 'Sel' LED is illuminated. The CMP-P1 module that was previously in control should now be in standby mode.

This can be checked by confirming that the 'Sel' LED is extinguished and the 'WD' LED is still flashing.

9.4 Check that the scan LEDs on the CMO modules now represents the newly selected processor module.

9.5 Check that the changeover switch is returned to the auto position and that any alarms that can have been raised have been cleared by using the Alarm/Ack switch on the CCO module. Confirm that no faults have been introduced onto the system by checking the EFA LED is out.

9.6 Check that no system faults have occurred.

9.7 On PIIU and RC/TDM systems use the logger system, on PMUX and TDMUX systems check the fault LED.

9.8 Record all details on the card. This includes the date and time of the changeover.

10. Final

10.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

10.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

11. Equipment Cubicles

11.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

12. Control and Interface Equipment

12.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

12.2 If provided, disconnect and clean all keyboards as necessary.

12.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

12.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

12.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

12.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

13. System Measurements (all systems)

The different system configurations cannot have all the same components; readings are to be taken as fits the system.

13.1 Check that any alarms raised have been cleared and no faults have been introduced to the system.

13.2 Check the LED indications are correct see Appendix A for details.

The audible alarm needs to be acknowledged by means of the acknowledgement switch on the CCO-A/CCO-B module.

13.3 If provided, measure using a meter, the following DC voltages on power supply test points:

Test Point	Voltage (dc)
7VL logic	between 6.5V & 7.5V
12VIF interface (on CPW-A)	between 11.5V & 12.5V
24VIF interface (on CPW-D)	between 23V and 25V

Table 1 – Test Point Voltages

If any are outside the specified range, the CPW-A requires changing.

13.4 If provided, measure the modem levels at the line termination points:

Cable Pair	Values
Transmission (Tx)	nominal -13dBm
Receive (Rx)	between -13dBm and -30dBm

Table 2 – Modem Levels

13.5 If provided, measure the voltages on external power supplies:

Supply	Voltage (dc)
External 12V	between 10.5V & 13.5V
External 24V	Between 21.5V & 26.5V
External 48V	Between 44V& 63V

If any are outside the specified range, the power supply requires changing.

13.6 If provided, check that the logger and archive PCs are powered up.

14. Line Protection and Route Selection

14.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

14.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

15. Spares

15.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

15.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

16. Final

16.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

16.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications

Not all module types are fitted to every system and there can be more than one module type.

Modules	Function	LED(s)
CPW	Interface and logic	Illuminated
CMP-A/B	Module power (Pwr)	Illuminated
CCO		
CMM-A		
CMI		
CMO		
DCD	Modems	Illuminated
CMP- A/B[#1]	Watchdog (WD)	Flashing
	Available (Av)	Illuminated
	Selected (Sel)	Illuminated on one module only
CMI (configured)	Scan	Illuminated
CMO (configured)	Scan	Flashing # 3
		Extinguished # 4
External PSUs [# 2]	Power	Illuminated

1: For RC/TDM & PIIUs with a field end, check that the same CMP-A/B module is in control at both the office and the field end.

Check that the scan LED representing the CMP-A/B selected as being in control is either on or flashing on the configured CMO modules.

Either state is acceptable, both scan LEDs off is not and shall be investigated.

2: As provided.

3: Controlling module.

4: Standby module.

END

Includes:	Sapphire T48, Communication Processor, MCS Concentrator MCS, Train Describer (TD), SpadAlert and Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Before working on system use an ESD wrist strap connected to the Earth Bonding Point on the cubicle.

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

The Sapphire T48 is a communications processor system that interfaces to computer-based interlocking's (e.g. VHLCs) and a Signaller's panel via a Delphin1024 PIIU. The comms processor receives all controls from a Delphin1024 PIIU via dual serial links.

The system can process this data and transfer these controls, based on the rules within its database, to the remote interlocking's (VHLCs). All indications data from the remote interlocking's is passed by the comms processor to the Delphin1024 PIIU, which drives the panel indication lamps.

When configured as a train describer, the database configures the SapphireT48 channels for use as a stepping Dual TD or as an Information TD. It can also be used as an interface between a Modular Control System and as SPAD alert system.

Refer to the GETS maintenance manual for each system configuration for more information.

System Configuration

Always check you know the configuration of the Sapphire T48 system you are working on, see the notes on system types in NR/SMS/PartC/IC00 (VDU Based Control Systems General) & NR/SMS/PartC/SB00 (Signal Box Control & Operating Systems General).

Not all the tests in this SMS are relevant for each system configuration therefore only the tasks relevant to system configuration should be undertaken. If you are in doubt, ask your SM(S).

Sapphire T48 Communications Processor

The Communications Processor is a system in a signal box that interfaces to computer-based interlocking's like VHLCs and a Signaller's panel via a Delphin1024 PIIU.

The Comms Processor receives all Controls from a Delphin1024 PIIU via dual serial links.

The system can process this data and transfer these controls, based on the rules within its database, to the remote interlocking's (VHLCs). All indications data from the remote interlocking's is passed by the Comms Processor to the Delphin1024 PIIU, which drives the panel indication lamps.

Sapphire T48 MCS Concentrator

The MCS Concentrator is a system in a signal box that interfaces to a number of Signaller's MCS systems and uses the data to provide information to Supervisors or Maintainers Workstation positions.

This allows the supervisor to view maps on his single workstation that are on the various Signallers' MCS workstations and acknowledge relevant alarms.

Sapphire T48 MCS

The MCS is a system in a signal box that interfaces to a number of Interlocking's, either SSI or Relay (via the Delphin1024) and the Signaller's Workstations.

The SapphireT48 consists of a duplicated system with automatic changeover. There are two identical processing elements labelled A and B within the 8U crate, whichever side is online is referred to as the Control side and the other as the Standby.

When the SapphireT48 is cold started, the element labelled A boots up first and takes 'Control', thus it is the default 'Control' side.

The 'Control' side scans its watchdog inputs and those of the 'Standby' side; if it has stopped pumping its own watchdog and the 'Standby' is pumping its watchdog an automatic changeover should occur.

The 'Standby' then becomes the 'Control' and vice versa. However, to prevent continual switching under certain fault conditions further automatic changeovers are prevented until a manual reset has taken place.

Sapphire T48 Train Describer (TD)

The TD consists of a system in a signal box connected to a Signallers Panel Display system and Signalling Input systems.

The TD system receives all signalling and train movements from TD Multiplexers and SSIs via dual serial links.

The system can process this data and step trains according to the rules within its database and display this on the panel displays and Operator Control Units and interface with other adjacent TDs for boundary steps.

The TD database configures the SapphireT48 channels for use as a stepping Dual TD or as an Information TD.

Sapphire T48 SPADAlert

The SpadAlert consists of a system in a signal box connected to an MCS system.

The SpadAlert system receives all signalling and train movements from the MCS Control Equipment (CE) via a dual link.

The system can process this data and any alarms generated shall be sent to the control equipment for displaying on the workstations and recording on the logger PC. A SpadAlert system can only be connected to a single MCS CE.

WEEKLY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. System Status

7.1 Check that the indications LED's on the DPW-A Power Supply Modules are lit, ON.

7.2 Check that all the module power 'Pwr' indications, LED's are lit, ON, i.e. check the DCP-K2/K4, DSS-A, DMS and DMX modules.

7.3 Check that the Watchdog 'WD' LED on the 'Comms' section of both processor modules, DCP-K2/K4, are lit, ON and one of the processors is in control, selected ('Sel' LED is lit, ON)

7.4 Check that the time on the DRC-A module is accurate.

7.5 Check that the peripheral units (Technicians' terminal and workstation) are functional.

7.6 On the Technician's terminal select the processor that is in control and confirm that all the links are OK by using the FLTS (Link Fault Status) command.

7.7 Check the external channel 'ack', 'nak' and 'no- response' counts using the PCCZ (Print Channel Count and Zero) command. Check that the sum of 'nak' and 'no-response' counts is less than 10% of the 'ack' count.

If it is greater this can point to a problem on the link, and should be reported to your SM(S).

On systems without a Technicians' terminal, a laptop computer can be connected to the system.

8. System Changeover

In liaison with the Signaller.

8.1 Before proceeding, check that the fault light on either processor is not illuminated.

8.2 Manually force a changeover to the standby processor by momentarily pushing up the processor modules 'select' switch. Check that the 'select' switch is returned to the auto position.

On some system configurations this is achieved by switching the select switch to 'Disable' on the on-line processor to bring the standby processor on-line, then switching to 'Auto'. If you are in doubt, ask your SM(S).

8.3 Check that the standby processor is now in control, selected ('Sel' LED is lit, ON) and the other processor is now in standby, not selected ('Sel' LED is not lit, OFF).

8.4 Check that any alarms raised have been cleared and that no faults have been introduced to the system. Depending on the system configuration, these alarms can be on the Signaller's panel.

Repeat Step 7.6 on the processor that is now in control.

Record all details on the card. This includes the date and time of the changeover.

9. Final

9.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

9.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

10. Equipment Cubicles

10.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

11. Control and Interface Equipment

11.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

11.2 If provided, disconnect and clean all keyboards as necessary.

11.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

11.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

11.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

11.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

12. System Measurements

12.1 Measure using a meter the voltages on the DPW-A test points:

Supply	Voltage (DC)
6V	Between 5.5V & 6.5V
5V	Between 4.75V & 5.25V

Table 1 – Supply Voltages

If any are outside the specified range, the DPW-A requires changing.

13. System Maintenance

13.1 On systems provided with a hot spares crate, check the modules are functional and check that the Program and Database is current.

13.2 Check that the spare Program and Database disks are available and current for all the systems by comparing with the labels on the SapphireT48 Processor Modules (DCP-K2) or by using the ISSU command on the Technician’s terminal.

TD Systems Only:

13.3 Check that the peripheral units (OCUs, Display Distributors, and Displays) are functional by checking with the relevant Signaller.

14. Line Protection and Route Selection

14.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

14.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

15. Spares

15.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

15.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

16. Final

16.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

16.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

Includes:	Older type MCS systems, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	MCS systems based on a Delphin 1024 or a Sapphire T48 platform and all other Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Control and Interface Equipment

4.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

4.2 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

5. Workstation Map Display Projector(s) (Where Provided)

Refer to the manufacturer's manual for cleaning and adjustment instructions.

5.1 Check all the air filters, clean as necessary.

5.2 Check the projector lens, clean as necessary.

5.3 Check the projected picture, adjust as necessary.

6. Control Equipment Cubicle

The following procedure checks that the 'standby' control equipment is serviceable by forcing a manual changeover. It shall only be carried out during light traffic periods in liaison with the Signaller.

6.1 Check the LED indications in auxiliary changeover crate one.

The select LED on the front of the 3AC-AX module connected to one of the controller crates will be illuminated. This indicates that this is the control system; the other system is the standby.

The watchdog LED's are illuminated on the 3AC-AX modules for both controller crate A and B.

6.2 List all the current faults using the 'EFAS' and 'FLTS' commands on the fault logger.

If any indication is not correct or if faults are logged for either the control or standby equipment, follow the fault-finding procedures in the maintenance manual before proceeding.

6.3 Press the select switch on the standby 3AC-AX module in the auxiliary changeover crate one to manually select the standby system. Observe the systems switch over.

6.4 List all the current faults using the 'EFAS' and 'FLTS' commands on the fault logger. Compare with the previous listing and investigate any differences.

6.5 Record the results in the system logbook.

7. Dual Workstation Changeover (Where Provided)

These tests should only be carried out during light traffic periods in liaison with the Signaller.

These tests should be repeated for each workstation with a 10 minute gap between each changeover. This is to check that the system recovers and any faults arising can be identified and cleared.

7.1 Check that the Signaller's keyboard and tracker ball are working correctly and that all the screen displays are OK.

7.2 Check that a standby workstation PC is serviceable by forcing a manual changeover as detailed in section 6.

7.3 Observe the workstation monitors for the correct display and observe a few operations of the keyboard and tracker ball.

a) List all current system faults using the 'EFAS' and 'FLTS' commands on the fault logger.

b) Check for any workstation malfunctions.

7.4 Record the results in the system logbook.

8. Power Supplies

8.1 Using a meter and/or oscilloscope measure the DC voltages and AC ripple on all the auxiliary changeover controller modules (control/slave 3AC- AX/SX) using the monitoring points on the front panels:

System	Limits	Ripple
7V Logic	6.5V to 7.5V	<50mV
+12V Interface	+10.8V to +13.2V	
-12V Interface	-10.8V to -13.2V	

Table 1 - Voltages Auxiliary Changeover Controller Modules

8.2 Using a meter and/or oscilloscope Measure the DC voltages and AC ripple on the power supply voltages on each control equipment crate power supply module (6PP-N):

System	Voltage	Ripple
5V Logic	4.5V to 5.5V	<50mV
+12V Interface	+10.8V to +13.2V	
-12V Interface	-10.8V to -13.2V	

Table 2 - Voltages Control Equipment Crate

NOTE: *Replace any module with readings outside the ranges detailed in 8.1 & 8.2.*

9. Final

9.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

9.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

10. Equipment Cubicles

10.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

11. Control and Interface Equipment

11.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

11.2 If provided, disconnect and clean all keyboards as necessary.

11.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

11.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

11.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

11.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

12. Line Protection and Route Selection

12.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

12.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

13. Spares

13.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

13.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

14. Final

14.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

14.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

Periodic Task

15. Routine Replacement

These tasks are applicable only to the earlier versions of GETS Modular Control Systems not the Delphin 1024 or Sapphire T48 based systems.

NOTE: *The tasks can be undertaken by Technical Support staff and/or equipment specialists, your SM(S) will advise you.*

15.1 Replace the following equipment cooling fans on each PC with new units of the same type. Check after replacement that each fan works correctly

- PC front air intake (x2).
- Internal PC processor fan.
- PC power supply.

15.2 Replace on each PC the internal clock and Bios chip battery with a new battery of the same type.

15.3 Replace on each PC the hard disk drive (HD) with a new HD of the same type.

15.4 Workstation Map Display Projector(s): Where provided, arrange for each projector to be sent to an approved service centre for servicing and fan replacement.

END

Includes:	Machine operated and mechanical operated detonator placers
Excludes:	All Other types of detonator placers

SERVICE A

1. All Detonator Placers

1.1 Check all detonators are in date. Replace any that have passed their expiry date.

Disposal of expired detonators shall be in accordance with current environmental policy.

2. Machine Operated Detonator Placer

2.1 Reference should be made to the following NR/SMSs for details of maintenance on this equipment:

a) NR/SMS/PartC/SG95 (Semaphore Signal Machine (BP, GRS, & SGE).

b) NR/SMS/PartC/SG96 (Semaphore Signal Machine (WRSL)).

3. Mechanical Operated Detonator Placer B.S. type

3.1 Examine the following items:

a) Split pins.

b) Holding down bolts. Tighten where necessary.

3.2 Examine and brush/wipe the following items:

a) Casing.

b) Roller.

c) Straight crank.

d) All Connections.

3.3 Lubricate with mineral oil the following items.

a) Roller shaft.

b) Crank pin.

c) Lid hinge.

4. Mechanical Operated Detonator Placer Clayton Type

<u>Exterior</u>

4.1 Examine the following items:

a) Split pins.

b) Holding down bolts.

c) Tighten where necessary.

4.2 Examine and brush/wipe the following items:

a) Body.

b) Connections.

c) Lever quadrant.

4.3 Lubricate with mineral oil the following items.

a) Turned pins in connections.

b) Lever centre pin.

<u>Interior</u>

4.4 Examine split pin in jaw pin.

4.5 Examine and wipe the following items:

a) Operating arm.

b) Operating bar.

c) Gear wheel.

d) Lower jaw and jaw fixing screw. Tighten where necessary.

4.6 Lubricate with lithium based grease.

a) Cam face.

b) Operating bar.

c) All grease nipples.

4.7 Lubricate trigger pin cam fixing bolt and jaw pin with mineral oil if grease nipples are not fitted.

5. Final (All Types)

5.1 Test by operation from the signal box.

END

Any deficiency or failure, which could affect the safe running of trains or the integrity of the signalling system shall be reported to the Signaller immediately and escalated as a fault.

1. Hazards Associated with Electrical Supplies

The Electricity at Work Regulations 1989 requires precautions to be taken against the risk of death or injury from electricity in work applications.

2. Principle – Live Working Prohibition

No work, other than taking electrical measurements is permitted on live equipment if:

a) The working voltage is 175V or more, or the short circuit current can exceed 25A.

AND

b) This is on exposed conductors or terminals, which can be touched by the person doing the work.

3. Exceptions

Where there is an instruction permitting the work, which details the procedures to be followed, the training required and the tools to be used, live work may be undertaken. In such circumstances, the following standards apply:

a) The person carrying out the work shall be accompanied.

b) Use the specified tools.

c) The insulation of hand tools should be inspected before use.

d) Use the specified PPE (e.g. rubber gloves, mats and eye protection).

4. Taking Measurements Where the Voltage or Current Can Exceed the Above Limits

The following precautions shall be followed:

a) Staff shall be accompanied.

b) The measuring instrument shall be the type approved for the work.

c) If using an unfused meter, HRC fused leads shall be used.

d) Prods shall be fitted with finger barriers

e) Bare metal at the prod ends should not exceed 2mm.

f) The use of crocodile clips and clip on prods is prohibited.

g) Meter leads and prods shall be carefully checked for security and insulation prior to use.

5. High Voltage Insulation Testers

These testers (e.g. Megger) can be used where the voltage they produce exceeds 175V as the short circuit current is restricted to a safe level.

6. Isolation

Before work starts on electrical equipment, it shall be isolated unless:

a) The working voltage is less than 175V and the short circuit current cannot exceed 25A.

OR

b) The work does not involve exposed terminals or conductors that can be touched by the person doing the work.

OR

c) It is unreasonable for the circuit to be isolated.

7. Local Disconnection of Equipment

Where the person doing the work can verify that the equipment is not reconnected and is not electrically live; no additional precautions are required.

Options include removal of plug and socket, links, fuses or operation of switches.

If the person doing the work cannot verify that the equipment cannot be reconnected, PROTECTIVE ISOLATION shall take place.

8. Protective Isolation

This shall always be employed for work on 650V power supplies. The following procedure applies:

a) Until the equipment has been proved to be isolated, it shall be assumed to be live.

b) Identify all necessary disconnection points using the diagrams.

c) Isolate the equipment from the rest of the system using switches fuses or links.

d) Fuses, links, and locking off keys are retained by the person doing the work.

e) A notice worded 'Danger Work In Progress – Do Not Reconnect' shall be secured by each isolation point.

f) Where possible, switches shall be locked off using a personal key. Where this is not possible, a personal padlock may be used to secure the equipment housing. Alternatively, a reliable person shall be stationed at the disconnection point to check that no one reconnects the supply other than the person doing the work. This person shall not have any other duty and shall not leave his/her post.

g) Before starting work, the circuit shall be tested for no voltage present. This shall include a check that any capacitors have been discharged

h) Shift changeover shall be planned to confirm that the person responsible for the isolation is clearly identified.

i) Only the person responsible for the isolation may restore it.

Where work involves more than one team, a multi-user lock off device shall be employed where possible.

Where the work is pre-planned, involves more than one team and it is not possible to provide protection as described above, a permit to work system shall be employed.

9. Touch Potential Risk

There is a risk where metallic items (location cases, metallic fences, concentrators, lever frames etc) do not have equipotential bonding and are connected to different earths.

Under certain fault conditions this can lead to an electric shock if the two items having different earths are touched simultaneously.

It is advisable if the earth bonding on an asset is unknown not to touch metallic items that are physically separate at the same time.

10. Signalling Circuit Insulation Testing

Insulation testing of signalling circuits detects deterioration or failure of the insulation of wires, cables or other circuit components. This function can be achieved by continuous monitoring or periodic testing.

10.1 Continuous Monitoring – SSI Trackside Functional Modules (TFMs)

An SSI TFM provides continuous monitoring of its outputs; any feed on an output which should not be there causes the unit to go into a safe operating mode.

No additional testing (e.g. busbar earth test) is required for equipment connected directly to an SSI TFM output.

Where an SSI TFM operates a relay, earth testing to NR/SMS/PartB/Test/051 (Busbar Earth Tests) or NR/SMS/PartB/Test/053 (Earth Leakage Detector (ELD) : Testing and Calibration) shall be required to the supply busbars.

TFM inputs are not continuously monitored. If you are in doubt, ask your SM(S).

10.2 Continuous Monitoring – Earth Leakage Detectors (ELDs)

An ELD provides continuous monitoring of all equipment connected to a busbar against any extraneous connection to earth. It does not detect problems that are not associated with a connection to earth (e.g. core to core insulation).

ELDs require to be calibrated correctly to provide correct monitoring; details in NR/SMS/PartB/Test/053 (Earth Leakage Detector (ELD) : Testing and Calibration) shall be followed.

10.3 Periodic Testing – Busbar Earth Testing

Where continuous monitoring is not provided, busbar earth testing is required to test the insulation of signalling circuits connected to busbar under test.

As per the monitoring provided by ELDs this test does not detect problems that are not associated with a connection to earth.

10.4 Periodic Testing – Cable Insulation Testing

This tests individual conductors for insulation from each other (e.g. multi core cable) and also from earth.

It is more onerous than busbar testing and requires the conductors to be disconnected from their associated circuits, therefore only the conductors are tested, not the associated equipment. Details of the test are in NR/SMS/PartB/Test/054 (Cable Insulation Tests).

10.5 Earth Testing and Earth Looping Testing

Earthing on incoming mains power supplies from an external source (e.g. fed from a consumer unit, 240V and above) is the responsibility of the E&P function.

This usually means that the earthing for equipment and relay rooms that have these power supplies fed into them has been installed and is maintained by E&P.

Earthing for signalling power supplies (110V and below), trackside locations, and equipment/relay rooms that do not have an incoming mains power supply from an external source (e.g. incoming 240V or above is fed from another equipment/relay room or trackside location) is usually installed and maintained by signalling.

The correct testing of these signalling earths requires specialist equipment, if you suspect there are any deficiencies with the earth itself or the continuity of the looping; you should report it as corrective maintenance NR/SMS/PartA/A02 (Preventative and Corrective Maintenance). The SM(S) shall arrange for the earth to be tested to the current standards.

11. Hazards Associated with Secondary Cells

11.1 General Precautions and Prevention of Explosions

Alkaline and lead acid cells give off explosive gas during the charging cycle.

Always observe safety directives and local instructions and, before starting work, check good circulation of air to disperse accumulated gases.

Open doors and check ventilation. Enforce air circulation by wafting or fanning where ventilation seems poor. NEVER tap cells to check electrolyte level or loosen battery connections whilst the cells are on charge or discharge and gassing.

DO NOT use hydrometers or distilled water top up bottles that have been used for the maintenance of alkaline cells on acid cells and vice-versa. Acid destroys alkaline cells and alkaline destroys acid cells.

Plastic cases have to be cleaned using a damp cloth. Dry cloths can cause a build-up of static electricity.

Connections shall be tight and properly made to avoid sparking and to maintain good conductivity.

Do not use excessive force. Use Insulated Box Spanners.

Short Circuit Risks

The outer case of steel cased cells is live. Never allow tools or metallic objects to rest across the cells as this might cause sparking and damage.

Care should be taken not to short out any cells during testing/maintenance as this might result in a short circuit current high enough to cause splashes of molten metal and possible explosion.

Use Insulated tools and test leads.

Beware of rings, watches with metal straps or any other jewellery you might be wearing.

The physical size of the cell is not necessarily indicative of its power. The 5Ah Cyclon cell can produce 200A and should be treated with as much care as larger cells.

11.2 Action in Case of Accident

EYES – Immediately wash liberally with water, following the instructions on the eyewash bottle and seek immediate medical attention.

SKIN – Rinse liberally with water and seek medical attention.

CLOTHING – Remove contaminated clothing as soon as possible.

SPILLAGE – Swill down spillage with water as soon as possible.

NOTE: Never swill down spillage in substations where there is high tension electrical equipment. Report the situation.

11.3 Secondary Cells – General

The rate of charging is dependent on the size and type of cell.

Whilst the function of lead acid and alkaline cells is similar, the chemical composition is different. Both types usually require regular topping up. Use only distilled or de-ionised water and do not over-fill.

Some cells are sealed (e.g. Cyclon) and do not require topping up.

The tops of cells should be kept clean, terminations of unsealed cells being protected with petroleum jelly.

Inter-cell connectors should be kept clean and firmly fitted.

Bare metal straps should be protected with petroleum jelly. Replace corroded or defective straps.

If a cell has to be moved, check straps and terminations before moving to check they do not break or become disconnected.

11.4 Secondary Cells – Installation

Connections are the correct polarity, tight and straps serviceable.

The bottom gland retaining nuts of Alkaline cells are torqued by the manufacturer and should not be altered.

Transit stoppers should be removed; vent caps free to open and electrolyte the correct level.

11.5 Disposal of Cell Material

Cells are to be disposed of as per the NR Environmental Policy.

11.6 Charging Rates

Constant Voltage Chargers (CVC) are set to the correct voltage per cell connected.

Match the correct charger to the number and type of cells. No adjustment is possible.

Non-constant Voltage Chargers require the charging rate to be set to give the minimum trickle charge necessary to keep the battery in a fully charged state under normal operating conditions.

Where intermittent peak loads occur, a slightly higher charging rate might be required.

Continual overcharging of a battery should be avoided as this produces excessive quantities of explosive gas.

11.7 Power Off Circuitry

The operation of a battery charger is usually proved in the circuitry of some automatic level crossings. You should always liaise with the monitoring point before switching the charger on or off.

To prove charger operation, switch off the battery charger and connect a voltmeter across the terminals of one cell.

Switch on the charger and observe the voltage reading slowly increase, which indicates that the charger is working.

11.8 Cyclon Cells

These are 'sealed for life' cells therefore topping up is not required.

Only a CVC to BR spec 1875, 955 or 928 (or equivalent) shall be used to charge Cyclon Cells, otherwise overheating occurs.

11.9 ALCAD Vantage Cells

Vantage cells are of a ultra-low maintenance type, if correctly set up and maintained they should only require topping up approximately every ten years.

Only a CVC to BR spec 1875, 955 or 928 (or equivalent) shall be used on Vantage cells.

These cells are pressurized. When topping up, slowly remove pressure vent cap to release pressure.

Do not place the filler neck into the cell. Position over vent cap opening and inject distilled water, observing the level on external fill lines.

11.10 Primary Cells

CEGASA air alkaline cells are a replacement for the SAFT air saline cells which have gone out of production. CEGASA cells have a more stable voltage-over-time characteristic (the voltage does not gradually reduce with age) therefore the cell voltage cannot be used as an indication of the remaining capacity of CEGASA cells.

There is no test available to routinely check battery capacity on CEGASA cells, replacement of them should be based on experience of typical battery life.

The capacity of the new CEGASA cells is at least as good as the old SAFT cells but can be affected by extreme low temperatures and high humidity.

Cells should be replaced at the same intervals as they were in the past taking into account the cell capacity (e.g. if a GEGASA 200Ah cell is used to replace a SAFT 100Ah cell it can be expected to have double the life).

12. Hazards Associated with Cables & Wiring

Problems and Hazards associated with cables and wiring are described in detail in NR/L3/SIG/19012 (SIGTAN 12). Technicians should be aware of the dangers when working in the vicinity of wiring and electrical terminations:

a) To check that metal tools do not come into contact with circuit components.

b) To avoid damaging insulation materials.

Certain sites are subject to wire degradation and should be looked for during maintenance visits. This manifests itself in two forms, dry degradation, or wet degradation.

12.2 Dry Wire Degradation

This causes the inner rubber insulation to lose elasticity, thus becoming dry and crumbly. If the wire is not disturbed, the outer PCP cover continues to convey a visual impression of good condition.

Bending or twisting affected wires might cause the insulation to break, therefore exposing the bare conductor.

Wiring in the vicinity of heat sources or in a warm, dry environment is particularly vulnerable. Brittle and cracked wiring shall be reported.
Wet Wire Degradation

This occurs where the inner rubber turns to a sticky liquid, which runs out of the PCP cover if the wire is vertical.

Report wiring that show signs of bulging, sponginess and leakage.

12.3 The Management of Affected Sites

The labelling and detailed working restrictions of these sites are specified in standard maintenance procedures.

Rodent damage and chafing (sharp metallic corners) These shall be reported to your SM(S)

12.4 Cable Clamps

These should be properly fitted to prevent snagged cables causing a short circuit. See Figure 1.

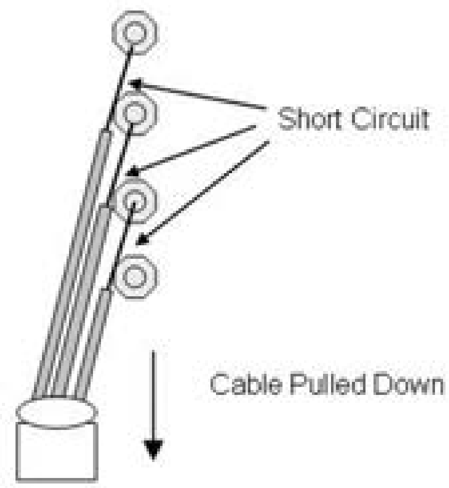


Figure 1 – Short circuits caused by cable being unsupported

12.5 Binding Posts

These are often found in locations and relay rooms as a space saving method of terminating cables without a disconnection point.

Wrong side failures have been caused in the past where a link has incorrectly been fitted to a pair of binding posts and has strapped out a circuit contact.

To prevent this from happening, red dome nuts should be fitted to all binding posts. This indicates that a link **SHALL NOT BE FITTED**.

If it is necessary to remove a cable core terminated on a binding post, only one dome nut of a pair should be removed at any one time.

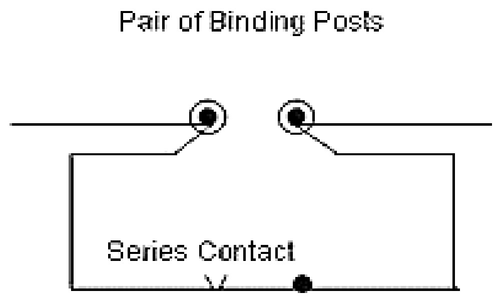


Figure 2 – Use of Binding Posts

12.6 Un-Terminated and Disconnected Wires

These shall be fully disconnected at both ends and suitably insulated or preferably removed to prevent the risk of short circuit. The methods of insulation are listed below:

a) ENDCAPS - May be used as a permanent insulation when the wire is cut as a blunt end.

b) BOMBTAILS - May be used as a permanent insulation with the wire cut away from any apparatus.

The following temporary insulation methods may be used for a maximum of 12 weeks:

a) End Caps (with wire stripped).

b) Squeeze on Sleeves.

c) Expandable Sleeves.

d) Bomb Tails (wire not cut away).

e) Plastic bags.

13. Shelf Type Relays

These and similar equipment might be a hazard where horizontally mounted terminals are fitted. This might result in a short circuit if a metallic object is dropped into the terminals. This risk may be minimized by fitting the terminals with insulated caps.

14. Hazards Associated with Relays

14.1 Relay Bases.

BR spec 829 relay bases can be found in 3 colours:

a) Black.

b) Blue.

c) White/Cream.

Black bases are made from a phenolic resin (which is dark brown) with carbon added to make it a black colour.

Blue bases are made from an epoxy resin (which is colourless) with a pigment added to make them blue.

White/Cream bases are made from a melamine resin which is naturally white/cream in colour.

14.2 Silver Migration

Black relay bases are made of phenolic resin; because of this they are susceptible to silver migration. This happens when under certain conditions the phenolic resin can become conductive by the movement of metallic silver from plated conductors over and into the base.

To overcome this problem blue bases, made out epoxy resin were used. The cost of making these bases out of this material was very high so another material was sought; this has led to the current White/Cream bases made from melamine resin.

Black phenolic bases are usually found in older installations. Lineside apparatus cases and unheated relay rooms present the greatest risk and elimination of black bases is targeted at these sites.

Heated relay rooms might also be affected.

Relay base changing and visual sampling programs form part of the maintenance schedule. Precise details should be obtained from your SM(S).

Full details of the technical requirements are contained in NR/L2/SIG/11107.

14.3 Relay Servicing

Relay servicing programs should form part of the annual maintenance plan. Details of servicing requirements are contained within the relay servicing plan.

Some relay functions have a mandatory servicing frequency of 10 years maximum, unless exempted by a risk analysis. These are:

a) Timer relays (BR937, 946, 947, 962, AEI-GS AS).

b) Magnetically latched or magnetic stick relays (BR935, 936).

c) Relays used in biased or polar circuits (BR932, 961, Tyers G1, Shelf type).

d) Track relays (BR938, 939, 966F2, 968, VT1, Shelf type).

e) Vane relays (WSL VL1), and

f) Searchlight signal mechanisms (WSL B5, SGE LN).

Recently serviced relays are labelled with the date of their servicing.

Many existing relays are labelled with the next servicing date, which might not correspond with the current servicing frequency.

Always refer to the relay servicing program for planned replacement.

Relay shelf life is three years. Relays past this shelf life shall be tested prior to placing into service. More details on relay servicing can be found in NR/L2/SIG/11129.

14.4 Timer Relays

These are tested every 12 months to make sure that that the time setting is maintained within acceptable tolerances.

When thermal timers are tested, make sure that enough time has elapsed before repeating a relay timer test to confirm that a true reading is not affected by warm heating elements.

14.5 UPS Testing

Carry out NR/SMS/PartB/Test/057 - Clause 1.3 – This specifies testing to check that the UPS can maintain the load for 50% of the expected hold up time.

Some level crossing UPSs have a hold up time of 24 hours, which would require UPS tests lasting 12 hours.

To enable such testing to be completed within a standard working day, the following reduction has been agreed by the Level Crossings Engineer:

a) At sites with long hold up times such as Level Crossing the 50% figure quoted may be reduced to 20%.

END

Includes:	TRTS, RA, CD and TRTS Pull Wires
Excludes:	All other types of Plunger and Pull Wires

GENERAL

Platform plungers and pull wires provide indications to train crew relating to the operation of trains.

They shall only be operated by Signal Technicians with permission of the Signaller to prevent any unauthorised train movements.

Platform plungers and pull wires are usually located in an area accessible to the general public.

They shall not be left unattended in an unsecured state.

SERVICE B

1. External Inspection

1.1 Check the unit is securely mounted, clean as necessary.

1.2 Check that doors, latches, and locking devices are effective.

1.3 Check that water seals are effective.

1.4 Check that tail cables are correctly routed, secure, and not damaged.

1.5 Check and lubricate hinges, locks, and latches.

1.6 Check that external labelling is fitted, clean, and legible.

2. Internal Inspection

2.1 Check the tail cables and internal wiring are secure and correctly terminated. Protect as necessary.

2.2 Examine the insulation for damage and degradation.

2.3 Check the internal labelling is fitted, clean, and legible.

2.4 Examine the switches and plungers.

2.5 Observe, if operated by Operating Staff, that the associated indications correctly illuminate.

3. Pull Cord Assemble (TRTS Pull Cord type Only)

3.1 Examine the following on the pull cord assembly:

a) Wire and thimbles.

b) Eyelets.

c) Connection to rotary switch.

3.2 Replace the wire if it is damaged or corroded.

3.3 Examine the following on the rotary switch assembly:

a) Operating arm.

b) Spindle.

c) Switch unit fixings.

d) Connecting lug and pin.

e) Mounting bracket.

f) Cable gland.

3.4 Check that the adjustable stop is tight (two lock nuts).

3.5 Lubricate the micro-switch spindle and lug connection.

END

Includes:	Dispatch Interface Unit fitted at, London Bridge
Excludes:	All other types of Dispatch Interface Unit LED Indicators

GENERAL

Asset Identification Image

Figure 1 – Dispatch Interface Units

There are no routine maintenance services on this asset.

PERIODIC TASK

1. Replacement of the Indicator LED's

1.1 Carry out NR/SMTH/Part04/EL24 - Replace an Encapsulated LED Indicator on each off the LED Indicators.

END

Includes:	Apparatus Case, Location Cases, Relay Cabinets, Equipment Cupboards, Stump Boxes
Excludes:	Dorman integrated Lightweight Signal [iLS], Modular Signalling Equipment Housings, Ansaldo Peripheral and Temperature Controlled Locations.

Always ‘test before touch’ any Functional Supply Points and any associated metal work.

General

Check any record cards for any entries since your last visit.

Where alterations are being carried out, your SM(S) should have briefed you on the work and the effect on planned maintenance.

If you find evidence of project work that you have not been told about, contact your SM(S).

Cable Locations

Sections 1 to 3 and 7 to 10 are not required for trackside location cases which only contains cable terminations.

PERIODIC TASK ONE

For all Busbars monitored by a busbar monitoring device and maintained using the II RADAR system to remotely monitor condition.

Earth fault investigation is required as a result of an alarm.

1. Remote Maintenance

1.1 Log in to the system and search for required asset.

1.2 Confirm the location ID using Ellipse number.

1.3 Check that the Device Health status is OK, and the logger has been receiving data within the last 24 hours as a minimum.

1.4 Check that there is data available for the last 24 hours.

1.5 Check that the Earth Loop Resistance is within usual tolerance for the site (this could be a specified maximum for the site).

If any of the checks in 1.1 to 1.5 are not correct, investigate as per local processes before continuing onto the next steps.

1.6 Steps 1.1 to 1.5 shall be completed before moving to the next step.

1.7 For each busbar, check for Voltage (Vs) alarms or alerts. Where the reading falls outside of tolerance report the details to your SM(S).

NOTE: *The normal tolerance for signalling power supplies is +/- 10% of nominal voltage; variances to tolerances might be specifically authorized by the SM(S)*

1.8 For each busbar, check for Resistance alarms or alerts.

NOTE: *The II RADAR alert and alarm thresholds are set in accordance with the levels specified in NR/SMS/PartZ/Z07 – Section 3.3.*

If a Red Earth is alarming, this is below the safety minimum limit and shall be treated with high priority. Check to confirm that a fault report has been raised, if not refer to local processes of managing earth faults below the reportable limit. For any other alarms, report to your SM(S) as per local processes.

1.9 Review all Red Earth alarms, that have occurred since the last maintenance visit was undertaken, and confirm that the correct actions have been taken.

1.10 Confirm the are no alerts or alarms before moving to the next step.

1.11 Compare the values to those of the last service. Where the trend is worsening significantly from previous results, report to your SM(S).

1.12 Confirm there are no outstanding issues found in Steps 1.1 to 1.10.

1.13 Any outstanding issues shall be reported to SM(S).

SERVICE A

2. Power Supplies

2.1 Measure the power supply and busbar voltages (±10% of rating) for all signalling supplies.

Your SM(S) shall advise you if current readings are required. Current readings should only be taken if this is practical to do so.

See the notes in NR/SMS/PartC/EL00 (Electrical Equipment – General) on hazards associated with electrical supplies.

Investigate any significant variation from previous records.

3. Earth Tests

3.1 If fitted, carry out NR/SMS/PartB/Test/053 (Earth Leakage Detector (ELD) Function Test).

3.2 Investigate ELD fault indications and record any faults on the record card.

3.3 Carry out NR/SMS/PartB/Test/051 (Busbar Earth Tests) on each power supply not continually monitored (excluding earth return circuits).

3.4 Rectify any earth fault found in steps 3.1 to 3.3 that is above the reportable limit.

Report to your SM(S) the problem and any difficulties in rectifying it. Failure to rectify shall be reported to your SM(S) for necessary remedial action. The report shall be made within 24 hours.

3.5 If any earth fault is found with the voltage below the reportable voltage, NR/SMS/PartZ/Z07 (Earth Leakage – Reference Values), but the trend is worsening significantly from previous results, report to your SM(S).

Make the report within 24 hours. Your SM(S) shall decide if any further action is required.

SERVICE B

4. External Inspection

4.1 Check cases are accessible, and the doors are not obstructed.

Remove or report excessive foliage or obstructions.

4.2 Check for fire risks around the location(s) remove or report any possible risks.

4.3 Check (if provided) that any guardrails and staging are secure.

4.4 Examine case steelwork and doors for corrosion, damage, obstruction, and security.

4.5 If provided, check door seals.

4.6 Check case numbers are clearly labelled.

4.7 Check locks are fitted and in good order.

4.8 If provided, check the earthing continuity between the location(s) and the earth rod.

4.9 Check that all connections are secure, and the earth rod is secure in the ground.

In SIMIS-W areas check that the protective sleeve is in place if the earth cable passes under the track.

See the notes in NR/SMS/PartC/EL00 (Electrical Equipment – General) on earthing. Report any earthing problems as a corrective maintenance item.

4.10 Check that any safety/warning labels/signs are correctly displayed and legible.

These can include No Smoking, Wear PPE No Mobile Phones etc.

4.11 Lubricate locks and hinges.

5. Internal Inspection

5.1 Check that the location ventilation is in order. If heating is provided, check that it is switched on and working correctly.

In damp locations and where black relay bases are still fitted, it is important that the heater is working correctly.

5.2 Check site copy diagrams are available, properly stored and fit for purpose.

Submit a request for replacements as required.

Report to your SM(S) any handwritten or temporary alterations to the site copy.

5.3 Check internal equipment for signs of contamination, damage or failure.

5.4 Remove any dirt/infestation.

5.5 Check that any cable entry openings are suitably sealed to prevent rodent entry.

5.6 Check internal case fittings, racks, shelves, and backboards.

5.7 Dust equipment as necessary.

5.8 Check equipment is correctly labelled.

6. Cables, Wires and Terminations

6.1 Examine cables and wires for damage particularly in ducting and where they pass above a heater, transformer, or any other heat source. Report any damage as a corrective maintenance item.

Take immediate action on any exposed conductors. Damage includes any new wet/dry degradation. Rodent damage can occur to wiring in ducting which is not immediately visible.

6.2 Check that wire degradation signs are in place if this is present in the apparatus case.

NOTE: *The examination of cables and wires for changes in wire degradation and the related timescales are now covered by NR/L2/SIG/11655 (Management of Cable and Wire Insulation).*

6.3 Check cables are secure and free from damage/chafing/rodent damage.

Cable clamps should be fitted to check that short circuits cannot occur if the cable is pulled from outside the case.

6.4 Examine cables and cable termination points for signs of new wet or dry wire degradation.

6.5 Check cable cores for degradation and damage especially if located above a heat source.

6.6 Where applicable, check terminals for security, corrosion, arcing and risk of short circuit/disconnection. Protect 2BA/0BA terminals as necessary.

6.7 Check potheads. Examine terminations and fixings. Clean and protect as necessary.

6.8 On 2BA/0BA terminals, check that red dome nuts are fitted as required. On WAGO terminals, check that red insulation stops are fitted as required.

6.9 Check un-terminated cores or wires are correctly insulated.

6.10 Report any temporary insulated, unterminated cables and wires to the SM(S).

Un-terminated cables and wires shall only remain insulated with temporary insulation (silicon sleeves) for a maximum of 12 weeks. If not terminated, they shall be permanently insulated.

6.11 Check any ‘red straps’ that are installed are secure and labelled.

6.12 Carry out NR/SMS/PartB/Test/054 (Cable Insulation Tests) on the following lineside cables, which are not monitored by an ELD or BMD.

a) Cables containing single cut safety critical circuits.

b) Safety critical reed circuits.

c) Earth return circuits.

d) Double cut lineside cables, If not monitored by a busbar test.

The number of cores to be tested shall be, all spare cores or 10% of the cable capacity, which ever is greater.

Cable insulation testing shall be carried out at one end of the cable only.

6.13 Power Cables are managed by E&P Staff under NR/L3/SIGELP/50001.

7. Rack/Shelf Mounted Equipment

7.1 If not managed by a relay re-servicing database, check a sample of relays to see they are within their Service date. Report any missing labels to your SM(S).

Details on relay servicing which could be carried out as a separate exercise can be found in NR/SMS/PartC/EL00 (Electrical Equipment – General). Your SM(S) is to advise you.

Service track circuit relays at 10 yearly intervals.

TC relays on TI21 installations are not covered by this requirement. TC relays on other types of frequency track circuits are. See NR/L2/SIG/11129 for further details.

7.2 Examine a sample of phenolic (black) relay bases (1% or 1, whichever is greater) and contact spacers for signs of silver migration or similar contamination following removal of the relay(s).

NOTE: *Where the spades are not silver plated this task need not be carried out. If you are unsure your SM(S) will advise you if this task is required.*

Your SM(S) can tell you specific relays to be examined. Report any silver migration found. More details on relay bases can be found in NR/SMS/PartC/EL00 (Electrical Equipment – General).

7.3 Check equipment for security and signs of damage, degradation, moisture, overheating, and cover distortion.

7.4 If provided, check for oil leakage from AC track circuit capacitors.

7.5 Check relay terminal shrouds are fitted.

7.6 On Thermal Relay Timers, carry out NR/SMS/PartB/Test/061 (Relay Timer Test).

8. Local Policy Requirement 1

8.1 On Non-Thermal Timers**, c**heck the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.

8.2 Check that the seals on timer relays are crimped.

9. Data Links

9.1 Carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

9.2 Carry out NR/SMS/PartB/Test/089 (SSI Datalink Test).

This test might not be required under certain circumstances:

a) on interfaced SSI.

b) or, when monitored remotely.

c) or, if scheduled against another work group.

Your SM(S) will advise you.

10. Power Supplies (Transformers / Rectifiers, TFU etc)

10.1 Examine earth connections.

10.2 Examine terminations.

10.3 Check for signs of overheating.

10.4 Check protective shrouding/covers are fitted and undamaged and that warning signs are correctly displayed (i.e. all equipment rated >175V).

10.5 Carry out NR/SMS/PartB/Test/053 (Earth Leakage Detector (ELD) Calibration Test.

10.6 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests) applicable equipment controlled by the Trackside Apparatus Case if not undertaken as part of the individual equipment SMS.

11. Final Check

11.1 Before leaving site, check that covers, doors and locks are properly fitted and secure.

END

Includes:	Equipment Rooms, Relay Rooms, Interlocking Rooms
Excludes:	Control & interface systems and associated cubicles, SSI equipment and Ansaldo equipment.

Always ‘test before touch’ any Functional Supply Points and any associated metal work.

General

Where alterations are being carried out, your SM(S) should have briefed you on the work and the effect on planned maintenance.

If you find evidence of project work that you have not been told about, contact your SM(S).

Before leaving site, check that access points are secured to prevent unauthorised access.

SERVICE A

1. General Inspection

1.1 Check and complete the site Logbook or Site Attendance Record Card.

Particular attention should be paid to any entries made since the last maintenance visit.

1.2 Check and record the equipment room temperature on arrival in the Logbook or on the Site Attendance Record Card.

The normal temperature ranges are between 15 – 20ºC.

1.3 Check (if fitted) that air conditioners (coolers) are switched on and working during the summer (April to September).

Check if they are controlled by thermostats, if they are then they should be left switched on all year round.

1.4 Check (if fitted) that heaters are switched off during the summer. If both heating and cooling are fitted and controlled by thermostats, check that the controls for this are working correctly.

Heaters and coolers should not be both on at the same time. If heating is turned on/up whilst you are working in the room, return the controls to their original setting when leaving Report any problems to your SM(S).

1.5 Report any sign of structural deterioration or forced entry to your SM(S). Check the interior roof/ceiling tiles for any signs of damp/damage.

1.6 Check for fire risks around the location and the existence of excess vegetation.

Remove or report any possible risks as a corrective maintenance item.

1.7 On portable equipment rooms check that the skirt around the bottom of the location is effective.

1.8 Check that security locks, lighting, and ventilation are in order.

1.9 Check that any safety/warning labels/signs are correctly displayed and legible.

These can include No Smoking, No Mobile Phones, Wire Degradation Classification etc.

1.10 If provided, check the earthing continuity between the signalling earth points and the earth rod. Check that all connections are secure, and the earth rod is secure in the ground.

See the notes in NR/SMS/PartC/EL00 (Electrical Equipment – General) on earthing. Report any earthing problems as a corrective maintenance item.

1.11 Remove any dirt/infestation.

1.12 Check cable entries are sealed to deter rodents, where practicable.

1.13 Check racks and equipment are secure and not damaged or contaminated.

1.14 Check site copy diagrams and (if provided) O&M manuals for electronic equipment are available and fit for purpose. Submit a request for replacements as required. Report to your SM(S) any handwritten or temporary alterations to the site copy.

1.15 Check time clock settings (e.g. AWCU). Remember BST & GMT.

1.16 Examine a sample of cables and wires for damage.

Your SM(S) can tell you which cables and wires to look at.

Immediate action shall be taken on any exposed conductors.

Damage includes any new wet/dry degradation. Rodent damage can occur to wiring in ducting which is not immediately visible.

2. Emergency Control and Technicians Indication Panels

2.1 Turn the panel on and check for the correct operation of the indications.

2.2 Check control/indication panel faceplate. In particular note and report:

a) Worn or illegible artwork.

b) Damaged panel sections.

c) Obvious faulty buttons/switches.

d) Faulty indications/lamps.

2.3 Dust and wipe panel faceplates with a cloth moistened with detergent or non-abrasive cleaner, as necessary.

2.4 Turn the panel off.

3. Power Supplies

3.1 Check warning signs are clearly displayed.

3.2 Dust and check power supply equipment.

Transformers, rectifiers, chargers, circuit breakers, fuses, links, switch-gear, bus-bars, connections etc: Investigate any signs of overheating/ arcing. Locks and latches shall be secured.

3.3 Check earth connections and cable terminations.

3.4 Check (>175V) that equipment covers, and safety labels are fitted and that rubber matting/ gauntlets are available.

3.5 Measure the power supply and busbar voltages (±10% of rating) for all signalling supplies.

Your SM(S) shall advise you if current readings are required. Current readings should only be taken if this is practical to do so.

See the notes in NR/SMS/PartC/EL00 (Electrical Equipment – General) on hazards associated with electrical supplies.

Investigate any significant variation from previous records.

3.6 Check power and standby system indications Uninterruptible Power Supplies (UPS) and Static Invertors.

3.7 Check spare fuses are available.

4. Earth Tests

4.1 If fitted carry out NR/SMS/PartB/Test/053 (ELD Function Test).

Investigate ELD fault indications and record any faults on the record card.

4.2 If an ELD is not fitted, carry out NR/SMS/PartB/Test/051 (Busbar Earth Tests) on each power supply not continually monitored (excluding earth return circuits).

4.3 Rectify any earth fault found that is above the reportable limit.

4.4 Record any faults in the site log book or record card.

Report to your SM(S) the problem and any difficulties in rectifying it. Failure to rectify shall be reported to your SM(S) for necessary remedial action. The report shall be made within 24 hours.

4.5 If any earth fault is found with the voltage below the reportable voltage NR/SMS/PartZ/Z07 (Earth Leakage – Reference Values) and the trend is worsening significantly from previous results, report to your SM(S).

The report shall be made within 24 hours. Your SM(S) shall decide if any further action is required.

5. Batteries & Cells General

5.1 Check warning signs (e.g. No Smoking) and P.P.E. signs (Goggles, Gloves etc).

5.2 Clean and examine batteries, cells, straps and terminations (use insulated box spanner).

5.3 Protect terminations as necessary.

Arrange for any defective cells to be replaced If a cell in a crate is found to be faulty, the whole crate shall be replaced.

6. Primary Cells

6.1 Check that there is ventilation over the top of the cells.

6.2 Carry out NR/SMS/PartB/Test/058 (Primary Cell Test) if required.

Continually loaded cells shall be replaced if their obtained readings indicate they could fail before the next maintenance visit. See NR/SMS/PartC/EL00 (Electrical Equipment – General).

7. Secondary Cells

7.1 Check that the correct number and type of cells along with the correct charger are fitted according to the diagram.

Changes could have been made during corrective maintenance.

More details are in NR/SMS/PartC/EL00 (Electrical Equipment – General). Report as corrective maintenance any discrepancies.

7.2 Clean and examine all exteriors and cases.

7.3 Check the level of electrolyte - top up with distilled/ionised water as necessary.

8. SSI Equipment (if applicable)

8.1 Examine the modules, connectors, cables for security and signs of overheating, arcing, or damage.

8.2 On the SIGNAL module (if fitted), observe that the following red indicators are illuminated:

a) Power.

b) System.

c) Rx data.

d) Outputs.

8.3 On the POINTS module (if fitted), observe that the following red indicators are illuminated:

a) Power.

b) System.

c) Rx Data.

d) Points X.

e) Points Y.

8.4 On the LONG DISTANCE TERMINAL, observe that the following red indicators are illuminated:

a) Power, System.

b) PCM TX Clock.

c) PCM Rx Clock.

d) PCM Rx Line.

e) Data From SSI.

f) Data To SSI.

g) Data To PCM.

8.5 On the DATA LINK module, observe that the red power indicator is illuminated.

If any of the indicators have failed but the equipment is still functioning correctly, make a note in the system logbook and inform your SM(S).

It is not necessary to renew modules for indicator faults only.

9. WESTLOCK Trackside Equipment (Zone controller) (if Applicable)

9.1 Check captive screws are tight on the PM, RSA and SOM110 Modules.

9.2 Where a 24V DC Power Module is fitted, observe that all the system "Healthy" indicators are illuminated, as follows:

Modules	Indication	Status
24 V DC Power supply	DC OK	Green Steady
24 V DC Buffer module (if Fitted)	Status	Green Steady
24 V DC Buffer module (if Fitted)	Diagnosis	Off
24 V DC Buffer module (if Fitted)	Check input Voltage	Off

Table 1 - DC Power module indications

10. Final

10.1 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

11. General Inspection

11.1 Check racks, shelves, and backboards. Dust equipment as necessary.

11.2 Check equipment is correctly labelled.

11.3 Sweep the floor and clean windows if required.

12. Power Supplies

12.1 Liaise with the Signaller before interrupting power supplies.

12.2 Check power panel voltmeters and ammeters.

Most panel meters are provided for indication purposes only and where practicable the indication shall be compared with a reading on a calibrated meter.

If the power supply is disconnected for any other maintenance reason you shall make sure the needle returns to zero.

12.3 Where an alternative supply is provided (main/standby) change over the load to the alternative supply.

a) Check the standby supply takes the load, without any system failures.

b) Change load back to the main supply.

c) Check that the standby supply is available before changing over.

12.4 Carry out NR/SMS/PartB/Test/053 (Earth Leakage Detector (ELD): Testing and Calibration).

12.5 Carry out NR/SMS/PartB/Test/056 (Avel-Lindberg Static Inverter Tests).

12.6 Carry out NR/SMS/PartB/Test/057 (Uninterruptible Power Supplies (UPS) Tests.

12.7 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests) on applicable equipment controlled by the Equipment/Relay Room, if not undertaken as part of the individual equipment SMS.

13. Cables & Cable Terminations

13.1 Check cables are secure and free from damage/chafing/rodent damage.

Cables shall be secure enough to prevent a movement, which can lead to a short circuit.

13.2 Examine cables and cable termination points for signs of new wet or dry wire degradation.

13.3 Check cable cores for degradation and damage especially if located above a heat source.

13.4 Where applicable, check terminals for security, corrosion, arcing and risk of short circuit/ disconnection. Protect 2BA/0BA terminals as necessary.

13.5 Check pot heads. Examine terminations and fixings clean and protect as necessary.

13.6 On 2BA/0BA terminals, check that red dome nuts are fitted as required.

On WAGO terminals, check that red insulation stops are fitted as required.

13.7 Check un-terminated cores are correctly insulated.

13.8 Where cable core diversions are in place: check 'red straps' are secure and labelled.

13.9 Carry out NR/SMS/PartB/Test/054 (Cable Insulation Tests). Test lineside cables containing single cut safety critical circuits, safety critical reed circuits and earth return circuits which are not monitored by an ELD.

The number of cores to be tested shall be, all spare cores or 10% of the cable capacity, whichever is greater.

13.10 Carry out NR/SMS/PartB/Test/054 (Cable Insulation Tests). Test double cut lineside cables not monitored by a bus bar test or ELD.

The number of cores to be tested shall be, all spare cores or 10% of the cable capacity, whichever is greater.

13.11 Power Cables are managed by E&P Staff under NR/L3/SIGELP/50001.

14. Internal Wiring

NOTE: *The examination of cables and wires for changes in wire degradation and the related timescales are now covered by NR/L2/SIG/11655 (Management of Cable and Wire Insulation).*

14.1 Check wiring is correctly routed, and free from insulation damage (e.g. chafing/wire ties/rodent damage).

Wires should be physically supported in ducting and away from metal corners.

Wire lacing shall not be tight.

Plastic ties shall have the serrated edge outermost.

Ducting should be in good condition and support the wiring.

14.2 Check that un-terminated wires are correctly insulated.

15. Relays and Rack Mounted Electrical Apparatus

15.1 Check all plug-in units and rack or shelf-mounted apparatus for security and signs of damage, degradation, moisture, overheating, and cover distortion.

15.2 If not managed by a relay re-servicing database, check a sample of relays to see they are within their service date.

Report any missing labels to your SM(S).

Details on relay servicing which can be carried out as a separate exercise can be found in NR/SMS/PartC/EL00 (Electrical Equipment – General).

Track circuit relays shall be serviced at 10 yearly intervals.

TC relays on Ebitrack200 installations are not covered by this requirement, other types of frequency track circuits are. See NR/L2/SIG/11129 for further details.

15.3 Examine a sample of phenolic (black) relay bases (1% or 1, whichever is greater) and contact spacers for signs of silver migration or similar contamination following removal of the relay(s).

Your SM(S) can tell you specific relays to be examined. Report any silver migration found. More details on relay bases can be found in NR/SMS/PartC/EL00 (Electrical Equipment – General).

15.4 If provided: Check for oil leakage from AC track circuit capacitors.

15.5 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

15.6 If provided, test audible alarms.

15.7 Shelf Type Relays check that terminal shrouds are fitted, where necessary.

15.8 Check that the seals on timer relays are crimped.

15.9 On Thermal Relay Timers, carry out NR/SMS/PartB/Test/061 (Relay Timer Test).

16. Local Policy Requirement

16.1 On Non-Thermal Timers**, c**heck the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.

17. SSI Datalinks (if applicable)

17.1 Check the Datalink cables entering the location are securely clamped.

17.2 Check that the terminations on the line termination units and surge arrestor units are secure, including confirmation that the termination strap between 3 and 8 is in place.

17.3 If the line termination resistors are separate external units, check the resistors are present and intact.

17.4 Note the mod state of the DLMs. Mod state 1 DLMs should be phased out in all locations and immediately at where DLMs are used as back to back repeaters.

A WAIF shall be raised if Mod state 1 is found and cannot be replaced immediately.

17.5 Confirm that the actual wire length of the current loop wiring (red/white twisted) between DLMs and the associated TFM is less than 5m.

Check that the current loop wiring is secure in the cable containment and that is clear from wiring that is likely to generate noise (eg point machine controls, level crossing barrier machine feeds etc).

Where over length loops or parallelism to noise are found, inform your SMS to arrange for remedial action.

17.6 Where recent alterations have been carried out (new version of location case prints since last maintenance visit), check the location wiring diagrams to confirm that the design calls for a strap between p and k (highlighted in figure 1) on the data link module plug (unless there are two data link connections to the DLM.

If the design omits this, inform your SMS for the situation to be further investigated.

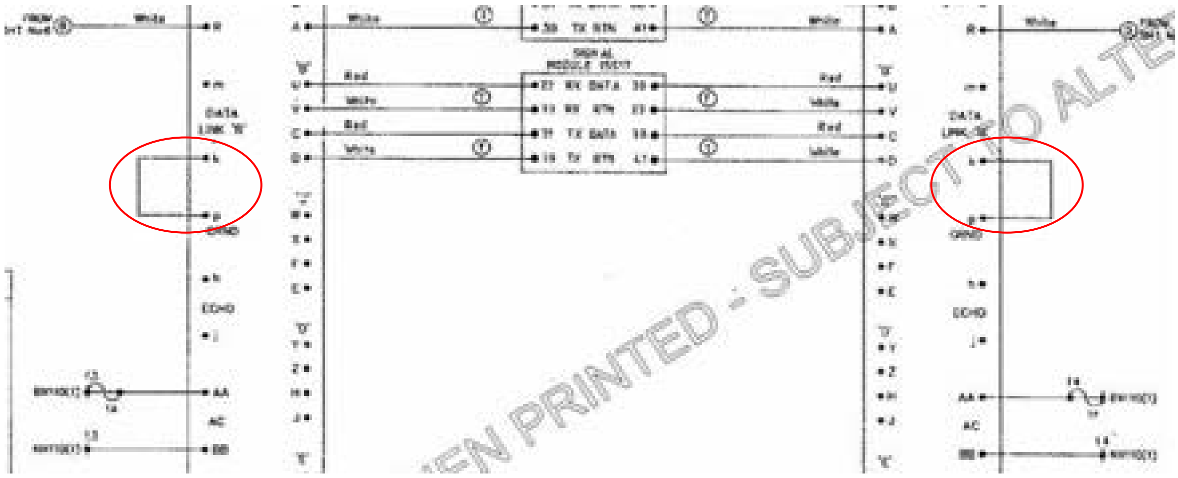


Figure 1 - SSI data link module wiring

17.7 Carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

17.8 Carry out NR/SMS/PartB/Test/089 (SSI Datalink Test).

This test might not be required on interfaced SSI, ask your SM(S).

18. WESTLOCK Trackside Equipment (Zone Controller) (If fitted)

18.1 Remove and test each Surge Suppression Cassette using a surge Cassette Test Unit.

If the Surge Suppression Cassette fails rectify using NR/SMTH/Part04/WL07 (Replace a Siemens Zone Controller Module).

19. Lead Acid Cells (If Fitted)

19.1 Test the specific gravity on each cell is a minimum of 1.220.

Specific gravity measurements shall be taken before any top up of the cell with distilled water as this could give a false reading.

Readings below this value can indicate that the cell is reaching the end of its life and should be reported to your SM(S).

20. Secondary Cells

20.1 Carry out NR/SMS/PartB/Test/055 (Secondary Cell Test).

21. Final

21.1 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

22. Emergency Control Panel

22.1 If possible and with the operating arrangements in place, test the correct operation of the emergency panel and associated switch boxes.

NOTE: *On some routes this task is carried out by the operational staff as part of their duties, if this is the case S&T staff are not required to complete this test. If you are unsure seek clarification from your SM(S).*

Reliability Centred Maintenance

Includes:	Equipment, Relay and Interlocking Rooms with double cut lineside circuits.
Excludes:	Ansaldo Equipment cases / rooms

SERVICE RA: Carry out Service A of this SMS.

SERVICE RB: Carry out Service B of this SMS.

SERVICE RE: Carry out Service A and B of this SMS.

END

Includes:	Any electronic equipment cabinets (located in an equipment room), which do not have an associated SMS which contains cabinet maintenance as a task. Such as: ElectroloGIX.
Excludes:	Any electronic equipment cabinets (located in an equipment room), which have an associated SMS, which contains cabinet maintenance.

SERVICE B

1. Electronic Equipment Cubicles

1.1 Before working on cabinet confirm if the use of an ESD wrist strap connected to the Earth Bonding Point on the cubicle is required.

1.2 Visually confirm the cabinet earth bonding is connected and undamaged.

1.3 Clean the exterior surfaces.

1.4 Dust the interior of equipment cubicles using a dry lint free cloth.

1.5 Check (if provided) cubicle cooling fans are working, and any filters are clean. Rectify as necessary.

1.6 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure and undamaged.

2. Spares (if provided)

2.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

2.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested by your SM(S), test the operation of the cards/units in the test rack.

3. Final

3.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

3.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

Includes:	Ansaldo signalling equipment only
Excludes:	All other types and makes of signalling equipment and associated enclosures

The infra-red light used for transmitting data in the fibre optic system is not visible. Do not look into the end of a fibre or directly into the open connectors of a fibre optic card while the card is plugged into a working system as the intensity is enough to cause permanent eye damage.

Field Isolation Unit (FIU) switches shall only be operated with the agreement of the Signaller. Lineside equipment, e.g. points, could be isolated from the Signaller's control.

Disconnecting a PC mouse from a 'live' system might disrupt the system operation.

A PC mouse shall only be replaced with the prior agreement of the responsible manager.

The affected PC shall be powered down before replacement.

A vital key board may be replaced without the need to power down the system. However, the prior agreement of the responsible manager is still required.

MSSCC AUT System, Maintenance Procedures

The majority of the equipment used in the AUT system, including the network equipment, clustered servers, and disk array is classed as specialist Information Technology equipment.

Familiarity with Windows NT, UNIX, LINUX, the tools required to manage the disk storage system and network configuration is essential.

The maintenance of the AUT System addressed in this SMS is restricted to preventative maintenance only. For further information refer to the Manchester South Signalling System O&M manuals.

REGULAR CHECKS 1

1. Interlocking/Control Rooms

1.1 Check the resistance to earth of those cables identified in Monitored Cables

More details can be found in NR/SMS/Appendix/02.

NOTE: *If a point cable is indicated as having a low insulation value the operation of the associated point heater(s) should be checked.*

1.2 Check the operating times of each set of points using maintenance terminal.

1.3 Check the life of each signal lamp using the lamp life monitoring system. Arrange replacement, as necessary. More details can be found in NR/SMS/Appendix/02.

1.4 Check the voltages of each track circuit using maintenance terminal.

1.5 Check that the event recording data is preserved.

1.6 Check the number of weekly alarms (both primary and secondary) for each data backbone and take action as required.

REGULAR CHECKS 2

2. Peripheral Location/Distributed Peripheral Location

2.1 Check the cable resistance to earth of VIO Fed Cables. More details can be found in NR/SMS/Appendix/02.

2.2 Check all the displays on 48V power supplies are operative.

2.3 Check the Field Device Controller watchdog indicators are illuminated as required.

2.4 Check the LED at each fuse holder is illuminated (rack mounted 48v DC/DC converter).

2.5 Check each fibre optic connection on fibre optic cards (vital hub, non-vital hub and FOA cards) for damage, correct connection, and minimum bend radius of optical fibre.

2.6 If applicable, NR/SMS/PartB/Test/171 (Earth Monitoring Integrity Test) Record details and results of the circuits tested.

2.7 If applicable, check the SECAP Insulation Monitor Alarms.

Alarms are monitored / displayed on the SCADA system. More details can be found in NR/SMS/Appendix/02.

2.8 Where fitted, check the temperature control thermostats and heating devices are set correctly and operative This is important especially during periods of extreme ambient temperatures.

2.9 Check all the fans in Peripheral Post modules are operative.

The Green LED adjacent to fan power supply switch indicates status of power supply not confirmation of fan operation.

2.10 Check each fan filter and clean if required.

3. Interlocking Room

3.1 Check the Interlocking Unit watchdog indicators are illuminated as required.

3.2 Check each fibre optic connection on fibre optic cards (vital hub, non-vital hub, PCs, and FOA cards) for damage, correct connection, and minimum bend radius of optical fibre.

3.3 Check the cable insulation status. Record details of any cables with deteriorating values for remedial action.

<u>AUT dedicated ELD monitoring system.</u>

3.4 Check that all the fans in Central Post are operative.

3.5 Check each fan filter. If necessary, clean as required.

3.6 Check that the thermostat in interlocking cubicle is set correctly and is operative.

3.7 Dust the keyboard(s). Hold the keyboard(s) upside down when dusting.

3.8 Clean the desk mounted VDU screen(s) in accordance with manufacturer's instructions.

3.9 Check the mouse/cursor co-ordination.

3.10 Check the ART monitor status.

4. AUT (Local Area Network (LAN) Equipment)

4.1 Check all the equipment in the LAN Rack is switched ON.

4.2 Check that all the cables are connected.

4.3 Check that each fibre optic connection on fibre optic cards for damage, correct connection, and minimum bend radius of optical fibre.

4.4 Check the green LED indications adjacent to the ports on the network hub for each item of connected equipment (AUT Servers, Communication Servers, ACC ART1 and ART2, Maintenance Terminal etc) are illuminated.

5. Maintenance Desk

5.1 Check the computer is switched ON and the keyboard and mouse are connected and working correctly.

5.2 Check the Alarm Log window is present and displays the last relevant events for the Audible Alarm.

5.3 Check that the clock corresponds with the Anthorn clock. This was formally called the 'Rugby' clock.

6. Control Room

6.1 Dust the keyboard(s). Hold the keyboard(s) upside down when dusting

6.2 Clean the desk mounted VDU screen(s) in accordance with manufacturer's instructions.

6.3 Check the mouse/cursor co-ordination.

6.4 Check the cube screens (wall display) for colour and image. Arrange remedial action as necessary. More details can be found in NR/SMS/Appendix/02.

7. AUT Desks (Primary and Secondary)

7.1 Check the workstation PC is switched on, the computer monitors are switched on, and the mouse and keyboard are connected and working correctly.

8. AUT Audible Alarms

8.1 Check that the loudspeakers on the AUT Desks are connected and switched on.

8.2 Wait for a relevant event and check the operation of the audible alarm function.

SERVICE A

9. Peripheral Location/Distributed Peripheral Location

9.1 Dust the equipment.

9.2 Check cables/connections (where accessible) and the switches on Adaptation Units.

10. Interlocking Room

10.1 Dust the equipment and Wipe glass door panels (equipment cubicles).

10.2 Clean (if necessary) monitor screens in accordance with manufacturer's instructions.

10.3 Check cables/connections (where accessible).

11. Control Room

11.1 Dust equipment.

11.2 Clean (if necessary) monitor screens in accordance with manufacturer's instructions.

11.3 Check cables/connections (where accessible).

11.4 If necessary, Wipe the cube screens (wall display) More details can be found in NR/SMS/Appendix/02.

SERVICE B

12. Peripheral Location/Distributed Peripheral Location

12.1 Carry out NR/SMS/PartB/Test/171 (Earth Monitoring Integrity Test). Record details and results of the circuits tested.

13. Stand-by Signallers Desk

Testing the standby system shall only be undertaken during engineering hours, when traffic delays are not incurred.

13.1 Check that the standby system takes over in the event of the main system shutting down.

13.2 Check associated monitoring indicator(s) are activated (if applicable).

13.3 Check associated monitoring indicator(s) are de-activated when main system is re-instated (if applicable).

14. ART and AUT Uninterruptible Power Supply (UPS)

14.1 Maintain in accordance with manufacturer's instructions.

15. External

15.1 Test the cable resistance to earth of Other Tail Cables. NR/SMS/PartB/Test/051 (Busbar Earth Tests) *or* NR/SMS/PartB/Test/054 (Cable Insulation Tests) as required.

More details can be found in NR/SMS/Appendix/02.

END

Includes:	Modular Equipment Housing (MEH), Object Controller (Axle Counter) [OC(A)], Object Controller (Interface) [OC(I)], Object Controller (Points) [OC(P)], Object Controller (Signal) [OC(S)], Feeder Pillar Power Box 1 (PB1), Power Box 2 (PB2) Power Box 3 (PB3), Axle counter Power box (PR1W) and Lockout Enclosure
Excludes:	All other types and makes of signalling equipment and associated enclosures

General

Visible light is used for transmitting data in the fibre optic system and is emitted within a tiny beam size; however, the intensity can cause permanent eye damage.

Do not look into the end of a fibre or directly into the open connectors of a fibre optic termination or use magnifying equipment to observe the light.

Anti-static precautions shall be taken when required.

It should be noted that there is no fixed lighting provided in the Lineside Compact Housings.

Further information regarding the system is available in Siemens Rail Modular Signalling Manuals.

Check any record cards for any entries since your last visit. Where alterations are being carried out, your SM(S) should have briefed you on the work and the effect on planned maintenance.

If you find evidence of project work that you have not been told about, contact your SM(S).

Before leaving site, check that access points are secured to prevent unauthorised access.

SERVICE B

1. General Maintenance

External

1.1 Check MEH, OC & PB are accessible and the door(s) are not obstructed.

1.2 Remove or report excessive foliage or obstructions as a corrective maintenance item.

1.3 Check for fire risks around the MEH, OC & PB(s). Remove or report any possible risks.

1.4 Check (if provided) that any guardrails and staging are secure. Also examine fixing bolts that secure the housing to the structure and / or foundations.

1.5 Examine MEH, OC and PB metalwork and door(s) for corrosion, damage, obstruction, and security.

1.6 Report any signs of forced entry to your SM(S).

1.7 Check lockable handle and locks are in good order and free from corrosion and damage etc.

1.8 Check the earthing continuity between the MEH, OC and PB and the earth point.

Check that all connections are secure.

1.9 See the notes in NR/SMS/PartC/EL00 (Electrical Equipment - General) on earthing. Report any earthing problems as a corrective maintenance item.

1.10 Check that any MEH, OC and PB identity numbers, safety / warning labels / signs are correctly displayed and legible.

These can include No Smoking, Wear PPE, No Mobile Phones etc.

Internal

1.11 Remove any dirt / infestation.

1.12 Check equipment is correctly labelled and that warning signs are correctly displayed (i.e. all equipment rated >175V).

1.13 Check that the silicone gasket fitted to the inside of all door(s) are free of dirt and damage and no signs of water ingress are present.

1.14 Check site copy diagrams are available, properly stored and fit for purpose.

1.15 Submit a request for replacements as required. Report to your SM(S) any handwritten or temporary alterations to the site copy.

1.16 Check equipment for signs of overheating, contamination, damage or failure.

1.17 Check MEH lighting is working correctly.

1.18 Advise your SM(S) if defective.

1.19 Check MEH thermostat is set correctly and that heating and fan are working correctly where provided.

1.20 Advise your SM(S) if defective.

1.21 Lubricate locks and hinges.

1.22 Before leaving site, check that covers, doors and locks are properly fitted and secure.

2. Technicians Facility (Local) [TF(L)]

2.1 Check the correct time and date are displayed, report to your SM(S) if this is not the case as incorrect date / time is indicative of a wider system fault.

2.2 Check the TF(L) for any outstanding faults. Rectify or report, any corrective actions required shall be logged with ICC/NRIFC.

2.3 Check that data logging is being undertaken correctly by analysis of a sample of information.

3. MEH, OC Surge Protectors, PB Surge Suppression Units

3.1 Check MEH & OC Surge Protectors are serviceable by viewing the colour of the varistor discs.

Report any failed as a corrective maintenance item.

Pink: Serviceable
Grey: Failed

Replace any failed surge protector unit immediately. Report to SM(S) any change.

Figure 1 – Surge Protector

3.2 Check PB Surge Suppression units are serviceable by viewing the colour displayed the small window.

Report any failed as a corrective maintenance item.

Green: Serviceable
Red: Failed

Figure 2 - Surge Suppression units

Replace any failed surge protector unit immediately. Report to SM(S) any change in the Indication windows.

4. Feeder Pillar

This equipment is rated at 230V AC and shall only be maintained by Technicians in areas where agreement has been reached with the E&P engineer to allow this practise.

4.1 Check the terminal cover plates, three position changeover switch MCBs are present, secure and free of damage and distortion.

4.2 Check the surge suppression unit indication windows: white indicating it is serviceable, and red when is has been subjected to a voltage surge.

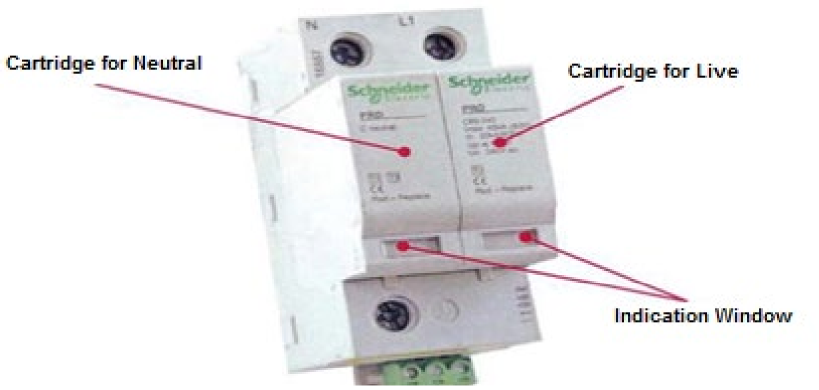


Figure 3 – MCB Units

4.3 Measure the Incoming DNO (Distribution Network Operator) voltage at the test points (Arrows A).

Measure the Incoming Gen (Generator) power supply at the test points (Arrows B), if the generator supply is in use.

Measure the Outgoing Feeder Power Supply at the test points (Arrows C). All of the voltage should fall between 207Va.c. and 234Va.c.

Figure 4 – Feeder Power Supply

NOTE: *Terminals are provided on the Feeder Pillar for measurements to be carried out. These are located behind a protective cover which shall be refitted at the end of measurements.*

5. Power Boxes [PB]

NOTE: *Terminals are provided on the PB Switch Rack for measurements to be carried out. These are located behind a protective cover which shall be refitted at the end of measurements.*

5.1 Check the terminal cover plates, power switch knobs and MCBs levers' are present, secure and free of damage and distortion.

NOTE: *in the MEH, MCBs are provided in association with barrier and other equipment and are distributed around the room. Refer to wiring details for positioning.*

5.2 Measure the power supply and busbar voltages for all equipment & logic supplies and check they are within the range as indicated in NR/SMS/PartZ (Index – Useful Values).

See the notes in NR/SMS/PartC/EL00 (Electrical Equipment – General) on hazards associated with electrical supplies Investigate any significant variation from previous records.

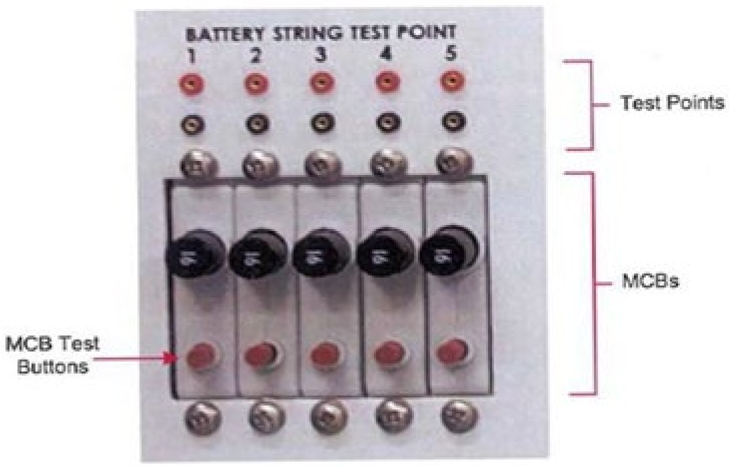
6. Power Box [PB] Battery Packs.

NOTE: *Terminals are provided on the front of the Battery Pack to enable voltage measurements to be taken.*

6.1 Check all MCBs are in their normal (fully in) position.

6.2 Press the red MCB test button and check the MCB trips. Press the black button to reset. Repeat this process for each MCB in turn.

6.3 Using the test point check each battery string has an output between 20V – 30V dc.



6.4 Repeat steps 6.1 to 6.3 for each Battery Pack.

7. Lockout devices

NOTE: *Liaison with the Signaller is required.*

7.1 Check both the switch label and local boundary diagram(s) are clean legible and secure. Clean as necessary.

7.2 Where practical, test operation of the lockout function.

a) Patrolman's lockout (LOD-P) NR/SMS/PartB/Test/174 (Patrolman's Lockout Device Test).

b) Signalling lockout (LOD-K) NR/SMS/PartB/Test/176 (Lockout Device Test).

7.3 Examine the unique key(s). Report the requirement for a replacement if worn as a corrective maintenance.

8. Audible Warning Control Unit

8.1 Check time clock settings (e.g. AWCU). Remember BST & GMT.

SERVICE C

9. Wiring and Cables

9.1 Check wiring and fibre optic patch cords are correctly routed, and free from insulation damage (e.g. kinking / chafing / wire ties / rodent damage) particularly those not in ducting and where they pass above a heat source. Report any damage as a corrective maintenance item.

Immediate action shall be taken on any damaged fibres or conductors. Damage includes any new wet/dry degradation. Rodent damage can occur to wiring in ducting which is not immediately visible.

Ducting should be in good condition and support wiring.

9.2 Check that cable entry apertures and rodent protection is intact and cables are secure by their associated clamping supports. Check cables are free from damage/ chafing/ rodent damage.

The cable clamping should be fitted such a way that short circuits cannot occur if the cable is pulled from outside.

9.3 Check that all cabling plug couplers are free from damage, secure.

NOTE: *Secure means hand tight, the use of tools to tighten the nuts on the Harting plug coupler is not allowed*

9.4 Check that all configuration plugs, logic supply, and surge arrestors are free from damage and their securing clip is engaged correctly. Also check that the seal on the addressing module is intact.

9.5 If required, examine cables and wires for changes to degradation; report any changes as a corrective maintenance item

NOTE: *To gain access to the OC(S) TPWS wiring and OC(P) relay wiring it will be necessary to remove these modules using NR SMTH test plans.*

Similarly, if you are required to inspect the wiring within a PB, access to the wiring requires the removal of all modules and isolation of the entire PB from the incoming supply. Your SM(S) will plan and advise you on either of these tasks.

More information on wire degradation can be found in NR/L2/SIG/11655.

9.6 Check that any un-terminated wires are correctly insulated.

10. Relays

10.1 If not managed by a relay re-servicing database, check a sample of relays to see they are within their service date.

10.2 Report any missing labels to your SM(S).

10.3 Check equipment for security and signs of damage, degradation, moisture, overheating, and cover distortion.

11. Final

11.1 Record details of your maintenance visit and record any other work undertaken in the site logbook or record card.

SERVICE D

12. Batteries

12.1 The batteries within the Power Boxes have an operational life and shall be replaced every 10 years.

The condition of each battery is affected by many factors but typically it is most dependent on when the battery has degraded to 80% of the manufacturers rated capacity.

END

Includes:	Ansaldo Location Case - Temperature Controlled Location (TCL)
Excludes:	All other Location Cases

PERIODIC TASK

1. External Inspection

1.1 Check TCL is accessible and the doors are not obstructed.
Remove or report excessive foliage or obstructions.

1.2 Check for fire risks around the TCL, remove or report any possible risks.

1.3 Check (if provided) that any guardrails and staging are secure.

1.4 Examine TCL and doors for corrosion, damage, obstruction, and security.

1.5 Check TCL identification number(s) are clearly labelled.

1.6 Check locks are fitted and in good order.

1.7 Remove fan cover, check the fans are free from obstruction and the fan alarm panel is operating.

2. Internal Inspection

2.1. Check on the Technician Terminal for any faults.

2.2. Check TCL for signs of contamination, damage or failure.

2.3. Remove any dirt/infestation.

2.4. Check that any cable entry openings are suitably sealed to prevent rodent entry.

2.5. Check that wire degradation signs are in place if this condition has been identified at the TCL.

2.6. Check site copy diagrams are available and properly stored.
Submit a request for replacement as required.
Report to your SM(S) any handwritten or temporary alterations to the site copy.

2.7. Replace the two air filters on the doors.

End

1. General

Logging systems are of two basic types, event loggers, and condition monitoring systems.

Event loggers log digital events such as the change of state of a relay.

Condition monitoring systems generally record measured values continuously or at predefined intervals. Hybrid systems may exist which do both types of logging. Further details of condition monitoring are given in Appendix A.

2. Time Setting

If the system time on a logger used for event logging is more than 5 minutes out, it shall be corrected.

The displayed time on all recorders or loggers should always be set to GMT (Greenwich Mean Time).

This can also be called UTC (Universal Time Constant).

Note that if the time system is controlled by the Anthorn (formally Rugby) transmitter, alterations to the time along with setting to GMT in BST periods will not be possible.

3. Sites with Remote Access

At sites with remote access the A Service is un-necessary provided that the system time and event logging are checked at least quarterly.

The system time shall be verified to within 5 minutes of the correct time, noting that this may be BST or GMT. Logging of data shall also be checked, either manually or by automated programme, by downloading the last hour’s data and confirming that the logger is logging.

4. Passwords

These are usually required for interrogating a logger. Area Technical Support may assist with lost passwords.

5. Records of Adjustments

Records should be made in the site log book of required adjustments to time or other system parameters that, if repeated and excessive, might indicate the need for system overhaul. Any such trend should be reported to your SM(S).

APPENDIX A - Condition Monitoring Equipment

1. Definitions

Indirect Measurement:	Measurement acquired without direct electrical contact e.g. using a current clamp.
Instrumentation Engineering:	The methodology for the use of monitoring and test equipment as specified in NR/GI/U033 (Use of monitoring and test equipment).

2. General

Condition monitoring equipment acquires data from on-track and lineside assets and may include a combination of analogue, serial and digital data sources. Measurements are acquired by indirect measurement and follow Instrumentation Engineering methodology.

One or more of the following methods can be used:

a) Analogue measurements acquired from sensors, e.g., current transducers; the default input range for analogue inputs is 4 to 20mA.

b) Serial data streamed from diagnostic ports e.g., RS232 or RS485.

c) Digital state monitoring, e.g., spare contacts of signalling relays.

The data acquired from the inputs is processed by the data collection unit (DCU) and transmitted to the remote server either by the mobile network using an internal modem and external antenna or the Fixed Telecom Network via an Ethernet port. Received data is processed and stored by the monitoring system and provides a record of recent and historical asset condition.

Server end functionality includes:

a) Display and trending of asset data.

b) Alarms and alerts when assets operate out of tolerance.

Approved types of DCUs are typically designed to mount into the space of a BR930 style relay to enable fitment into standard signalling equipment racks and are approved to be powered directly from 110Vac signalling supplies.

The devices require to be configured to correctly to acquire data and to communicate to the remote server; further information regarding configuration may be found within the Manufacturers’ User Manuals. See appendix B to E for further information regarding approved types of DCU.

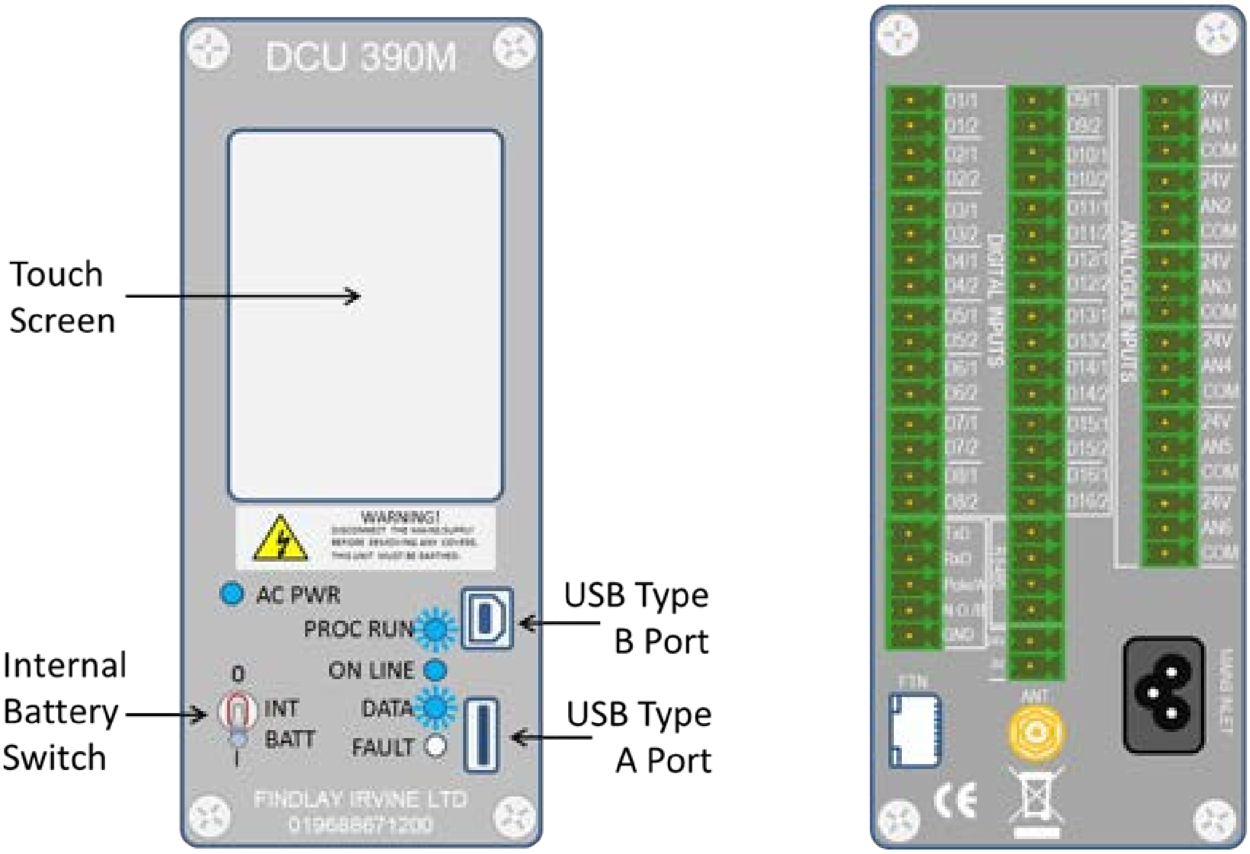
3. Maintenance Requirements

DCUs are designed to require minimal maintenance and should be replaced on failure only*. However, Technicians should take the opportunity to check device indications and dust / clean as the opportunity arises e.g., during routine maintenance of the equipment rooms and housings.

*Failure is indicated by a 'heart-beat' alarm raising in the monitoring system when a device does not communicate for an extended period, typically 6 hours.

Where condition monitoring equipment is powered from a secured power supply (e.g.110Vac derived from 650Vac supply) internal batteries, where fitted, are not critical to normal operation and do not require be routinely tested or renewed. By exception, where the monitoring application specifically requires a standby power source, special arrangements shall be required to periodically test the standby or to replace batteries following the manufacturer's instructions.

APPENDIX B - Findlay Irvine DCU390M



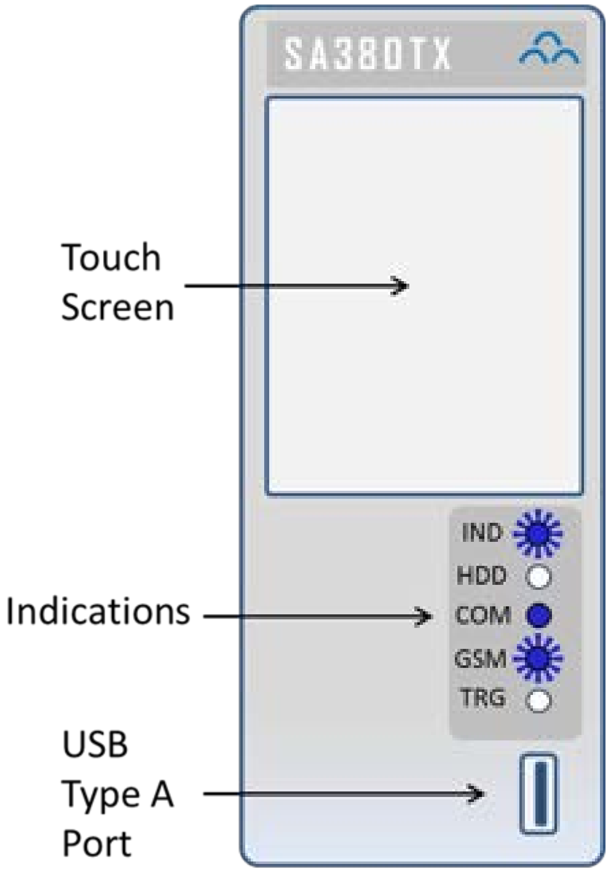
DCU 390M-Front **DCU 390M-Rear**

Figure 1 - DCU 390M Unit

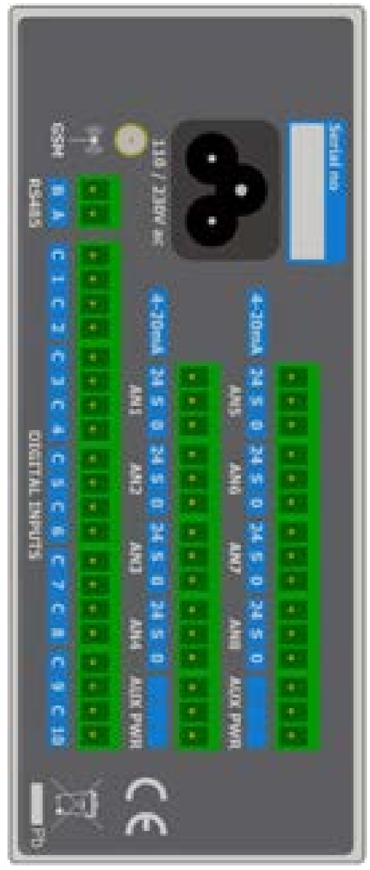
Findlay Irvine DCU 390M Normal Indications		
LED	Normal Indication	Description
AC PWR	ON	Indicates unit is correctly powered from AC Supply
PROC RUN	FLASHING	DCU main processor running correctly
ON LINE	ON	Unit connected to II via GPRS or FTN
DATA	INTERMITTENT	Lit when data acquired from inputs (Digital Signal Processor)
FAULT	OFF	Lit in the event a Digital Signal Processor Fault is detected

Table 1 – Indication Meanings

APPENDIX C - MPEC 380TX



MPEC 380TX Front



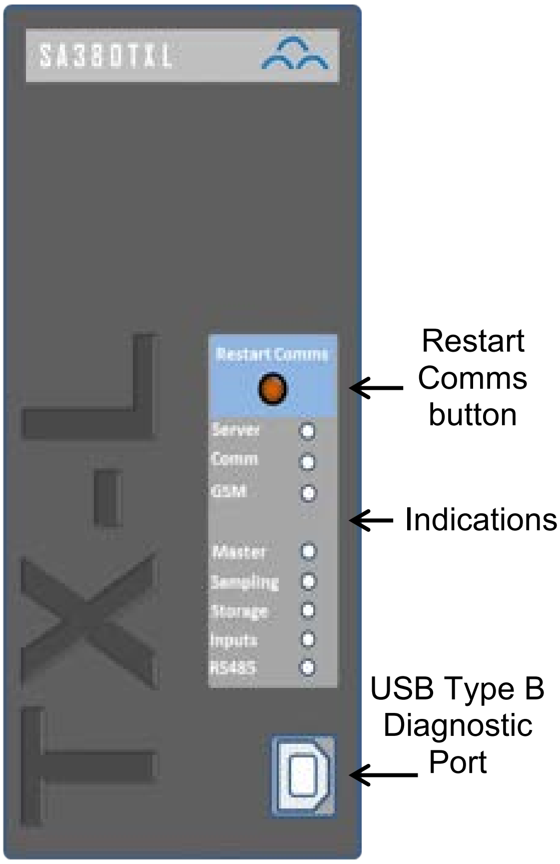
MPEC 380TX Rear

Figure 2 - MPEC 380TX Unit

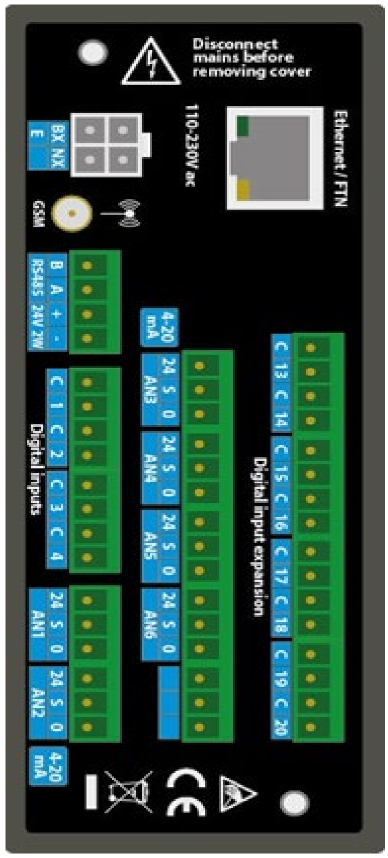
MPEC 380TX Normal Indications		
LED	Normal Indication	Description
IND	FLASHING	Indicates unit processor is running correctly
HDD	INTERMITENT	Lit with Hard Drive Activity
COM	ON	Lit when unit is connected to Remote Server
GSM	FLASHING	Flashes when connected to local network
TRG	INTERMITENT	Lit when a data event is being recorded

Table 2 - Indication Meanings

APPENDIX D - MPEC TX-L



MPEC TX-L Front



MPEC TX-L Rear

Figure 3 - MPEC TX-L Unit

TX-L Logger Normal Indications		
LED	Normal Indication	Description
Server	Steady On	Connected to the Central Data Server
Comm	Steady On	Connected to the GSM Network
GSM	Steady On	Modem Powered On
Master	Slow Flash (1 sec)	Device Operating Normally. (Fast flash 0.25s, Steady On or Off indicates processor fault)
Sampling	Intermittent Blink	Data processing activity
Storage	Intermittent Blink	Data Read / Write from database
Input	Intermittent Blink	Analogue or Digital Input change detected
RS485	Intermittent Blink	Data transmit / receive on RS485 port

Table 3 - Indication Meanings

APPENDIX E - ATLAS MINI-LOGGER

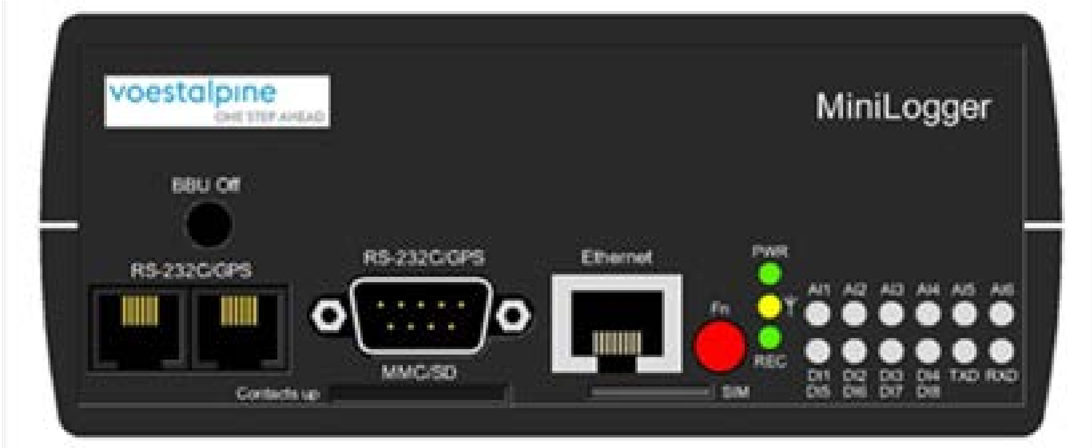


Figure 4 - Atlas Mini-Logger Front #

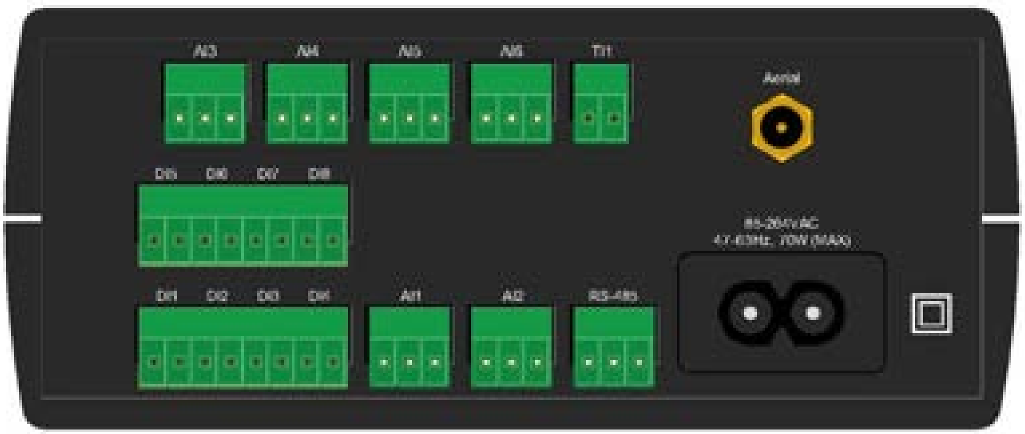
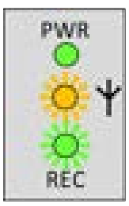


Figure 5 - Atlas Mini-Logger Rear #

NOTE: *#The device shown is typical example of the Atlas Mini-Logger. Variant models are in use with different arrangements of inputs and indications; however, the basic functionality of devices is similar.*



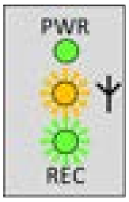
Atlas Mini-Logger Normal Indications		
LED	Normal Indication	Description
PWR	ON	Indicates the unit is powered correctly from an AC source
ANTENNA	FLASHING	Correctly connected to remote server
REC	FLASHING	Unit is logging data correctly

Table 4 - Normal Indications

APPENDIX F - MINI-LOGGER – 2

Figure 6 – ATLAS MINI-LOGGER – 2 FRONT

Figure 7 – ATLAS MINI-LOGGER – 2 REAR



Atlas Mini-Logger - 2 Normal Indications		
LED	Normal Indication	Description
PWR	ON	Indicates the unit is powered correctly
ANTENNA	FLASHING	GPRS/3G Status LED to indicate • Off = Modem Powered Off • On = Modem on, not registered onto the network • Slow flash = Modem on, registered onto the network • Quick flash = Modem on, registered onto the network and communications in progress
REC	ON	Unit is logging data correctly (LED will flash when data is stored to the internal SD card)

Table 5 – Normal Indications

APPENDIX G - RML6

Figure 8 – RML6 Front

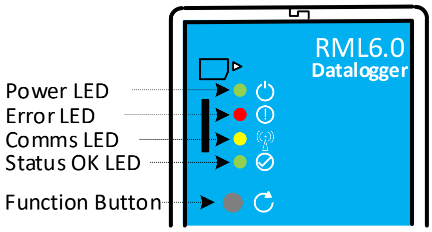


Figure 9 – RML6 LED Explanations

Figure 10 – RML6 Rear

RML6 - Normal Indications		
LED	Normal Indication	Description
PWR	ON	Indicates the unit is powered correctly
Error	OFF	Indicates the unit is operating normally and no error detected by the RML6 (LED is lit when an error is detected)
COMMS	FLASHING	GPRS/4G Status LED to indicate • Off = Modem Powered Off • On = Modem on, not registered onto the network • Slow flash = Modem on, registered onto the network • Quick flash = Modem on, registered onto the network and communications in progress
STATUS	ON	Unit is logging data correctly (LED will flash when data is stored to the internal SD card)

Table 6 – Normal Indications

END

Includes:	Instead 3, Instead 64, Instead 64 Active
Excludes:	All other types of Instead Event Recorder

General

Record any work undertaken on the record card or site log book.

SERVICE A

1. Visual Checks

1.1 Check that the 'Recording' indication is flashing and the fault indication light is not lit.

1.2 Check the displayed time and date are correct. Note that the time is always stated in GMT

SERVICE B

2. Full Test

2.1 Dust the top of the unit and wipe the clear front panel.

2.2 Run the self-test routine, observe that there are no faults indicated.

2.3 Remove the floppy disk from the unit. Using the special cleaning disk provided, run the disk drive cleaning routine. Remove the cleaning disk when completed.

2.4 Check the removed disk on a computer using the 'Instead/Sentinel' office software.

Check all functions operating correctly.

This may be done on site or alternatively the disk can be returned to a central office for this operation.

2.5 If the disk has been interrogated on site, replace it back into the unit. If the disk is to be removed from site for interrogation, insert a blank formatted 720kB disk into the unit (On the Instead 64 Active use a formatted 1.4MB disk).

Check that both disks are marked with the site name, the date and time of removal is marked on the recovered disk and the date and time of installation are marked on the new disk. Check that recording continues on the new disk.

2.6 Record the work done on the event recorder record card or the site logbook.

PERIODIC TASKS

3. Battery Replacement

3.1 Replace the unit's internal 'Cyclon' battery pack.

NOTE: *The battery pack replacement is a workshop job that will require temporary removal from site. See details in NR/SMS/PartC/ER00 (Logging Systems - General).*

3.2 Replace the unit's internal dry battery used for backup of the clock. Reset the time and date (time to GMT).

END

Includes:	Westrex signaling event recorder

SERVICE A

1 Westrix Host Logger Equipment Cubicle

1.1 Visually check the integrity of all connections.

1.2 Check that green 'Power ON' LED indicators on both logger PCs are illuminated.

1.3 Check Radio clock module status using its LCD setup/diagnostic panel.

1.4 Close Host Logger Equipment Cubicle door.

2 Westrix S3 Baseplates

2.1 Electro-static precautions shall be observed where physical contact with S3 equipment can occur.

2.2 Visually check the integrity of all connections.

2.3 Check that the operational status LED indicator displayed on each S3 module is as follows:-

- Power Supply Module (FPS400-24) green
- Data Input Module (DIP-1) green
- Scanner Module (Scanner-1) green

3 Westrix Technicians Terminal

3.1 Visually check the integrity of all connections.

3.2 Power up monitor screen and Check monitor and keyboard for correct operation.

3.3 Investigate and clear any outstanding fault messages.

3.4 Power down monitor screen.

SERVICE B

4 Equipment Cleaning and Inspection

4.1 Clean Technicians Terminal monitor and housing using a proprietary dry anti-static screen cleaner.

4.2 Check that the Technicians Terminal PC cooling vents are clear and its internal fan is operating quietly.

4.3 Clean Host Logger Equipment Cubicle door with a dry lint free cloth with door closed.

4.4 Check that Host Logger PC cooling vents are clear and internal fans are operating quietly.

4.5 Carefully dust the interior faceplates and blanking panels with a dry lint free cloth.

4.6 Close Host Logger Equipment Cubicle door.

5 Periodical Tasks

Technical support staff and/or equipment specialists could manage these tasks separately.

5.1 Replace each Host Logger PC hard disk drive (HD) with a new HD of the same, or a compatible, type.

5.2 Service/replace Host Logger PC cooling fans.

5.3 Replace Host Logger PC Lithium ion coin cell.

5.4 Service/replace Technicians Terminal PC cooling fans.

5.5 Replace Technicians Terminal PC Lithium ion coin cell.

END

Includes:	Alpha and IMP based Portable Loggers and Interlocking Monitoring Systems
Excludes:	

General

Renewed USB sticks will be automatically formatted by the standard Windows 2000 or Windows XP operating system, they will operate regardless of capacity but their size must be sufficient for the site concerned. Record any work undertaken on the appropriate record card or site log book

SERVICE A

1. Visual Checks

1.1 Alpha based systems only

Check that the Alpha Units LED indicators are illuminated
Power steady and RS485 flashing.

1.2 IMP based systems only

Check that the Solartron IMP LED indicators are illuminated for correct operation
Power illuminated but no other LED illuminated.

1.3 Check correct time is displayed. Note that the time is always stated in GMT

1.4 Open the most recent hour of data and verify that logged functions are being recorded.

SERVICE B

2. All Units

2.1 Clean all external surfaces using a lint free cloth and a mild detergent. Do not use any solvents.

2.2 Check the integrity of input connections by checking they are connected and secure.

3. Interlocking Monitoring System

3.1 Check that the processor and rack fans are clear of obstructions and dust that may restrict the airflow, and are running correctly, Rectify as necessary. Clean filters as necessary.

3.2 Carry out the UNINTERRUPTIBLE POWER SUPPLY TESTS (057))

4. Portable Logger

4.1 Check the hard disk for sufficient space until the next 'Service B', archive the old data and then delete the relevant directories to free up space as necessary. For Interlocking Monitoring Systems and Portable Loggers with the full interlocking software, at the end of each year at 2 Minutes after midnight a new year's set of files are automatically created. For other ACIC Portables these will have to be created manually.

4.2 Check modem for correct operation by dialling in.
This may be done visually on modems with LED indicators, accessed by removing the back panel.

A slow flashing LED indicates normal (modem not in use), a fast flashing LED indicates modem connected and a continually illuminated LED means no service available.

PERIODIC TASKS

5. Battery Replacement (All Systems)

5.1 Release 4 screws securing the back facing panel to gain access to Motherboard and replace the lithium cell.
This task must only be carried out when the system is isolated from the equipment it is monitoring.

The battery type is CR2032.
This should also be carried out if the clock display loses time or there is a BIOS failure.

6 Associated UPS System (Where Fitted)

6.1 Replace the batteries in the associated UPS system The UPS documentation will give the suggested periodicity for replacement.

6.2 Carry out the UNINTERRUPTIBLE POWER SUPPLY TESTS (057).

End of Periodic Task

Reliability - Centred Maintenance

SERVICE RE Carry out service A and B of this SMS

End

Includes:	Alpha 933 and Solartron IMP based Wall Mounted and Rack Mounted Event Loggers
Excludes:	All other logger types

General

Renewed USB sticks will be automatically formatted by the standard Windows 2000 or Windows XP operating system, they will operate regardless of capacity but their size must be sufficient for the site concerned. *Record* any work undertaken on the appropriate record card or site log book

REGULAR CHECKS

1. System logging

1.1 At sites with remote access and as locally agreed, either manually or by automated programme, download the last hour's data and check that the logger is logging.

SERVICE A

2. Visual Checks

2.1 Alpha 933 based systems only

Check that the Alpha Units LED indicators are illuminated.

Power steady and RS485 flashing.

2.2 Solartron IMP based systems only

Check that the Solartron IMP LED indicators are illuminated for correct operation.

Power illuminated but no other LED illuminated.

2.3 Check the correct time is displayed. Note that the time is always stated in GMT

2.4 Open the most recent hour of data and verify that logged functions are being recorded.

SERVICE B

3. Clean and Visual Inspection

3.1 Clean all external surfaces using a lint free cloth and a mild detergent. Do not use any solvents.

3.2 Check the cabinet earth bonding is secure at the Door, Cabinet Side, Side Panels (Rack Mounted system only), Rear Mounting Plate, and Gland Plate.
Visually check the integrity of connections.

4. PC Case Fan/Filter

4.1 Remove the front panel fan cover and Check that the PC fan is running. Rectify as necessary. Replace both the fan and filter unit together.

4.2 If the fan was not replaced, remove the filter cover and either Clean (plastic bubble type) or fit a new filter.

4.3 UNINTERRUPTIBLE POWER SUPPLY TESTS (057).

PERIODIC TASKS

The following tasks are to be carried out by suitably competent staff. These tasks must be carried out when the PC has been fully disconnected.

5. Motherboard CPU & PSU Fans & Battery Replacement

5.1 Remove the 6 securing screws and remove the PC cover to access the motherboard.

5.2 Replace the following:

- CPU heat sink fan.
- The fan in the rear of the PC PSU
- The lithium battery cell.
- See CD containing PC manual for type.

6 Associated UPS System (Where Fitted)

6.1 Replace the batteries in the associated UPS system The UPS documentation will give the suggested periodicity for replacement.

6.2 Carry out UNINTERRUPTIBLE POWER SUPPLY TESTS (057).

End of Periodic Task

Reliability - Centred Maintenance

SERVICE RE Carry out service A and B of this SMS

End

GENERAL

Detailed instructions for this recorder are provided in the user manual that is supplied with each recorder.

Record any work undertaken on the appropriate record card or site logbook.

SERVICE A

1. System Operation

Service A may be carried out remotely if the facility is available.

NOTE: *Touching the logger front screen will cause the display to light.*

1.1 Check that the time shown is correct.

NOTE: *the time is always stated in GMT.*

1.2 Open the most recent hour of data using the touchscreen and verify that logged functions are being recorded.

SERVICE B

2. Inspection and Test

2.1 Check that all logger cable connectors are pushed fully home, and that the logger housing is secure.

2.2 Carry out NR/SMS/PartB/Test/057 (Uninterruptible Power Supplies Test).

NOTE: *Where no external UPS is provided, the test period should be a maximum of three hours.*

PERIODIC TASKS

3. UPS System (Where Fitted)

3.1 Replace the batteries in the associated UPS system.

NOTE: *The UPS will need to be placed in by-pass and the batteries isolated from the supply.*

The UPS documentation will give the suggested periodicity for replacement.

3.2 Carry out NR/SMS/PartB/Test/057 (Uninterruptible Power Supplies Test).

4. Internal Inspection & Battery Replacement

These tasks are to be carried out by the manufacturer or a servicing agent approved by the manufacturer.

These tasks should only be carried out when the logger has been fully disconnected.

4.1 Replace the internal battery in accordance with the manufacturer's procedure.

4.2 Fully inspect and functionally test the logger in accordance with the manufacturer's procedure.

SERVICE RE Carry out service A and B of this SMS.

END

Includes:	DOS based Trackwatch Max, Trackwatch LX & Trackwatch Lite systems that use IMPs to collect digital event data
Excludes:	Windows based and Atlas Technology based Trackwatch products

Anti-static precautions are required when working on the Trackwatch Controller Internal Circuitry.

General

This system uses Solartron IMP units to interface with signalling functions and gather data, which is then forwarded to the Trackwatch Controller using an S-Net connecting system. The Trackwatch Controller provides time, date, and storage for the logged data, and has facilities for local and remote interrogation and retrieval. Certain systems may have Modbus devices connected as well as or instead of IMPs, for maintenance of these refer to manufacturer's documentation.
Record any work undertaken on the appropriate record card or site log book.

Equipment

A suitable multimeter and portable VDU and keyboard or laptop PC with pc anywhere installed (and on logger) are required.

SERVICE A

1. UPS & IMPs

1.1 Check the LEDs on the IMP units are lit as appropriate for normal working, note that the Power LED should always be lit, investigate and rectify as required.

SERVICE B

2. Trackwatch Controller

2.1 Connect VDU to the output socket at rear of Trackwatch Controller. Connect the portable VDU and keyboard or laptop PC to the Trackwatch Controller.

This provides either an 110V isolated supply (no other 110V supply is to be used) or 230V.

A cross-over Ethernet cable must be used.

2.2 Investigate and rectify any faults indicated in upper window of display.
Note that some faults may need to be dealt with at the next task, when logging is stopped.

2.3 At sites not implementing Service A, stop the logging and inspect the last hour's data and system health file to check the logger is working correctly.

2.4 Enter directory C:\EVA and use DOS commands to copy the entire directory to the floppy disk, Check the floppy disk now has the directory.

2.5 Delete the Watchdog log file and Check that the hard disk has sufficient spare capacity for all data up to the next Service B, if in doubt ask your SSM.

2.6 This task should be performed only If the system is running slow or there are system performance issues:

Run DOS commands 'SCANDISK' then 'DEFRAG' and Record any bad sectors in the log book.

2.7 Check the system date & time by entering directory C:\ALTAIR and running the command 'TIME'.

Note that the time is always stated in GMT

2.8 Test the system Watchdog by exiting the program and leaving it running at "Exit Yes/No" screen. Time the system to check that it automatically reboots in under two minutes.

2.9 Replace the floppy disk, labelling the removed one and returning it to your SSM.

2.10 Restart the Trackwatch Controller and check the screen for error messages, press F6 for a health check, before removing the portable VDU and keyboard or laptop PC.

2.11 Check that main fan is rotating.

3. Equipment Cubicle

3.1 Clean the air intake filters and check any air vents are clear of any obstructions.

3.2 Clean the cubicle exterior with a suitable non- abrasive cleaner.

3.3 Dust the cubicle interior with a dry lint free cloth.

3.4 Where provided, Carry out the UNINTERRUPTIBLE POWER SUPPLY TESTS (057).

3.5 Visually Check cables and connections.

4. System Filters

4.1 Switch off Trackwatch Controller.

4.2 Replace filter gauze at the front of the Trackwatch Controller with manufacturers approved part

TN6 type uses RS part number 184-5141.

4.3 Using an air duster, Clean the power supply grid at the rear of the Trackwatch Controller.

4.4 Switch on Trackwatch Controller.

PERIODIC TASKS

5. Trackwatch Controller Internal Circuitry

5.1 Switch off Trackwatch Controller, then disconnect, and remove it from cabinet or other housing.

5.2 In a suitable workshop environment with electrostatic protection remove outer case.

5.3 Blow away any dust that has built up on the circuit boards with an air duster.

5.4 Replace processor cooling fan.

5.5 Replace system internal battery (5 yearly).

5.6 Refit outer case.

5.7 Refit in cabinet and reconnect all cabling, fit portable VDU and keyboard.

5.8 Switch Trackwatch Controller on and Observe the start-up routine.

5.9 Investigate any error messages and Rectify.

5.10 Remove portable VDU and keyboard.

6. Associated UPS System (Where Fitted)

6.1 Replace the batteries in the associated UPS system
The UPS documentation will give the suggested periodicity for replacement

6.2 Carry out the UNINTERRUPTIBLE POWER SUPPLY TESTS (057).

End of Periodic Task

Reliability - Centred Maintenance

SERVICE RE Carry out service A and B of this SMS

END

Includes:	Any Voestalpine, Atlas system including the Mini logger, Mini logger 2 & RML6 used for logging data acquired through digital, analogue, or serial interfaces
Excludes:	External equipment such as sensors, cabling, and isolation devices

General

Atlas, logging systems can be configured to log digital and analogue functions, and combinations of these. There are several models to accommodate different numbers of monitoring channels and asset types. Table 1 places these types into three categories:

Logger Description	**Category**
PC card rack-based system (Atlas)	Rack Atlas Systems
Mini Logger: Lite, Serial, Analogue, Plus, VTI, HVI	Legacy Mini loggers
Mini Logger 2 & RML6	Web based Loggers

Table 1 – Logger Categories

The sensors used by analogue systems, and any cabling, fastenings and external isolation required to connect such sensors, are subject to separate and additional maintenance requirements.

Test Equipment (Atlas – Rack Atlas) & (Legacy mini loggers)

A multi-meter and laptop computer with a terminal emulator.

Test Equipment (Web based)

A multi-meter and laptop computer with a compatible web page browser.

SERVICE A

1. Visual Checks (Atlas – Rack Atlas) & (Legacy mini loggers)

1.1 Observe that all indications are illuminated for normal working.

NOTE: *Rack Atlas and Mini Loggers channels indications need to be triggered to turn on its indications.*

1.2 Check Rack Atlas display for error messages and for correct time.

NOTE: *The time is always stated in GMT.*

1.3 Open the most recent hour of data and verify that logged functions are being recorded.

Mini Logger Only (Legacy mini loggers)

1.4 Visually check that the system and its connections are suitably secured to prevent accidental electrical contact with other signalling systems.

2. Visual Checks (Web based loggers)

2.1 Observe that all indications are illuminated for normal working.

2.2 Visually check that the system and its connections are secured to prevent accidental electrical contact with other signalling systems.

SERVICE B

NOTE: *The tasks in this service are optional for the Mini Logger connected to a central server.*

3. Interrogation of System (Atlas – Rack Atlas) & (Legacy mini loggers)

3.1 Connect the PC to the Atlas using either the Ethernet or Null modem connections and run 'Hyper-Terminal' to establish a valid connection.

NOTE: *The Ethernet cable must be of the 'cross-over' type.*

3.2 Log on to the Atlas using your password.

3.3 Type the word 'STAT' and press the return key. Rectify any faults indicated in the PC display.

3.4 Check that any media cards are installed in the Atlas using the PC on-screen menu.

3.5 Remove the media card from the front of the Atlas. Push the card into the slot and release.

It should pop up sufficiently to enable removal.

3.6 Insert the media card into the PC and copy the contents to the laptop memory, then check for correct copying.

3.7 Refit the media card in the Atlas.

NOTE: *When the media card is re-inserted, the logger may start to bleep. This indicates the internal and external cards are syncing data. This bleeping will cease once both cards have the same data. Some newer style loggers only have one internal media card. Steps 3.5 to 3.7 can be ignored in this case.*

3.8 Log off from the Atlas logger and disconnect the PC.

3.9 Check the Atlas display for error messages and rectify any faults identified.

4. Interrogation of System (Mini Logger 2 & RML6)

4.1 Connect the PC to the Mini logger or RML6 using an Ethernet Cable and open a web page using the integral IP address 169.254.201.100 to establish a valid connection.

4.2 Select “Mini Logger Status” from the web page menu.

4.3 Rectify any faults indicated on the web page.

4.4 Click on the Voestalpine Logo to return to the menu.

4.5 Select “Mini Logger Diagnostics” and check the Loggers Date and Time, using the tab on the web page. Correct if needed.

You are prompted for your Voestalpine Password.

NOTE: *Passwords can be obtained from the user manual or your local Technical Support.*

5. System Cubicle or Housing

NOTE: *This section is not applicable to the Mini Logger*

5.1 Check the air vents are clear of any obstructions, clean or renew any filters as necessary.

5.2 Clean cubicle exterior with a suitable non-abrasive cleaner.

5.3 Dust cubicle interior with a dry lint free cloth.

6. Power and Connections

6.1 Carry out the NR/SMS/PartB/Test/057 (Uninterruptible Power Supplies Test).

6.2 Visually check all cables and connections are secure.

7. PERIODIC TESTS

7.1 Using eye protection, remove the Atlas from housing, open system cover and using an air duster carefully blow away any dust from the interior.

7.2 Replace the system internal battery.

7.3 Re-fit system cover and secure with screws, re-fit Atlas into housing and secure.

7.4 Reconnect all associated cabling, attach screen and keyboard, and switch the system on.

7.5 Observe the start-up routine and check that the program is launched using the system Autoexec file.

7.6 Observe the system messages at the top of the screen; Check that no system errors occur during boot-up.

7.7 Remove the screen and keyboard

End of Periodic Task

Reliability - Centred Maintenance

SERVICE RE Carry out service A and B of this SMS.

END

Includes:	Balfour Beatty Rail Ltd. Relay^{ALERT} data logging system
Exclude:	All other logging/event recording systems

Take anti-static precautions when working on the RelayALERT Data Logging System.

General

Detailed instructions for this data logger can be found within the user manual provided at each site where a logger has been installed. System icons can be found in Appendix A.

Relay^{ALERT} data logging systems can be configured to log digital functions. There are two sizes of housing to accommodate different numbers of monitoring channels. A master Relay^{ALERT} alongside a maximum of 7 slave data loggers can be configured to measure a total of 3072 channels.

SERVICE B

1. System Operation

The checks specified in this section are only applicable to the Relay^{ALERT} master logger unless the slave is specifically referenced. Where there is a single data logger present, consider this unit to be the master.

1.1 Touch logger screen to illuminate then proceed with the tests listed below.

1.2 Functions being logged by the data logger should appear on the screen of the master data logger as they change state.

NOTE: where one or more slave loggers have been installed, the functions being logged by these will also appear on the screen of the master logger.

1.3 Check the correct time is displayed along the bottom of the screen.

NOTE: the time is always displayed in UTC.

1.4 Open the most recent hour of data and check that logged functions have been recorded.

1.5 To check the ability to retrieve data from the external storage:

a. Click remove memory stick on the data logger screen and wait for the logger to instruct you it is safe to remove the memory stick

b. Remove memory stick from the data logger

c. Insert into a laptop and review the log.txt file for the current date – this will be located within WWW\Current Date

d. Check the file opens and contains logged events

e. Remove USB memory stick from laptop/computer and reinsert into data logger.

This applies to slave loggers only.

1.6 Check the IND light is flashing steadily showing connection to the master data logger

2. Inspection and Test

2.1 Check all data and power cables are connected securely and are fully inserted to both the data logger and the breakout board.

2.2 To check the health of the internal UPS follow UNINTERRUPTIBLE POWER SUPPLY TESTS (057)

NOTE: The test period should be for a minimum of 30 minutes and a maximum of 3 hours.

Whilst this test is being carried out on a master data logger observe the change in state of the icon on the bottom of the screen in accordance with Appendix A.

PERIODIC TASK

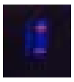
3. Internal Inspection and Battery Replacement

3.1 Periodic replacement of the data logger battery should only be carried out by the manufacturer or an approved agent and in accordance with the manufacturer's procedure.

It is recommended the battery should be replaced every 5 years.

This task shall only be carried out when the data logger has been disconnected from mains power and fully shutdown.

APPENDIX A

	**Relay^{ALERT} data logger icons**
	Icon when memory stick inserted
	Icon when memory stick removed
	Icon when mains power connected
	Icon when mains power removed

END

Includes:	Power Ground Frame, Mechanical Ground Frame
Excludes:	Points, Signals and Connections

SERVICE A

1. Visibility

1.1 Check signals and points are visible from the ground frame.

The operator shall have an unobstructed view of signals and points or is provided with indications.

2. Power Ground Frame

2.1 Maintain the trackside apparatus case/housing in accordance with NR/SMS/PartC/EL21 (Trackside Apparatus Case).

2.2 Maintain the switch panel in accordance with NR/SMS/PartC/SB11 (Signallers Control & Indication Panels or Displays).

3. Mechanical Lever Frame

3.1 Maintain in accordance with NR/SMS/PartC/LV11 (Lever Frames - Non Specific) or NR/SMS/PartC/LV12 (Lever Frame - Direct Locking), as relevant to the frame type.

4. Structure

4.1 Check structure, landing boards, staging, handrails, and stanchions (etc) for signs of serious rotting, corrosion, cracks, deterioration or damage. Report significant deterioration as corrective maintenance

4.2 Check that all covers and boards are properly fitted.

5. Cables and Wires

5.1 Check tail cables are correctly routed, secure and free from damage.

5.2 Check cable terminations. Protect as necessary.

5.3 Examine wires and cable cores for signs of damage and degradation.

5.4 Check that wiring is secure, properly routed and clear of moving parts.

6. Diagram

6.1 Check diagram is clean, legible, undamaged and secure.

6.2 Clean using damp cloth, dampened with dilute detergent.

7. Electric Locks and Circuit Controllers

7.1 Maintain in accordance with NR/SMS/LV21 – LV41.

8. Key Release Instrument

8.1 Maintain in accordance with NR/SMS/PartC/LV51 (Key Release and Token Instruments).

9. Plunger/Switch

9.1 Dust and examine plunger/switch mechanism, linkage, terminations, wires and fixings.

10. Needle Indicator (Spagnoletti)

10.1 Dust and examine exterior.

10.2 Check clarity of label/artwork.

10.3 Examine interior mechanism, particularly for:

a) Any damage or misalignment to needles/banners. Do not attempt to clean or oil.

b) Degraded terminations or wires.

10.4 Clean the glass.

10.5 With no current applied, gently operate the needle by hand. Observe it returns smoothly and rapidly when released.

10.6 Apply current for each position and check that the needle does not overdrive.

10.7 Check wires cannot be trapped or damaged; carefully replace and secure cover.

10.8 Request the Signaller to operate and observe correct operation.

11. Lamp Indicators

11.1 Dust and examine exterior.

NOTE: *Carefully remove the cover.*

11.2 Examine the interior, pay particular attention to:

a) Terminations and wires.

b) Lenses and lens engravings.

11.3 Check the lamps.

11.4 Clean the glass.

11.5 Examine fixings.

11.6 Carefully replace and secure cover.

11.7 Request the Signaller to operate and observe correct operation.

12. Telephone

12.1 Maintain in accordance with NR/L3/TEL/30181/011 - Maintenance of Operational Telephones.

SERVICE B

13. Function Test (Mechanical Lever Frames)

Simple ground frames only (e.g. 1 releases 2, 2 reverse locks 1). Layouts that are more complex might require a certified tester. If in doubt, ask your SM(S).

13.1 Check that the release lever is locked until a release is given by the controlling signal box or release mechanism/key.

13.2 Obtain a release and test (pull through) the operation of the ground frame.

13.3 Check that the controlling signal box cannot take the release back or the release mechanism/key remains locked until the release lever is replaced normal in the frame.

When replaced normal, check that the controlling signal box can take the release back or the release mechanism/key is unlocked and the release lever is locked.

14. Function Test (Power Ground Frames)

14.1 Check that the panel is inactive until a release is given by the controlling signal box.

14.2 Test the operation of the switch panel.

14.3 Check that the controlling signal box cannot take the release back until the panel is normalised.

When normalised, check that the controlling signal box can take the release back and the panel is inactive.

END

Mobile telephones that are switched on shall not be brought in close proximity of operational VDU based equipment.

SECTION INDEX

1. IECC – Classic
2. IECC – Scalable
3. Modular Control System (MCS)
4. WESTCAD
5. ElectroLogIXS

1. IECC - CLASSIC

Integrated Electronic Control Centre (IECC) - Classic.

Commonly Used Abbreviations.

Abbreviation	Meaning
ARS	Automatic Route Setting Subsystem
DIS	Flexible Display Subsystem
ECS	External Communications Subsystem
FBS	Fringe Box Subsystem
GWS	Gateway Subsystem
ISM	IECC System Monitor Subsystem
RII	Remote Interlocking Interface Subsystem
SDS	Signalling Display Subsystem
SPAD	Signal Passed at Danger
SSI	Solid State Interlocking
TTP	Timetable Processor Subsystem
IPL	Data Logging Facility
VDU	Video Display Unit (Monitor)

Table 1 - Commonly Used Abbreviations

ARS The ARS determines the optimum routing of trains in the area based on the timetable, their current position, their importance and their destination. It automatically requests the required route when they are available.

DIS DIS is a PC based operating interface between the IECC and the Signaller.

ECS The ECS provides an interface between the information networks and systems that cannot use the IECC's communications protocols or data notations.

FBS The FBS provides a train describer map, interpose and cancel facilities for the fringe Signaller via a monitor and keyboard.

GWS The GWS provides a link between the signalling network and the information network. It transfers information between the two when the source and destination are not on the same network. It also provides a buffer storage facility between the two networks.

ISM The ISM monitors the operation of all the subsystems in the IECC system and of the two networks and reports the system status to the Technicians. It also provides aids for fault finding and for reconfiguration of the IECC.

RII The RII enables a relay interlocking to be interfaced into an IECC in place of using a SSI interlocking.

TTP The TTP processes the timetable information for the IECC and the surrounding areas. This information is used by the ARS.

IPL The IPL provides the data logging facility in place of the PSM where the IECC is equipped with a DIS vice an SDS.

Master/Standby Changeover Testing

You shall liaise with the Signaller before initiating a changeover from master to standby. The changeover shall be initiated by command from the ISM (except when testing the status control panel).

Use the manual reset to restore from the failed to the available state and observe that further transition to standby takes place.

Following an ARS changeover, the Signaller needs to re-enable the ARS sub-areas as required.

Subsystem status shall be confirmed by using the ISM.

DIS Hot Standby

The DIS hot standby is confirmed by observing that the VDU information remains the same before and after a manual operation of the video switch.

Circuit Boards

To avoid damaging the circuit boards refer to the instructions in the IECC Technical Handbook, section IECC 6000 before attempting to extract, insert or move boards.

ISM Printout

Alarms/reports on the printout shall be noted and action taken as necessary.

ISM Printer

Printer paper and cartridges/ribbons shall be changed as detailed in the printer manufacturer's instructions.

Recording Medium, Storage and Rotation

The recording mediums should be handled carefully and removed from service if found to be damaged.

They should not be stored in hot or damp places and should be kept away from any magnetic fields.

They should be used in rotation to store data for a given period (this is usually seven days). The medium containing the oldest data should be used as the next replacement.

Tape Head Cleaning

Tape heads shall be cleaned as detailed in the manufacturer's instructions. Head cleaning tapes SHALL NOT be used.

Keyboard Maintenance

Keyboards should be held upside down when dusted.

VDU Screen Cleaning

Screens should be cleaned using an anti-static VDU cleaner following the manufacturer's instructions.

Tracker Ball

If the action of the tracker ball is not smooth, it should be cleaned or replaced.

VDU

VDU monitors using cathode ray tubes as the display media do require the degaussing if the colour display has deteriorated. In severe cases the monitor should be changed.

This does not apply to LED monitors.

Records

Record all IECC associated activities along with the time, date and signature in the site log.

IECC (Upgrade U003) System Architecture

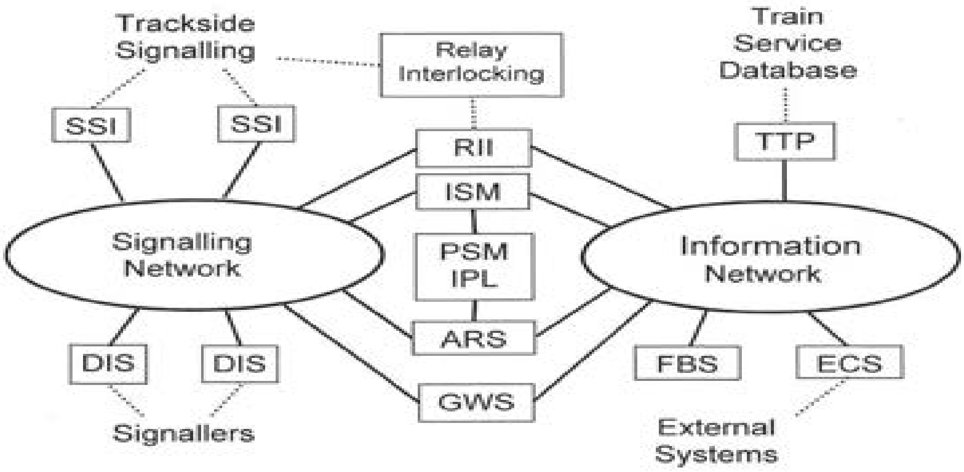


Figure 1 – IECC System Schematic

2. IECC - Scalable

Integrated Electronic Control Centre (IECC) – Scalable system description

IECC Scalable is a modern Signalling Control system designed to use up to date computer and network components commonly found in many high availability information technology applications.

The system provides the Signaller with the tools to monitor and control train movements and the state of the signalling infrastructure through a VDU based workstation.

IECC Scalable comprises sub-systems which replicate the functions of those found in IECC Classic. Ethernet network technology and a new sub-system, the Message Broker replaces the Nine-Tile network or Advanced Virtual Network of IECC classic.

Commonly Used Abbreviations

Abbreviation	Meaning
ARS	Automatic Route Setting Sub-system
CEG	Combined ECS and GWS
DIS	Flexible Display Sub-system
ECS	External Communications Sub-system
GWS	Gateway Sub-system
ISM	IECC System Monitor Sub-system
NAS	Network Attached Storage
RAID	Redundant Array of Inexpensive Devices
SII	SSI Interlocking Interface Sub-system
SSI	Solid State Interlocking
TD	Train Describer
TI	Technician's Interface
TTP	Timetable Processor Subsystem
VDU	Video Display Unit (Monitor)

Table 2 - Commonly Used Abbreviations

ARS The ARS determines the optimum routing of trains in the area based on the timetable, their current position, their importance and their destination. It automatically requests the required route when they are available.

CEG CEG provides the IECC Scalable with an interface to systems which provide data to and/or receive data from IECC Scalable, but do not use standard IECC Scalable protocols or data structures. E.g. TDs at adjacent signal boxes, SMART, etc.

DIS The DIS is a PC based operating interface between the IECC and the Signaller.

ISM The ISM monitors the operation of all the subsystems in the IECC system and of the two networks and reports the system status to the Technicians. It also provides aids for fault finding and for reconfiguration of the IECC. Interrogation of the ISM is via the TI.

SII Manages communications with SSI (and SSI derived interlockings) forwarding controls to the interlocking and receiving state of railway indications. SII also passes the interlocking diagnostic status to other Scalable sub-systems.

TTP The TTP processes the timetable information for the IECC and the surrounding areas. This information is used by the ARS.

NAS The NAS provides the data logging facility for ISM, ARS and TTP. This uses RAID technology and enables hot-swapping of the Hard Disk Drives.

Master/Standby Changeover Testing

You should liaise with the Signaller before initiating a changeover from master to standby. The changeover should be initiated by command from the ISM (except when testing the status control panel).

Use the manual reset to restore from the failed to the available state and observe that further transition to standby takes place.

Following an ARS changeover, the Signaller needs to re-enable the ARS sub-areas as required.

Subsystem status should be confirmed by using the TI.

DIS Hot Standby

DIS Hot Standby is confirmed by observing that the VDU information remains the same before and after a manual operation of the video switch.

Circuit Boards

These are susceptible to damage through electro-static discharge and through physical damage while handling. To avoid damaging the circuit boards refer to the instructions in the IECC Scalable maintenance manual before attempting to extract, insert or move boards.

Keyboard Maintenance

Keyboards should be held upside down when dusted.

VDU Screen Cleaning

Screens should be cleaned using anti-static VDU cleaner following the manufacturer’s instructions.

Tracker Ball

If the action of the tracker ball is not smooth, it should be cleaned or replaced.

Records

Record all IECC associated activities along with the time, date and signature in the site log.

3. Modular Control System (MCS)

The control system is generically called a Modular Control System (MCS). The structure of the system can vary depending upon the equipment it includes and the task it is performing.

Later systems are based around the Delphin 1024 platform or the Sapphire T48 platform; these can be configured as different sub-systems within the overall system.

The Signallers control equipment can be a VDU based control centre or a panel based control centre using a switch or NX panel.

As the system is 'modular' the SMSs for this equipment are separate. For the preventative maintenance of an MCS system some or all of the following SMSs are applicable:

SMS	Title
NR/SMS/PartC/CS06	Control System - Modular Control System
NR/SMS/PartC/IC51	Logging & Archive System (formerly GETS)
NR/SMS/PartC/IC61	Rugby Whole Route Display System
NR/SMS/PartC/TD42	GE Automatic Code Insertion (ACI) Terminal
NR/SMS/PartC/SB11	Signallers Control & Indication Panels or Displays

Table 3 - Maintenance Tasks

The tests applicable to the system (NR/SMS/PartB/Test/) are linked from the task SMS. Your work order advises you as to which tasks and tests are applicable to the system you are maintaining.

NOTE: *Earlier MCS systems not based around Delphin 1024 or Sapphire T48 platform are covered by other SMS's.*

System Architecture

The diagrams on the following pages give an outline of the system architecture for the permutations of GETS systems based on the Delphin 1024 and the Sapphire T48.

Please note that these are generic outlines and actual system configurations can vary, if you are in any doubt about the configuration of the system you are working on, ask your SM(S).

DELPHIN 1024 SYSTEM - RC / TDM & PIIU SYSTEMS

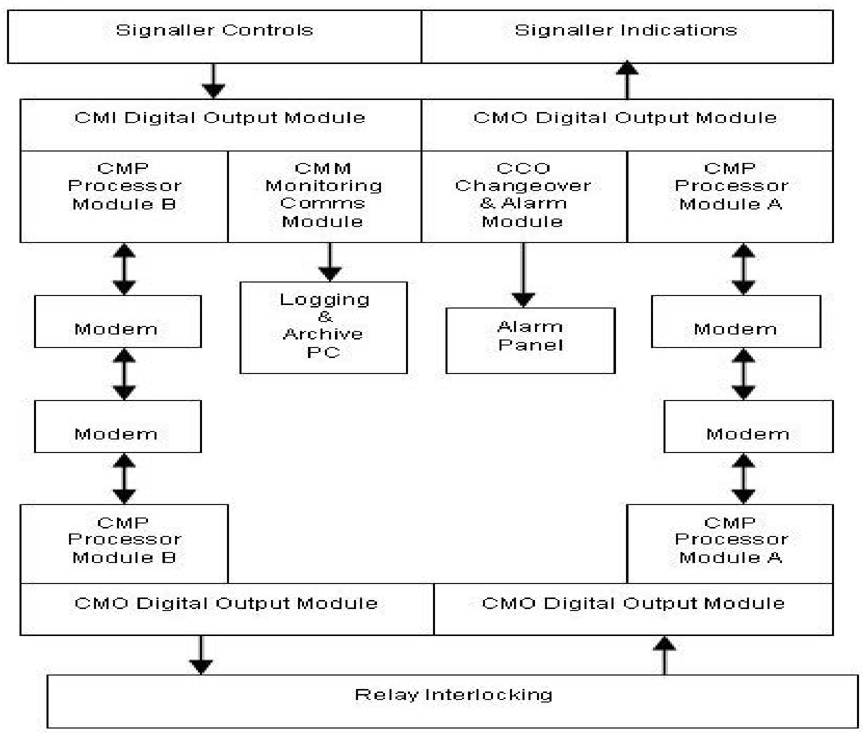


Figure 2 - Office End

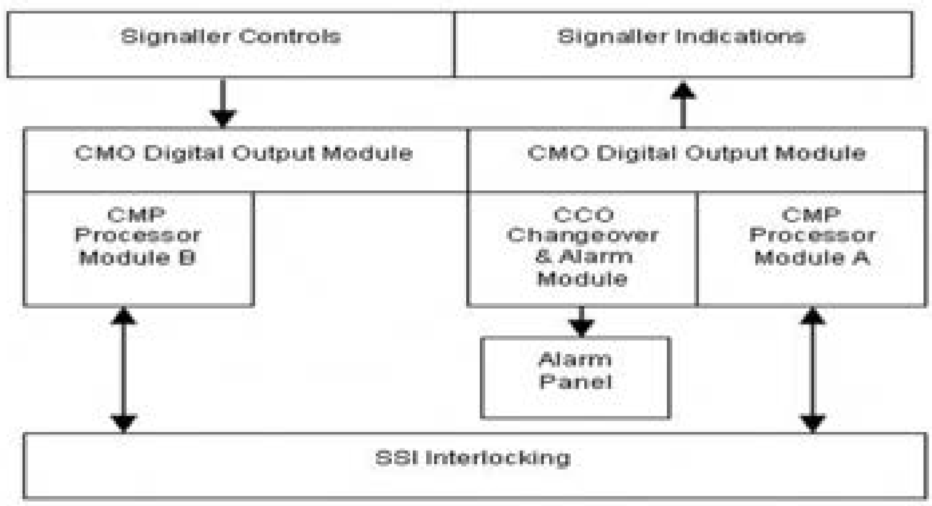


Figure 3 - Field End - PMUX

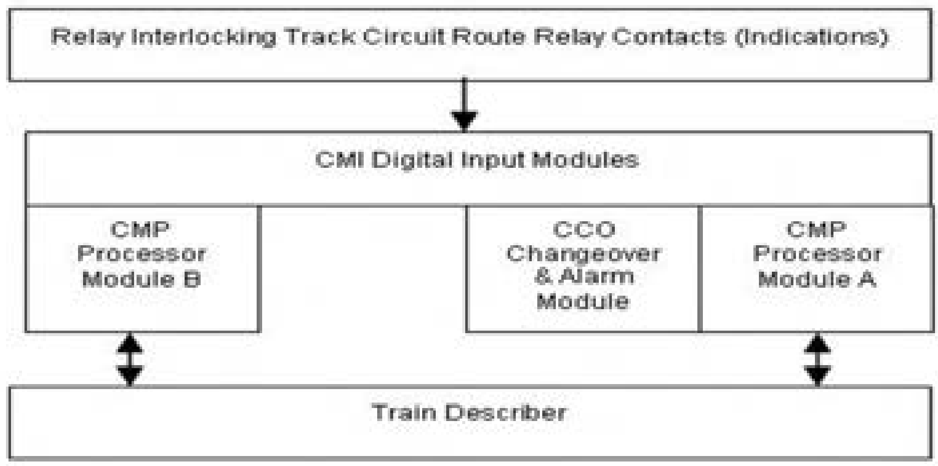


Figure 4 - Field End - TDMUX Systems

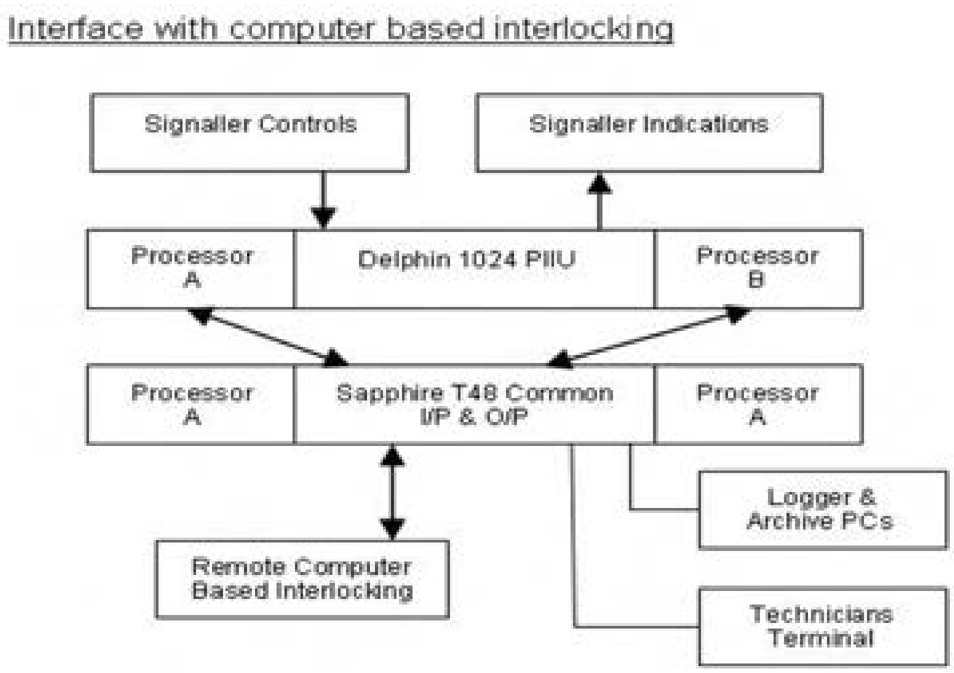


Figure 5 - Sapphire T48 Systems

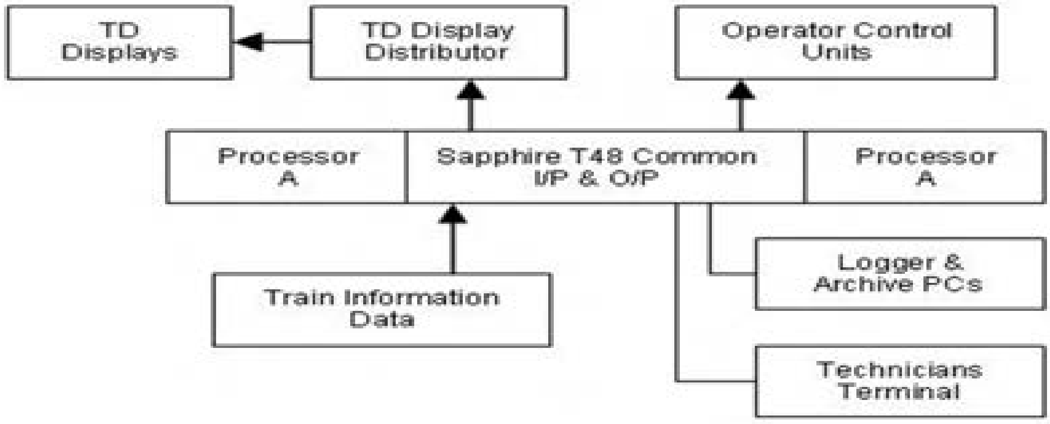


Figure 6 - Train Describer Interface

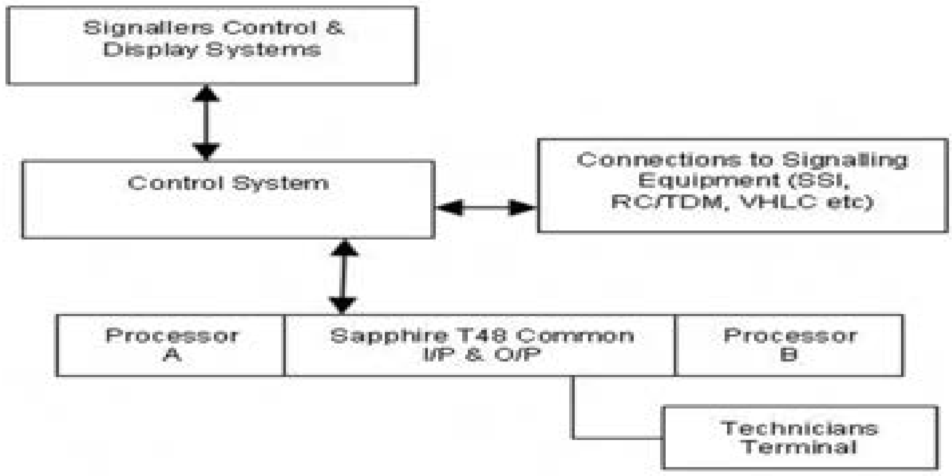


Figure 7 - SPAD Alert System

4. WESTCAD

Controlguide WESTCAD is an integrated Signalling Control System that provides a flexibly configurable platform for the control and indication of railway signalling.

This typically has a Signaller's user interface in the form of either a VDU based workstation or via a panel, and an interlocking control interface which can be to CBIs, SSIs, RRIs, or a combination of these.

WESTCAD can have an integral Train Describer (TD) or be interface to an external TD.

Automatic Routeing functions might be integrated or provided by interfacing to third party ARS products.

The WESTCAD system might be configured as a single hardware unit or as interconnected sub-systems performing specific functions.

The sub-system interconnection might be direct serial interfaces or by Ethernet networks.

There are two variants of the WESTCAD hardware platform: those based on legacy Compact-PCI modules and those using the later Modular Control Rack (MCR).

WESTCAD systems or sub-systems are assembled from standard modules comprising:

a) Power supplies and power filters.

b) CPUs and rear transition cards.

c) System Arbiter and rear transition cards.

d) Video output.

e) Serial Communications interfaces.

f) Video change-over.

g) Serial Communications change-over.

h) Modems.

Systems can have single or dual PSUs, Single or Dual CPUs. Modems can be integrated or external (depending on the Platform used).

A typical dual-redundant MCR system might have the following configuration:

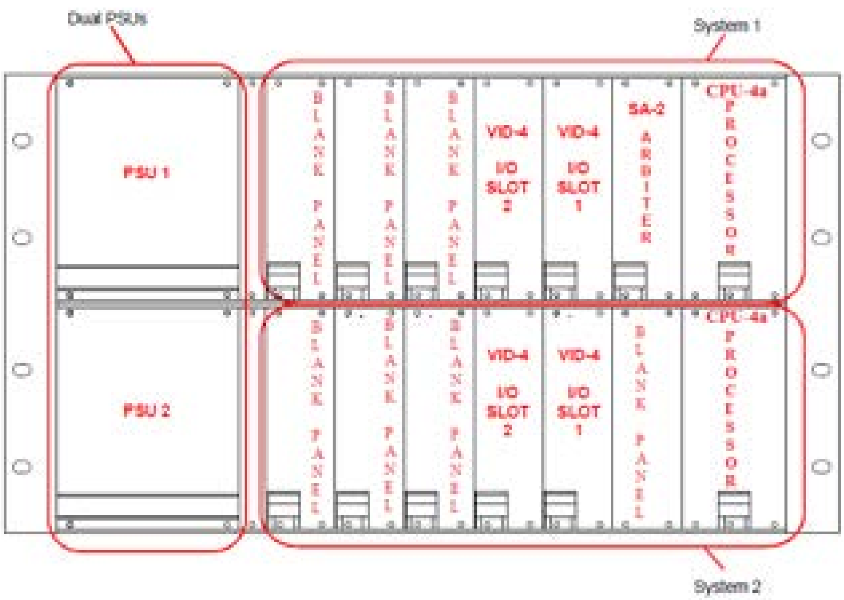


Figure 8 - Front Mounted Modules

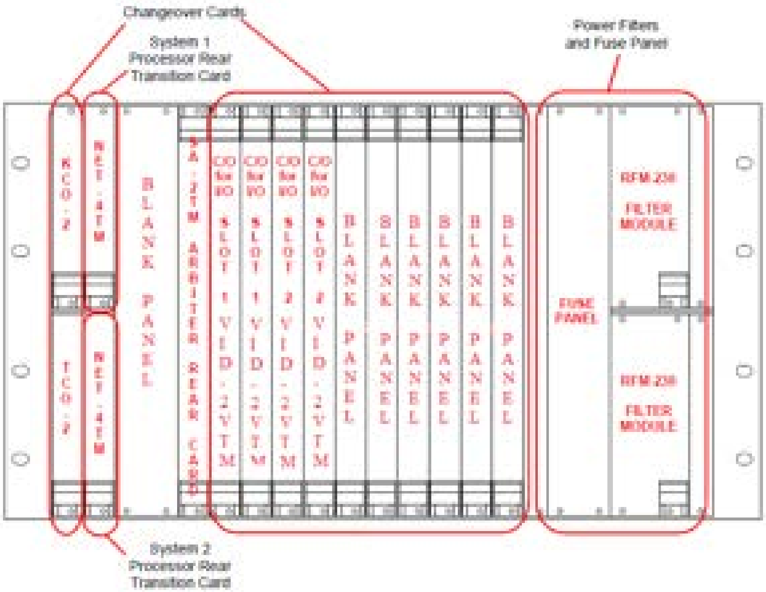


Figure 9 - Rear Mounted Modules

A PC based Technicians' terminal provides logging facilities and allows reconfiguration of the display system if necessary.

The terminal can be remote from the WESTCAD system and connect via a local area network (LAN) link.

Controlguide WESTCAD-E is a development of WESTCAD which provides additional interfaces and functionality to support the introduction of Traffic Management (TM) systems, ETCS signalling, and Automatic Train Operation.

This product uses the same MCR hardware platform as WESTCAD, but is configured into specific sub-systems:

a) Service Control Server (SCS).

b) Service Control Workstation (SCW).

c) Service Control Terminal (SCT).

d) ETCS Diagnostics Terminal (EDT)

e) Remote Interface (RIF) variants -

- Interlocking.
- RBC.
- Voice.
- CCTV.

Each system configuration only uses those sub-systems that are required for that instance, e.g. non-ETCS configurations do not need an SCT.

5. ElectroLogIXS

The ElectroLogIXS VLC is a generic logic processing platform, with the functionality being defined by the software i.e. the ElectroLogIXS System Software.

This means an ElectroLogIXS can be configured by the application designer to fulfil the functionality of different signalling system components that would normally use bespoke products.

For example, a single ElectroLogIXS unit can be used as the basis for an interlocking, or an object controller, or both simultaneously.

Some of the plug-in hardware ("modules") are the same for both configurations, and some might be different, and the application data stored in the unit is different, but the general features, limitations and appearance are the same.

All application modules have front panel indicators that display module health status and indicate individual I/O status.

Parameter set-up and modifications can be performed via the VPM-3 web graphical user interface (web GUI) or via a local control/display unit at the ElectroLogIXS.

The Web GUI runs on a separate computer, or similar device, running a web browser.

There are 3 chassis types; 1, 4 and 9 slot, which correspond to the numbers of Vital I/O and/or Lamp Driver modules that can be accommodated.

It does not require air conditioning or forced air cooling, so when used at the trackside, it is normally installed in a location case.

There are two power feeds into the ElectroLogIXS one 12V supply to the chassis, then each VLD-R8AC also has a separate 110Vac supply onto the personality module.

END

Includes:	Automatic Route Setting Subsystem; External Communications Subsystem, Flexible Display Subsystem, Fringe Box Subsystem, Gateway Subsystem, IECC System Monitor Subsystem, Remote Interlocking Interface Subsystem, Signalling Display Subsystem, Timetable Processor Subsystem IECC PC Logger, PC SPAD Monitor
Excludes:	

DAILY SERVICES

1. IECC System Monitor Subsystem

1.1 Check that the ISM terminal is functioning correctly.

1.2 Check that the ISM displayed time is identical to Rugby clock time, and the Anthorn (formally Rugby) clock readouts are identical.

2. Printer

2.1 Check the paper supply and reload as required.

2.2 Check the quality of the printout and if necessary, replace the printer cartridge/ribbon

3. All Subsystems

3.1 Observe all equipment, panel and board indications are illuminated as for normal working.

3.2 Rectify any faults that are indicated on the ISM alarm panel and the RII field indication panel.

3.3 Check Node statistics on the ISM and record results in log book.

If a significant number of rejected packets or checksum errors are shown (i.e. greater than 1% of all 3.1 packets sent) then report it to your SM(S).

4. Recording Media Replacement

4.1 Remove the recording media(s) and re-load in the correct rotation order a recording media(s) in the Timetable Processor Subsystem.

5. PC SPAD Monitor or IECC PC Logger

5.1 Check using the PSM/IPL Technician facilities that the ARS and ISM are logging data correctly.

REGULAR SERVICES

6. IECC System Monitor Subsystem

6.1 Dust the keyboard and clean the VDU screen.

7. Flexible/Signalling Display Subsystem

7.1 Check that the crosshairs cursor is steady.

7.2 Check that all text is displayed on each monitor and that the cursor is visible when positioned in each corner of the display.

7.3 Check the operation of the tracker ball.

7.4 Check the monitor(s) for picture quality. Clean the monitor(s) screen(s). Replace with site spares and send defective monitors for servicing as necessary.

7.5 Dust the keyboard. Check its condition and change if necessary.

7.6 Check that the offline unit is at hot standby.

To check for hot standby, observe the signalling screens and perform a manual changeover of the video switch.

Check that the signalling screens are the same as previously observed, then reset the video switch to its original position.

This task shall only be performed with the Signaller’s permission.

SERVICE A

8. Standby Changeover (ARS, DIS, ECS, GWS, ISM, RII, SDS TTP and IPL).

8.1 Check that the non-operational computer unit is in a standby state and if SDS/DIS that it is at hot standby.

8.2 Change over the standby to master from the ISM terminal, check the changeover is successful.

8.3 Restore the previous master from failed to standby by pressing the reset button.

8.4 Initiate subsystem change, by using the status control panel change over pushbutton (not applicable on Vaughan IECC).

8.5 Check that the changeover was successful.

Observe that the IECC works correctly and the expected message is displayed in the system alarm window on the Signaller's workstation.

8.6 (Where fitted) observe that the serial line switches change from all green to all red indications (or vice versa) on a subsystem changeover.

8.7 Restore units from failed to standby by pressing the reset button(s).

8.8 Initiate a changeover to leave the original Standby in the Master state.

8.9 Check that the offline unit is in Standby mode.

8.10 Check that all the subsystems are fully operational from the ISM terminal.

SERVICE B

9. Recording Heads

9.1 If fitted, clean the recording media heads in the Timetable Processor Subsystem in accordance with the manufacturer's instructions.

This task is not applicable if the TTP-Server PC is installed.

10. All Subsystems

10.1 Check the following items:

a) The equipment is securely mounted.

b) The cables are undamaged.

c) The cable connectors are secure.

10.2 Clean the outside of the equipment cubicle and Dust the interior units.

10.3 Isolate the 110V feed to each node crossflow fan, remove the front grill, and extract the filter and check/clean the following:

a) The fan bearing for wear.

b) Clean or replace the filter, replace the front grill and reconnect the 110V supply.

c) Each fan operates correctly.

10.4 Dismantle the tracker ball assembly; Clean the tracker ball and its associated housing. Reassemble and verify correct operation.

10.5 (As necessary) degauss the CRT monitor(s).

11. SPAD Monitoring Facility

11.1 In liaison with the Signaller set up a number of SPAD scenario's using the SSI Technician's terminal to check the Monitoring Facility is functioning correctly.

The frequency shall not exceed 1 year.

This task is not necessary if SPAD has occurred on the workstation since the last maintenance visit.

PERIODIC TASKS

The tasks in sections 12 to 13 are not all at the same periodic frequency.

Unless the frequency is specifically stated below then ask your SM(S) for details of the manufacturers recommended frequencies, which are detailed in relevant sections of The IECC Technicians Manual NR/GN/SIG/19053.

Technical support staff and/or equipment specialists can manage these tasks separately. These tasks should be carried out in an electronic workshop environment.

12. Battery Replacement All Nodes

12.1 Replace the battery at 2 yearly intervals.

MVME 162, 172 and 215 Processor Boards.

12.2 Replace the board-mounted batteries in accordance with the IECC Technicians Manual NR/GN/SIG/19053 Section 5N.

<u>All IECC PCs</u>

12.3 Replace the internal batteries in accordance with the IECC Technicians Manual NR/GN/SIG/19053 Section 5N.

13. Fan Replacement

<u>All IECC PCs</u> (except TTP-Server PCs)

13.1 Replace the following equipment cooling fans on each PC with new units of the same type at 3 yearly intervals.

a) PC front air intake (x2).

b) Internal PC processor fan.

c) PC power supply.

Check after replacement that each fan works correctly.

END

Includes:	All IECC Scalable Sub-systems and components (including Scalable 2)
Excludes:	IECC Classic equipment

Record the results of all actions in the system logbook/Technicians Logsheet.

DAILY SERVICES

1. IECC Scalable Technician's Interface

1.1 Check that the Technicians Interface (s) are functioning correctly and that all subsystems / equipment it reported upon are healthy (see IECC Scalable & Middleware Technicians Interface User Manual).

1.2 Rectify any faults that are indicated by the Technicians Interface.

WEEKLY SERVICES

2. Data logging Health check

2.1 Check that the ARS and Status Monitor data is logging correctly using the IPL remote client or the IPL local Technicians interface.

2.2 Rectify any faults that are discovered.

3. IECC System Cabinets

3.1 Observe all equipment, panel and board indications are illuminated as expected, for normal working or carry out a "Remote System Status Check".

3.2 Rectify any faults that are indicated.

3.3 Observe the time on each TTP unit relative to the Network Clock. If the drift is greater than 1 minute, manually set the TTP time to match the Network Clock using the TCF client.

4. DIS System Cabinets

4.1 Observe all equipment, panel and board indications are illuminated as expected, for normal working both front and back panels or carry out a "Remote System Status Check".

4.2 Check the workstation Remote Level Convertor front and back panels for normal indications.

5. Middleware Cabinets

5.1 Observe all equipment, panel and board indications are illuminated as expected, for normal working or carry out a “Remote System Status Check.

5.2 Observe the Management PC and the Middleware Technician’s Interface are operating correctly.

MONTHLY SERVICE

6. Operator Interfaces

6.1 Check that the cursor or mouse pointer is steady.

6.2 Check that all text is displayed on each monitor and that the cursor or mouse pointer is visible when positioned in each corner of the display.

6.3 Check the monitor(s) for picture quality. Replace defective monitors with site spares and investigate the cause. Send defective monitors for servicing as necessary.

6.4 Clean and dust all monitors.

6.5 Dust the keyboard. Check its condition and change if necessary.

6.6 Check that the offline unit is at hot standby. To check for hot standby, observe the signalling screens and perform a manual changeover of the video switch. Check that the signalling screens are the same as previously observed, and then reset the video switch to its original position.

This task is applicable for DIS only and shall only be performed with the Signaller’s permission.

6.7 Dust and clean the Technician Interface keyboard and screen.

SERVICE A

7. Middleware and Upgraded Workstation

7.1 Check there is backup mouse and keyboard stored in a location convenient for the Signaller and replace if missing.

8. Standby Change-Over

This task shall only be performed where the DIS & blades operate in master/standby configuration.

Come to a clear understanding with Signaller, the implications of each subsystem changeover.

8.1 Check that the non-operational unit is in a standby state. For the DIS, check that it is at hot standby (see Technicians Interface User Manual).

8.2 Reboot the standby units and check they return to a standby state correctly.

8.3 Initiate subsystem change-over by using the Status Control Panel change-over pushbutton.

8.4 Check that the change-over was successful.

8.5 Observe that the IECC Scalable works correctly and the expected message is displayed in the system alarm window on the Signaller's workstation.

8.6 Restore units from failed to standby by pressing the reset buttons.

8.7 Check that all the subsystems are fully operational from the Technician's Interface terminal.

9. IECC Scalable Chassis Fan Filters

9.1 Replace the chassis Fan Filters (See IECC Scalable Hardware Maintenance & Fault Finding Manual).

9.2 Check the Technician's Interface to ascertain that it reports good health status for the Chassis, CMM, Fan Tray and Power Supply.

10. DIS Host , DIS PC and TI Fan Filters

10.1 Replace DIS Host, DIS PC and TI Fan Filters (See IECC Scalable Hardware Maintenance & Fault Finding Manual).

10.2 Check that DIS Host, DIS PC and TI are operating correctly.

11. Middleware Fan Filters

11.1 Replace Management PC and the Middleware Technician's Interface PC Fan Filters (see Middleware Maintenance & Fault Finding Manual).

SERVICE B

12. All IECC Scalable, DIS,TI Middleware cabinets and workstations.

12.1 Check the equipment is securely mounted.

12.2 Check the cables are undamaged.

12.3 Check the cable connectors are secure.

12.4 Dust and clean cabinets and workstations.

13. SPAD Alarm Test

13.1 In liaison with the Signaller set up a number of SPAD scenario's using the SSI Technician's terminal to check the Monitoring Facility is functioning correctly.

The frequency shall not exceed 1 year.

This task is not necessary if SPAD has occurred on the workstation since the last maintenance visit.

13.2 For SSI (also WESTLOCK or Smartlock) set up a SPAD scenario using the interlocking Technician's terminal for a sample of routes not less the three for each workstation.

13.3 For relay interlocking, perform a SPAD Alarm test as described in the IECC Scalable Technicians Interface User Manual.

13.4 Repeat 13.1 and 13.2 for each IECC Scalable Signaller's Workstation.

PERIODIC TASKS

14. All Blades, PCs and Radio Clocks

14.1 As per Table 1-Periodic tasks, replace the batteries in the listed components at the specific frequency.

Intervals	Description	Cycle
Periodic task 1	Blade Batteries	2 years
Periodic task 1	DC PC Battery	2 years
Periodic task 1	DIS Host PC Battery	2 years
Periodic task 1	TI Battery	2 years
Periodic task 1	Management PC Battery	2 years
Periodic task 1	MTI PC Battery	2 years
Periodic task 2	Workstation PC	4 years
Periodic task 2	NAS RAID	4 years
Periodic task 3	MSF Network Clock	9 years

Table 1 – Periodic Tasks

END

Includes:	Compact-PCI hardware-based versions of WESTCAD and Interface Systems (see appropriate NR/SMS for system type)
Excludes:	Siemens Controlguide WESTCAD and WESTCAD-E – MCR hardware-based versions (see NR/SMS/IC16)

GENERAL

Cable routes shall not be altered from their original position (if in doubt refer to the drawings manual). Never re-route cables during maintenance.

A usable copy of the Westcad maintenance manual should be available on site, if missing or damaged inform your SM(S).

The site software should be available although this might not be on site but held by the technical support group.

DAILY SERVICES

1. Technicians' Terminal

1.1 Check that the terminal remote access facility is working.

1.2 Any outstanding fault messages shall be investigated and cleared as corrective maintenance.

REGULAR SERVICES

2. Control Equipment Cubicle

2.1 Check that the LEDs on the CM2 module are showing as in Table 1.
If any LED is not showing as indicated, refer to the system maintenance manual.

LED	State
Sys 1 On Line	Illuminated if On Line, Extinguished if Off Line
Sys 2 On Line	
Sys 1 Available	Illuminated if Off Line, Extinguished if On Line
Sys 2 Available	
Sys 1 Watchdog	Flashing if Off Line, Extinguished if On Line
Sys 2 Watchdog	
Auto Latch	Flashing
PSU Fail	Extinguished

Table 1 – System LEDs

If any LED is not showing as indicated, refer to the system maintenance manual.

2.2 Check that the cubicle earth terminal is securely bonded to the equipment room earth point.

2.3 Visually check all cables and connectors are secure.

2.4 Check that the area in and around the cubicle is clean and tidy. Remove any rubbish and debris.

2.5 Check that all the cubicle doors are closed. The cubicle provides EMC protection, any signs of damage or deterioration shall be reported as corrective maintenance.

3. Surge Protection Units

3.1 Where Fitted: Carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

SERVICE A

4. System Changeover

4.1 Check that the LED indications on the CM2 or system arbiter module are showing as per 2.1.

4.2 Set the rotary switch to manually select the off-line system and observe that the systems switch over.

4.3 Check the Technicians terminal fault reports to ascertain the system is working correctly.

4.4 Set the rotary switch back to the ‘Auto’ position.

4.5 Check that the ‘Auto Latch’ LED is flashing, if not press the ‘Latch Reset’ button.

4.6 Check that the Signaller’s workstation(s) are operating correctly.

5. Equipment Cleaning

5.1 Clean all monitor screens and housings with a proprietary anti-static dry screen cleaner. Use cleaning products in accordance with the manufacturer’s instructions.

5.2 Disconnect and clean the keyboard as necessary. Hold the keyboard upside down while cleaning.

5.3 Disconnect and clean the tracker ball / mouse. If necessary (if the operation has become intermittent or jerky), remove and clean the ball and rollers.

5.4 Check fans are working, and filters are clean. See appendix B.

6. Technicians' Terminal

6.1 Check that the time on the Technicians' terminal (bottom right of the monitor screen) is correct, re-set if necessary (Appendix A).

The internal clock on the Technicians' terminal is not controlled by the Anthorn (formally Rugby) clock therefore some drifting might occur. The change from GMT to BST and vice versa necessitates re-setting the time.

SERVICE B

7. System Reboot

This is only required on Systems running on the Windows NT operating system.

7.1 The two off line systems should be rebooted one at a time.

Remember to allow time for each system to collect all of the "state of the railway" information it requires. While this collection of information is taking place, the system appears to be in a failed state, hence the need to wait.

7.2 When both off line systems are operating normally the on-line system should be changed over to one of the now rebooted systems.

7.3 The system which was on line shall now be rebooted.

If this task is not completed for any reason the SM(S) shall be advised.

8. Cubicle Cleaning

8.1 With the front and rear doors closed, clean the outer surfaces using a dry lint free cloth.

8.2 Carefully dust the interior faceplates and blanking panels with a dry lint free cloth.

8.3 Check that all doors are securely closed on completion of cleaning. The cubicle provides EMC protection, any signs of damage or deterioration shall be reported as corrective maintenance.

PERIODIC TASKS

9. Computers

The routine replacement of the PC hard disk drive is only required on early versions of the system.

9.1 Replace the PC hard disk drive (HD) with a new HD of the same type.

APPENDIX A

Adjustment of Clock on Technicians' Terminal

1. On the windows task bar at the bottom right of the screen, double click on the time display with the left-hand mouse button. A date/time properties dialogue box is displayed.

2. Select 'Time Zone' by left clicking the tab. Check that the time zone shows '(GMT) Greenwich Mean Time: Dublin, Edinburgh, London, Lisbon', or select this zone from the selection in the drop-down menu.

3. Check that the tick box next to the dialog box 'Automatically adjust clock for daylight saving changes' is not ticked. If it is, un-tick it by a left hand click in the box.

4. Select 'Date & Time' by left clicking the tab. Check that the date is correct. If not select the correct month and year form the selection in the drop down menu and the date by left clicking the correct one displayed on the calendar.

5. Set up the time display for a short time in advance of the actual time. This is done by highlighting the hours figures located in the box under the clock by dragging the cursor across the figures whilst holding down the left hand button on the mouse. Adjust the hours by clicking the up or down arrows to the right of the box. Repeat for the minutes and seconds.

6. At the precise time left click the 'Apply' button and then left click 'OK'. The adjusted time is displayed in the windows task bar at the bottom right of the screen.

END

Includes:	Siemens VICOS VDU Control System
Excludes:	All other Siemens VDU Control Systems

DAILY SERVICES

1. VICOS

1.1 Check the alarm list on all VICOS terminals for any outstanding faults. Rectify or report.

1.2 Check the archive PC is recording, there are no fault messages displayed, and that the display is pink. Rectify or report.

1.3 Archive daily logs to an external recording media.

This can range from a floppy disc to a memory stick depending on the system hardware. Data is automatically over written after 7 days if not archived.

1.4 Check that the IBS_PC and IBS_PC Mirror are operational there are no fault messages displayed and that the display is updating.

Check that all the nodes in the NUC view connections window are green. Rectify or report.

SERVICE A

2. VICOS Terminals.

2.1 Clean & dust the terminal screens, keyboards, & mouse. Use a dry lint free cloth for dusting and an approved cleaning product to remove marks & stains.

Keyboards should be held upside down when cleaning.

2.2 Check that all PC GPS & Anthorn (formally Rugby) clocks are correct. Rectify or report.

2.3 Check the filters in the back panel projection units. Replace if required.

SERVICE B

3. VICOS Terminal.

These tasks shall be undertaken in liaison with the Signaller

3.1 Shutdown and then reboot the main VICOS terminal.

3.2 Login to terminal then run the static test, dynamic test & all image tests. Rectify or report any problems. On completion, log off the terminal.

3.3 Check that all the connections to the terminals are correctly seated and fixing screws are tight where applicable.

Do not inadvertently disturb anything whilst undertaking this task.

END

Includes:	Siemens Controlguide WESTCAD and WESTCAD-E – MCR hardware-based versions
Excludes:	Compact-PCI hardware-based versions of WESTCAD and Interface Systems (see relative NR/SMS for system type)

GENERAL

Cable routes shall not be altered from their original position (if in doubt refer to the drawings manual). Never re-route cables during maintenance.

Observe ESD precautions before handling any electronic equipment.

A usable copy of the WESTCAD maintenance manual should be available on site, if missing or damaged inform your SM(S).

The site software should be available although this might not be on site but held by the technical support group.

DAILY SERVICE

1. Technician's Terminal

1.1 Check that the terminal remote access facility, where provided, is working.

1.2 Any outstanding fault messages shall be investigated and cleared as corrective maintenance.

2. ETCS Diagnostics Terminal

2.1 Check clock indication is displaying white text, investigate and rectify as corrective maintenance if displaying anything else.

2.2 Any outstanding fault messages (M_ERRORs) shall be investigated and cleared as corrective maintenance.

REGULAR SERVICE

3. Control Equipment Cubicle

3.1 Check that the indication LEDs on the SA-2 module, where fitted, are showing as in Table 1.

Any fault indication shall be investigated and cleared as corrective maintenance. Refer to the system maintenance manual as necessary.

Indication	Colour	State
Power	Green	When lit indicates the 12V dc power supply to the SA-2 module is present
WD	Yellow	Watchdog - flashes to indicate the associated system is operating correctly
OL	Green	When lit, indicates which System is on-line
FT	Red	When lit, indicates conditions for indicated System Watchdog are Not true
PSU 1/ PSU 2	Green	Indicates PSU functioning normally
	Red	Indicates PSU fault

Table 1 - LED indications

3.2 Visually check that the cubicle earth terminal is securely bonded to the equipment room earth point.

3.3 Visually check all cables and connectors are secure.

3.4 Check that the area in and around the cubicle is clean and tidy. Remove any rubbish and debris.

3.5 Check that all cubicle doors are closed.

4. Surge Protection Units

4.1 Where fitted, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

SERVICE A

5. Equipment Cleaning

5.1 Operator's monitor surfaces shall be cleaned using a lint-free non-abrasive cloth. Do not use any cleaning solution or glass cleaner.

5.2 Keyboards shall be cleaned using a soft cloth and mild detergent solution.

Moisture shall not be allowed to enter equipment apertures and shall be dried off surfaces as soon as possible. Do not use abrasive cleaners or pads.

5.3 The Operator's mouse (where provided) shall be cleaned using a soft cloth and mild detergent solution.

Moisture shall not be allowed to enter equipment apertures and shall be dried off surfaces as soon as possible. Do not use abrasive cleaners or pads.

5.4 Disconnect and clean the tracker-ball (where provided). If the operation has become intermittent or jerky, remove and clean the ball and rollers.

6. Operators mouse

6.1 Check for correct operation of mouse left and right buttons and cursor movement response. Replace any defective mice as corrective maintenance.

7. Technician's Terminal Clock

7.1 Check that the time on the WESTCAD Technician's Terminal (bottom right of the VDU) is correct. Adjust if necessary (Appendix A).

The internal clock is free running and is not controlled by the WESTCAD time reference, some drifting might occur.

8. Fan Tray (if fitted)

NOTE: *before carrying out this task liaise with the Signaller, as an alarm is generated.*

8.1 Disconnect and slide out the fan tray, clean using a soft cloth moistened with a detergent solution.

SERVICE B

9. System Changeover (dual processor systems only)

It is recommended that this task is carried out during periods of no train movements or only light traffic.

9.1 Check that the Indications on the SA-2 module are showing as follows:

- One On-Line LED is illuminated to indicate which system is on line.
- Both 'Watchdog' LEDs are flashing.
- Power LED is illuminated.
- FT LEDs are not illuminated.
- PSU LEDs are both illuminated green.

9.2 Set the rotary switch to manually select the off-line system and observe that the systems change-over.

9.3 Check the LED indications to verify the system is working correctly.

9.4 Check the Technician's terminal fault reports to ascertain the system is working correctly.

9.5 Verify correct operation of the system at the Signaller's workstation.

9.6 Set the rotary switch back to the 'Auto' position.

10. Cubicle Cleaning

10.1 With the front and rear doors closed, clean the outer surfaces using a dry lint-free cloth.

10.2 Carefully dust the interior faceplates and blanking panels with a dry lint-free cloth.

10.3 Check that all doors are securely closed on completion of cleaning.

11. Plugs and sockets

11.1 Check that all plugs and sockets are correctly fitted and that screw fasteners are tight.

11.2 Check that all wiring connections are correctly made.

12. CPU-3 and CPU-4a Modules Checks

Lithium Batteries

12.1 Check the date on the label fitted to the front of the module which details the date the module was installed or issued as a spare.

NOTE: *These Lithium batteries have a 5-year service life.*

If four years has elapsed since the date shown on the module you shall advise your SM(S), so that arrangements can be made to replace this module and replace its battery.

Hard Disk Drives (if fitted)

NOTE: *Earlier CPU-3 Modules were fitted with Hard Disk Drives (HDD). In the case of these modules, a label is fitted to the module detailing the date this module was installed. These Hard Disk Drives have a 5-year service life.*

12.2 Check the date on the label fitted to the front of the module which details the date the module was installed or issued as a spare.

If four years has elapsed since the date shown on the module you shall advise your SM(S), so that arrangements can be made to replace this module.

13. WESTCAD MCR 12V dc PSUs

13.1 Using a Digital Multi-Meter check the output voltage of each PSU. Adjust the trim control on the PSU front panel as necessary to achieve 12.0V DC.

Appendix A - Adjustment of Technician's Terminal Clock

This instruction should be carried out as soon as possible after changes between BST and GMT to realign the WESTCAD Technician's Terminal internal clock with the WESTCAD clock.

1. If not already powered up, switch on the Technician's Terminal. At the Windows task bar at the bottom of the screen double-click on the time display with the left-hand mouse button. A 'Date/Time Properties' dialogue box is displayed.

2. Select the 'Time Zone' by clicking on the tab. Time zone should show '(GMT) Greenwich Mean Time: Dublin, Edinburgh, London, Lisbon' immediately below the tab.

   If a different legend is shown, click on the down arrow to the right of the legend and select the required GMT from the drop-down menu displayed.

3. Near the bottom of the dialogue box, check the box adjacent to the legend 'Automatically adjust clock for daylight saving changes' is NOT ticked. If it is, click in the box to remove the tick.

4. Select 'Date & Time' by clicking on the tab.

5. To change month or year, click on the down arrow next to the month/year display, then click on the required month/year on the drop-down menu displayed.

6. To set the date, position the cursor over the required date and click the left-hand mouse button.

7. Set up the time display for a short time in advance of the actual time as displayed on the front panel of the radio clock/NTP server unit or other reliable time display.

8. To set Time, scroll the cursor over the 'hours' figure located under the clock face. The figure becomes highlighted. Now click on the up or down arrow to the right of the time digits to set as required.

9. Repeat Step 8 for 'minutes' and 'seconds'.

10. At the precise time, click on 'Apply'.

11. Click on 'OK' to clear the dialogue box from the screen.

12. On completion, the new time is shown at the bottom right of the monitor screen.

END

Includes:	Signallers Assistant (TREsa)
Excludes:	Any other Signallers Assistance Equipment

TREsa is an automatic route setting system designed to help signallers by reducing working by routing timetabled services automatically.

The TREsa consists of a number of subsystems:

- A Diagnostics subsystem. This subsystem acts as a central communications hub, maintains log files and is the TREsa configuration management system.
- A Timetable server (TREtts). This subsystem receives and processes timetables from Network Rail's integrated timetable planning system (ITPS). This subsystem distributes the timetables to the rest of the system.
- A number of SARS processors. Each pair of SARS processors (one acting as Master and the other as Standby) interfaces to the control equipment and issues panel requests to set routes for trains.
- A number of SACS PCs. These subsystems provide the signaller's interface to TREsa. They provide a means of controlling ARS functions and provide the signaller with information regarding the route setting status of each train.
- A number of smaller subsystems such as a change-over system (for each SARS pair), an internet router, network switches and printers.

The SARS can run standalone, but when connected to the Diagnostics system requires a user to set them both to standby. The change-over system should then select one as the Master SARS to provide the automatic routing functions, while the other SARS operates as the standby processor.

Please refer to the System Maintenance Manual for comprehensive maintenance and fault finding instructions.

DAILY SERVICE

1. Daily Tasks

1.1 Check the Diagnostics System Status display for subsystem status.

1.2 Check the Diagnostics alarm list for alarms raised in the last 24 hours:

- If there is an alarm regarding a failed timetable download, inform the Signalling Manager.
- Contact ITPS and request a new full timetable download.

WEEKLY SERVICE

2. TREtts

2.1 Login to the TREtts PC. Open Windows Explorer and navigate to C:\TRETTS\data\backup. Remove all but the last week's database backup files; these files will have a .gbk file extension.

2.2 Remove any error files in C:\TRETTS\import.

2.3 Navigate to C:\TRETTS\data and check the size of the TRETTS.GDB file. Using the TREsa TREtts database form, note the file size against the date and check that it is less than 5GB.

If the file is now larger than 5GB, perform the backup and restore procedure (see TREtts database maintenance below).

2.4 Empty the Recycle Bin.

2.5 Using Windows Explorer, navigate to My Computer, right click on the C:\ drive icon and select Properties. Check the disk space on the C: drive. It should be no more than 80% full. If the preceding activities have not freed up sufficient disk space, contact the design authority.

2.6 Logout of the TREtts PC.

MONTHLY SERVICE

3. SARS

3.1 Inform the signallers that this maintenance task can cause all sub areas to drop out of ARS control.

The sub areas for each workstation need to be manually put back into ARS control by the signaller when the new Master SARS processor is online.

3.2 Force a change-over of SARS processors using the change-over subsystem.

This can force the current Master SARS to reboot and the current Standby SARS to be promoted to Master.

On completion of the reboot, promote the SARS to Standby using the 'SARS Control' function on the Diagnostics subsystem.

4. TRETTS

4.1 Check that:

- The TREtts is not performing a timetable import (this normally happens between 7pm and midnight every day);
- No users have a TREtts Client running.

4.2 Reboot the TREtts Server PC.

4.3 Allow up to 10 minutes for the PC to reboot and initialise, then check that the subsystem is displayed as 'up' on the Diagnostics System Status display.

SERVICE A

5. Diagnostics

5.1 Inform the signallers that they can still be able to control the ARS functions (with the exception of Parameter Set activation/deactivation) via the workstation while the Diagnostics is being rebooted.

5.2 Reboot the Diagnostics PC.

6. SACS

6.1 Inform the signallers that they can still be able to control the ARS functions (with the exception of Parameter Set activation/deactivation) via the workstation while the SACS PC is being rebooted.

6.2 Reboot each of the SACS PCs.

SERVICE B

7. General

7.1 Remove, clean and replace the air filter at the front of the all PC's.

8. Diagnostics

8.1 Remove and exchange the removable hard drive for a new one. Archive the old removable hard drive.

9. TREtts database maintenance

9.1 On the TREtts Server, stop TREtts service:

- From the Windows start menu select
  Control Panel > Administrative Tools > Services > TTPService

- Highlight TTPService, right-click and select Stop.

9.2 Using Windows Explorer, navigate to the folder C:\TRETTS\data

9.3 Rename the database file TRETTS.GDB with the current date as the prefix in the format YYYYMMDD, for example: 20150402TRETTS.GDB

Note that this filename must be used where ever DATABASE.GDB is mentioned in the instructions below:

9.4 Start a command line session:

- From the Windows start menu select Run.
- Type cmd in the dialog box then press OK.

9.5 In the command line, enter the following commands:

Note: Only if the command is unsuccessful, an error can be returned by the program, otherwise the command is deemed to be a success.

a. cd C:\Program Files\Firebird\Firebird_2_5\bin Now <press enter>

b. gbak –b –G C:\tretts\data\DATABASE.GDB C:\tretts_backup.gbk –user sysdba –pass masterkey Now <press enter>

Command on a single line:

c. gbak –b –G C:\tretts\data\DATABASE.GDB C:\tretts_backup.gbk –user sysdba –pass masterkey Now <press enter>

d. gbak –r C:\tretts_backup.gbk C:\tretts\data\TRETTS.GDB –user sysdba –pass masterkey Now <press enter>

Command on a single line:

e. gbak –r C:\tretts_backup.gbk C:\tretts\data\TRETTS.GDB –user sysdba –pass masterkey Now <press enter>

Should command b. be returned as unsuccessful, re-enter the command before attempting command c.

Should it be unsuccessful a second time, then undo the process of file renaming as described at the start of this task by renaming the file back to its original name of TRETTS.GDB. Reschedule this maintenance for one week later.

9.6 Reboot the TREtts PC.

Allow up to 10 minutes for the PC to reboot and initialise, then check that the TREtts subsystem is displayed as ‘up’ on the Diagnostics System Status display.

End

Includes:	ElectroLogIXS Electronic Interlocking / Controller 1 Slot, 4 Slot & 9 Slot Chassis'
Excludes:	All other types of Electronic Interlocking and Chassis variants

No possession arrangements are required to perform the services described below; all the tasks are non-intrusive.

Equipment Identification


1 Slot Chassis


4 Slot Chassis


9 Slot Chassis

SERVICE B

1. Cleaning

1.1 Clean the outside of the chassis using a dry lint-free anti-static cloth.

2. Visual Checks

2.1 Check for foreign material inside the chassis. Remove if electrical isolation of equipment is not required to do so, or report these findings as corrective maintenance.

2.2 Check the chassis is securely mounted.

2.3 Check that all modules are fully seated within the chassis and the locking mechanisms are in the locked position.

2.4 Check for any visual damage. Report any damage so that a replacement can be arranged as necessary.

2.5 Visually confirm that all VPM-3 and CIO-PCA module network cables are latched in position.

2.6 Examine the equipment, terminals, cables and cable connectors. Particularly look for physical damage, overheating and arcing. Rectify as necessary.

END

Includes:	Siemens WESTCAD-LC-TSD (Level Crossing Touch Screen Device)
Excludes:	WESTRONIC 1024 TDM System or WESTRONIC Eight Bit TDM

Cable routes shall not be altered from their original position (if in doubt refer to the drawings manual). Never re-route cables during maintenance.

Observe ESSD precautions before handling any electronic equipment.

A usable copy of the WESTCAD-LC-TSD maintenance manual should be available on site, if missing or damaged inform your SM(S).

The product data is stored on a CompactFlash card. The spare CompactFlash card should be available; this may not be on site but held by the technical support group.

Equipment Identification

There are two versions of the LC-TSD as follows:

- 12.1" LCD monitor with integral processor card, Siemens Part No. 615300129
- 12.1" LCD monitor with external processor installed in a 3U housing located in the workstation desk section, Siemens Part No. CAT00000000306

Cleaning Products

When cleaning the LC-TSD never use:

- Abrasive pads or paper towels.
- Window cleaner, soap or scouring powder.
- Solvents such as alcohol, benzene, ammonia or paint thinner.
- Cleaning fluids, wax, or chemicals.

Service A

1 General Cleaning

LCD screens are fragile and can be damaged if you press too hard during cleaning.

1.1 With the signaller's agreement, activate the products cleaning mode.

1.2 Clean the frame and screen with a microfiber cleaning cloth.

If that does not work, spray water directly onto the microfiber cleaning cloth.

Never spray anything directly onto the LC-TSD screen.

1.3 Return the LC-TSD to its operational mode after cleaning.

Service B

2 Regular Maintenance

2.1 Check the LC-TSD panel brightness and contrast are suitable for the user, adjust the settings as necessary.

The contrast and brightness controls are accessible after removal of a rear mounted protective cover (refer to the technical manual for additional information if required).

2.2 Visually check all cables and connectors are secure.

2.3 The field end Time Division Multiplexer (TDM) System status is displayed on the LC-TSD screen (Top middle section). Investigate further any TDM faults displayed (refer to the technical manual for additional information if required).

2.4 Check on the technician’s terminal for any LC-TSD related faults. Investigate further any LC-TSD faults displayed (refer to the technical manual for additional information if required).

End

Includes:	Logger and archive/analysis PCs
Excludes:	All other types of Logger or Archiving PC

Before working on the system ESD precautions shall be taken.

General

The Logger (or Archive Recorder) PC can be connected to a number of different systems (e.g. RC/TDMs and/or PIIUs). The logger records the information sent from these systems.

It operates in conjunction with an Archive/Analysis PC, which regularly extracts each day's information to be preserved as required on CD ROM, and which provides an analysis facility. These archived logs can then be analysed by creating reports, which can be printed.

An Archive & Analysis PC is designed to connect to the GE Logger either directly through a LAN or remotely through a modem. The messages to the Archive/Analysis hard disk are overwritten every eighth day.

The Logger transfers data to the Archive/Analysis PC every 24 hours or on request, where it is stored on a removable CDR, which is typically capable of holding one month's data.

It is recommended that six re-writeable disks are provided, labelled, and used in rotation, providing six months of stored data.

Records

All activities carried out on the Logger and Archive/Analysis PCs shall be recorded in the system log book.

REGULAR SERVICES

1. System Health

1.1 Request and print a train report for a late train from the previous day specifying date, time, and train description. This proves that the archive PC has received the previous day's data.

1.2 Check all power supply indications are correct.

2. Archive Data

2.1 Change the CDR disc in archive & analysis PC, and label and store the old disk.

2.2 Place a new CDR in the archive & analysis PC.

2.3 Check that the removed disc has accessible and readable data before storage.

SERVICE A

3. System Checks

Due to individual system configurations not all the tasks are performed on both the logger & archiving system, if you are unsure of the correct tasks, ask your SM(S).

3.1 Check that the power supply cooling fans and other cooling fans are running and that the air intakes are not obstructed on both the Logger and archive & analysis PCs.

3.2 Check that the link between the logger terminal and the train describer is reported as OK. Rectify any defect.

3.3 Check that the link (LAN or Modem) between the logger and archive & analysis PCs is reported as OK. Rectify any defect.

3.4 Check the time and date on the logger and archive & analysis PCs. If it is incorrect check the Radio Clock unit and connections.

3.5 Check the power supply indications are indicating correctly for all units.

3.6 Check that the PCs keyboards and mouse are functioning and that the display screens are working correctly. Confirm that there is a working spare keyboard and mouse on site.

SERVICE B

4. System Maintenance

4.1 Change out the Logger and Archive/Analysis PCs with the spare units. Check that the detail of each unit location and serial number is recorded in the site log-book.

4.2 Clean the display screens and housings using a proprietary anti-static screen cleaner, used in accordance with the manufacturer’s instructions. Disconnect and Clean the keyboard and mouse as required, then reconnect. Hold the keyboard upside down when cleaning.

PERIODIC TASKS

5. Equipment Servicing

5.1 Arrange for the PCs to be returned to the supplier for service and replacement of PSU and processor fans, batteries, and hard drives.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/IC52		
GE Standalone FTN unit		
Issue No. 01	Issue Date: 04/03/17	Compliance Date: 31/05/17

Includes:	Standalone FTN unit
Exclude:	

ESD Precautions.

Before working on system use appropriate ESD precautions.

General

FTN Protocol Converter Unit interfaces the TDM products via the Network Rail Fixed Telecom Network fibre infrastructure. This product adds a wrapper layer to the serial (PS9) message structure of the TDM system.

Records.

All activities carried out on the unit shouldbe recorded in line with current maintenance standards.

A Discrepancy Report Form provides a method of logging equipment and system discrepancies/faults that have occurred on a commissioned system. The form is to be completed and should accompany any returned equipment In the event that it is not practical to return the faulty equipment due to its size or installation, the form should be returned to GE as a means of advice of a problem.
Any failures found should be reported to the supervisor/manager.

1 SERVICE A

1.1 Check that the power supply is functional and that its ventilation is not obstructed.

1.2 Check that the link between the TDM systems (field to office) is reported as OK, rectifying any defect.

1.3 Check the power supply indications are indicating correctly for all units.

1.4 Check that the DCD LEDs on any fitted modems are lit.

1.5 Check that there are no fault indications lit.

2 SERVICE B

2.1 Check that all power and serial cables are plugged in and retained to the unit. Do not over tighten the jackscrews / retainers.

2.2 Clean the unit housing using a proprietary anti – static cloth, used in accordance with the manufacturer's instructions.

End

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/IC53		
GE Leicester Keyboard/Trackerball unit		
Issue No.01	IssueDate: 04/03/17	ComplianceDate: 31/05/17

Includes:	GE Leicester keyboard/trackerball unit
Exclude:	Any other Keyboard or Trackerball

ESD Precautions.

Before working on system use appropriate ESD precautions.

General

The GE Leicester Keyboard/Trackerball unit is a replacement solution that effectively emulates the original interface connections to the Vaughan Keyboard/Trackerball and is transparent to the signallers.

Records.

All activities carried out on the unit shall be recorded in line with current maintenance standards.

A Discrepancy Report Form provides a method of logging equipment and system discrepancies/faults that have occurred on a system. The form shall be completed and shall accompany any returned equipment In the event that it is not practical to return the faulty equipment due to its size or installation, the form shall be returned to GE as a means of advice of a problem.

Any failures found should be reported to the supervisor/manager.

SERVICE A

1.1 Check the link between the unit and the Train describer is OK by checking the cursor moves on the map display with the trackerball movement and that the keyboard characters echo back on the map display. Rectify any defect.

1.2 Check the power supply indications are indicating correctly on the Fanless PC and its power supply.

1.3 Check that the there is a working keyboard/trackerball spare on site

SERVICE B

1.4 Clean the keyboard, trackerball and PC housing using a dry lint-free cloth.

1.5 Check all signal and power connections to the PC are made and where applicable secure. Do not over tighten screw-locks.

PERIODIC TASK

1.6 Send the PC to the supplier for service of battery and hard drive.

End

Includes:	Synelec LMR 1000-50 cube units & LMR 1200- 84 projector & lens
Excludes:	All other Route Display Systems

General

Before working on the system ESD precautions shall be taken.

The Rugby Whole Route Display System utilises the Synelec LMR1000-50 cube units, which comprise of the mechanical structure, the LMR1200-84 projector, and lens. A maintenance PC, installed with the Combase software, is provided that connects to all the cubes via an Ethernet LAN.

This can be used to control the projector functions. Projection lamps will be run until they fail therefore routine lamp changing will not be carried out.

More information on the system can be obtained from the manufacture's manual.

Records

All activities carried out on the system shall be recorded in the system log book.

SERVICE A

1. Screen Cleaning

1.1 As required, clean the front screen with a clean lens cloth.

SERVICE B

2. System Inspection

2.1 Check the condition and the display quality of the system. Ask the Signaller(s) if they have any problems.

This should include the physical condition of the hardware and the projector adjustment.

Any problems should be addressed if possible, prior to continuing with the servicing.

3. System Maintenance

3.1 Check the alignment between projectors. Adjust if necessary.

For very poor alignment use the grid pattern. More information on this can be found in the Mechanical Adjustment Lite Master 50" Series manufacturer's manual.

Check for correct colour balance and adjust if necessary, using the Combase software. More information on this can be found in the Mechanical Adjustment Lite Master 50'' Series manufacturer's manual.

3.2 Check that all cables are secure and undamaged and that they are all screwed into position.

Extreme care should be taken when performing this task as 380V is present on one of the cables.

3.3 Check the image processing electronics. Check that all the cooling fans are working, rectify as necessary. Check that filters are clean and change if necessary.

Check that all the connectors are in position.

4. Cube Cleaning

4.1 Dust the projector casings. Clean the projector lens with a clean lens cloth. Mirrors should not need cleaning, but when necessary clean only with a clean lens cloth.

The inside of screens should not require cleaning on each visit but should be monitored and cleaned when necessary. The same cleaning procedure for lenses and mirrors apply.

5. Final

5.1 Check that all projectors are closed and securely fastened. Check that the Signaller(s) are satisfied with the quality of the displayed images.

END

1. Cambrian Lines (ERTMS)

1.1 System Overview

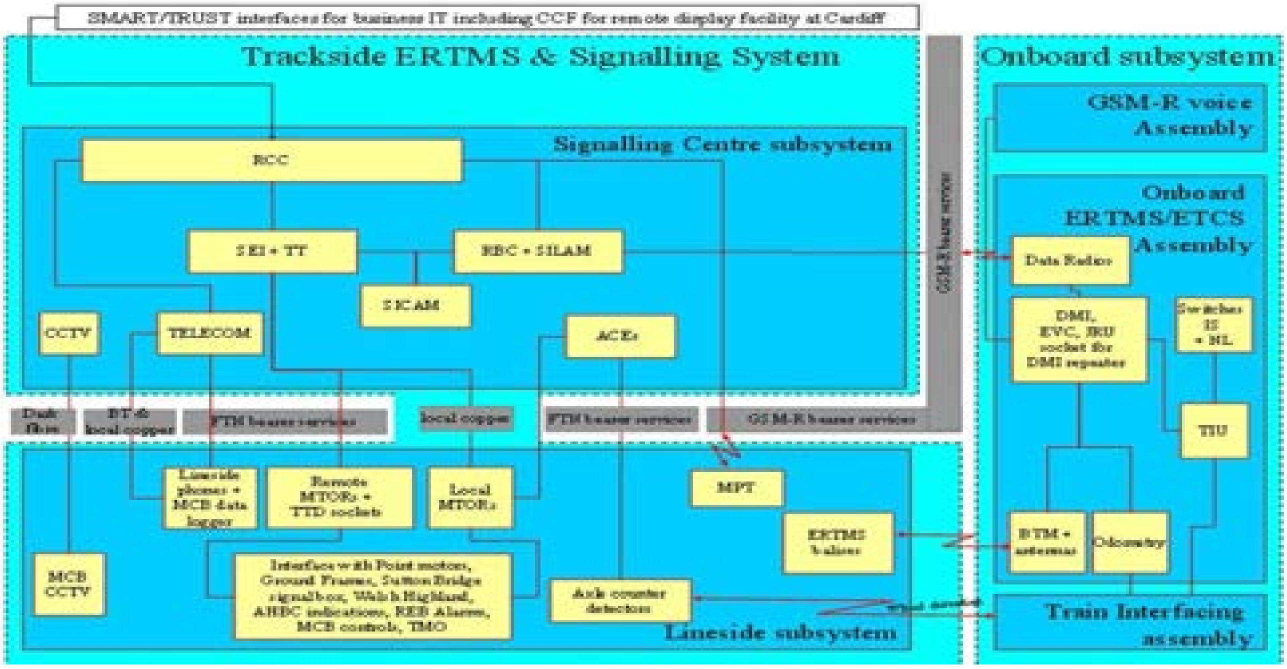


Figure 1 - Schematic Layout of the Cambrian System

1.2 ERTMS Abbreviations

Abbreviation	Meaning
ACE	Axle Counter Evaluator
AHBC	Auto Half Barrier Level Xing
BTM	Balise Transmission Module
CCTV	Closed Circuit Television
DMI	Driver Machine Interface
EVC	European Vital Computer
IS	Isolation
JRU	Juridical Recording Unit
MCB	Manual Crossing Barriers
MTOR	Object Controller
MPT	Mobile Protection Terminal
NL	Non-Leading
RCC	Route Control Centre
RBC	Radio Block Centre
REB	Relocatable Equipment Building
SEI	Interlocking
SICAM	Central Maintenance Aid Equip
SILAM	Local Maintenance Aid Equip
TMO	Trainman Operated Level Xing

Abbreviation	Meaning
TT	Technicians Terminal
TTD	Technicians Terminal Remote
TIU	Train Interface Unit

Table 1 - Abbreviations

1.3 General

The European Rail Traffic Management System (ERTMS) is a cab-based speed signalling system providing automatic train protection (ATP) and is designed to standardise the train control systems of Europe.

ERTMS is the collective term for the following:

a) European Train Control System (ETCS) – Automatic Train Protection (ATP).

b) GSM-R – Standardised mobile communications system for railways that can handle voice communication between the Signaller and train driver as well as data communication between the signalling system and the on-board train ETCS equipment.

The Cambrian lines operate in ETCS Level 2, the principle elements of Level 2 are:

a) Continuous voice communication between the train and Signalling Control Centre (SCC) via GSM-R.

b) Continuous data communication between the train and Signalling Control Centre (SCC) via GSM-R except for defined radio holes.

c) Intermittent communications via Eurobalise to trains.

d) Movement Authority is requested by trains and issued by the Radio Block Centre (RBC) when all necessary conditions are met.

e) Continuous train detection on running lines is by axle counter.

f) Local track circuits are provided to operate level crossings.

g) Fixed block principles are used to separate trains.

h) Line side signals have generally been removed.

i) Degraded mode signalling is provided, train separation achieved by fixed block markers and speed controlled by degraded mode speed signs.

The interlocking system is provided by a 2-out-of-3 Computer Based Interlocking (CBI), the Ansaldo CBI is known as the SEI.

The Radio Block Centre (RBC) enables communications to be made between the SEI and the on-board train ETCS equipment via the GSM-R data radio.

The RBC is a 2-out-of-3 safety processor using similar architecture to the SEI and is configured to confirm only valid messages are transmitted. It also receives position and other information from trains operating within the area of supervision.

All messages between the RBC and trains are encrypted and communications are established by comparing ERTMS Radio Keys loaded onto the RBC and those loaded onto on board units.

Security of these keys is critical therefore copies of the ERTMS Radio Keys shall be stored in a secure specified location.

The contents of any medium on which they are stored shall not be copied or provided to third party.

Separate procedures are in place for the security of ERTMS Radio Keys and only authorised persons shall amend, distribute, receive, store or upload ERTMS Radio Keys.

Lineside signals are only provided in the transition area between the ERTMS and conventional signalling at Sutton Bridge Jcn and in the train maintenance depot at Machynlleth. Lineside markers and speed signage is provided for use when operating in degraded mode.

Moveable items of the infrastructure are sent commands and return indications to the SEI via Object Controllers using the Fixed Telecommunication Network (FTN) or British Telecom (BT) fibre optic networks.

Train detection for train separation is by axle counter, these also use the FTN or BT fibre optic networks to communicate with their respective Axle Counter Evaluator (ACE). All detection points report into one of the four ACE located in the SCC at Machynlleth.

Balise are installed centrally between the rails at intervals along the line, they can be single units or form part of a group using up to four individual balise.

These are passive programmed devices that only transmit data to trains when activated by the train on board equipment.

The data received by the train can include its position in meters, awakening function, text messages, stop messages, etc. This information is used to enable various on-board functions.

e.g. Preventing trains from exceeding the permitted limits of shunt or degraded mode moves, display of text messages on the Driver Machine Interface (DMI) i.e. "AOCL AHEAD", wheel diameter calibration etc.

1.4 GEST

Temporary and Emergency Speed Restrictions (TSR & ESR) are imposed by the Signaller who sets the requirement for a restriction on a screen called the GEST located in the SCC.

When a restriction is activated the GEST updates the RBC which in turn modifies the data sent in the Movement Authority for the area of the TSR or ESR.

No on-track equipment is required to notify drivers of the position of a TSR or ESR as details are displayed to the driver on the in-cab Driver Machine Interface (DMI) screen.

The on-board equipment calculates the braking for the restriction and displays this to the driver on the DMI.

1.5 Axle Counter Missed Packets and Constraints on the use of RAAA Serial Cards.

The axle counter system employed at Machynlleth is the THALES AZLM and its data transmission is via the FTN 1511 MUX.

This arrangement requires two conversions of message protocol to allow communication over the FTN, firstly from ISDN to V24 at the detection point end of the system and then V24 back to ISDN at the evaluator end.

Both conversions are performed by V24/ISDN dual channel converters located close to the FTN equipment, copper cable is used elsewhere in the system.

Using this arrangement for converting from ISDN to V24 and back again shortens the AZLM packets at each conversion.

THALES, the AZLM manufacturer, specifies a maximum of two conversions to confirm the packet remains long enough to be read by the ACE and give reliable operation.

However, the FTN 1511 MUX is not designed to efficiently handle the AZLM packet configuration. To overcome this problem its Rate Adaptor Cards (RAC) are configured to over sample the message packets, this over sampling effectively equates to a third conversion of protocol, one conversion over the maximum specified for the AZLM.

When the AZLM system was first installed and tested it worked satisfactorily with no corrupt messages or dropped packets and was duly issued with a Trial Product Acceptance Certificate.

During the first months of operation some pre-processor boards also known as the Serial Cards were changed in response to failures, it then became apparent that random single message packets were being dropped by the detection points where the replacements were installed.

The original Serial Cards were coded by THALES as QBAA and the replacements coded as RAAA, the RAAA had been given permanent Product Acceptance as a direct replacement for the OBAA.

The upgrade from QBAA to RAAA was necessary because the processor chip of the QBAA had become obsolete, the same chips are used in the ISDN to V24 converters and on the EAK digital card, and these boards were also been upgraded and continued to work reliably.

An investigation into packets were being dropped revealed the clock speed of the QBAA and RAAA were different, this change coupled with the over sampling of the FTN RACs caused the AZLM packet to be shortened very slightly more when the RAAA was used as a substitute for the original QBAA.

The shortened messages were now very occasionally incomplete when presented to the AZLM processor, so it correctly rejected them and recorded the event.

When the RAAA boards were replaced with the earlier QBAA variant the missed packets ceased and the system ran error free.

Consideration was given at the time to an upgrade of the FTN 1511 MUX to a 1511 MAX variant of the MUX, but trials on the Exeter Salisbury line found this did not rectify the problem.

Upgrading of the AZLM to an Ethernet version was not possible at the time because the only example of an Ethernet version was undergoing trials in Switzerland and was likely to remain on trial until 2014.

The four ACE at Machynlleth are configured to allow a maximum of four consecutive message packets to be rejected and for the system to continue operating normally. Should a fifth consecutive message be rejected the detection point enters a disturbed state.

This tolerance is higher than that specified for wholly copper cabled installations and is required to permit re-routing operations to take place within the FTN network without disturbing the axle counters.

The disturbed state is where the ACE processor fails the detection point causing one or two track sections to become occupied in the signalling system. During tests it was seen that the RAAA never missed more than a single message packet so retained safe and reliable operation with a large margin remaining before a service affecting failure occurred so can be used in the system.

It should however be noted that as the population of the RAAA Serial Cards increases the number of reports of missed message packets increases and can in time mask other reports where attention is required.

1.6 Electronic downloads for achieving

Where maintenance requires the downloading for achieving of data purposes the data shall be retained for 12 months.

1.7 Positioning of ETCS Equipment

On the Cambrian, the longitudinal position of all items of signalling infrastructure installed as part of the Cambrian ERTMS Project were set and recorded by reference to Kilometre and 0.5 Kilometre posts with the zero point at Sutton Bridge Jcn.

The Kilometre posts were taken out of use as a general location reference point and the heads removed in favour of retaining mileposts.

The posts that formally supported the Kilometre heads have been retained as reference points and a label attached indicating the location of each one in Kilometres.

These posts shall be used as a reference to position ETCS, axle counters, point ends and other signalling infrastructure for consistency.

2. Technician Controls

The Cambrian ERTMS password protected Technical Terminals have seven options for applying Technician's controls, they can be found in the TT and TTD Technical data under Technician Controls in the Command menu, they are:

Description of the Bar	Type of Control	Use
AXLE TS	Equipment	Disconnection of equipment using T1A
ENTRANCE EXIT OF A ROUTE	Equipment	Disconnection of equipment using T1A
GROUND FRAME	Equipment	Disconnection of equipment using T1A
POINT	Equipment	Disconnection of equipment using T1A
ROUTE	Route Bar	Protection of staff or work by ERTMS possession, line blockage or disconnection of signaling equipment
SIGNAL NODE	Equipment	Disconnection of equipment using T1A
WHR INTERFACE	Route Bar	Protection of staff or work by ERTMS possession, line blockage or disconnection of signalling equipment

Table 2 - Technician Controls

3. Route Bars

3.1 Entrance Exit of a Route

This control prevents a route node from being used as both an entrance and exit and can also be applied to an exit route node of a bay platform or siding.

This control applies to all routes irrespective of class to and from the node being set. An individual control can be applied at each route setting point.

3.2 Route

The Interlocking system provides a control for the maintainer to prevent a specific route being set.

An individual control is provided for each route.

A route bar cannot cancel a route that is already set at a route setting point.

3.3 Node

This control allows routes to be set from the disabled node but prevents the node from clearing and prevents a movement authority from being issued.

An individual control is provided for each Signal and Node.

This control does not prevent a route being set, and any route that has been set with the control in place clears when the control is removed.

4. Equipment Bars

4.1 General

It is not possible for the Signaller to override equipment bars put in place by use of the TT.

4.2 Axle TS

This control allows an axle counter track section to be set to occupied when clear within the SEI, the operation of the axle counter equipment is unaffected by this control.

Occupation of an axle counter track section does not prevent routes from being set, where permissive routes are provided, an MA can still be issued for these routes.

4.3 Ground Frame

This control allows a ground frame release to be locked in the normal position and for detection to be maintained.

4.4 Point

This control allows a set of points to be held in the normal and / or reverse position with detection maintained and prevents the Signaller moving them except as described below.

A point control can be put in place with the switches detected in the position for which the bar is to be enforced and for them to be moved away from that position by the Signaller.

If the padlock is not displayed on the Technical Terminal, the control is not effective.

4.5 Computer Virus Protection

The uploading or downloading of software using any medium is strictly prohibited without the specific authority of the Network Rail Duty Box Technician.

This requirement applies to all equipment, at all times.

5. Indications and Useful Voltage

Board	LED Name	Colour	Meaning	OK state	NOK State
CVO	W	Green	Watchdog	On	Off or Flashing
CVO	H	Red	Halt	Off	Flashing or on
CVO	M	Yellow	Master	Flashing	Off
CVO	E	Yellow	Slave	Off	Flashing or on
CVO	1	Green	Software active	Flashing	Off
CVO	2	Red	Showing the functioning of the 2 out of 3 processing	Off	Blinking (2 out of 2 processing) On (1 out of 1 processing)
PVF2	NORMAL	Green	Fans Okay	On	Off
CME	E	Red	Error	Off	On
CME	V/Rx	Yellow	Reception message valid	Flashing	Off or On
CME	A/Rx	Green	Reception link Active	On	Off or Flashing
CME	V/Tx	Yellow	Transmitting message	Flashing	Off or On
CME	A/Tx	Green	Transmitting link Active	On	Off or Flashing
CALS	5V VME	Green	Supply Present	On	Off
CALS	+12V VME	Green	Supply Present	On	Off
CALS	-12V VME	Green	Supply Present	On	Off
CALS	5V VL	Green	Supply Present	On	Off
CALS	24VREG	Green	Supply Present	On	Off
CAP	BFL	Yellow	Board Failure	Flashing	On or Off
CAP	CPU	Green	Processing Unit Correct	Flashing	On or Off
CALM2	+5V1	Green	Supply Present	On	Off
CALM2	+5V2	Green	Supply Present	On	Off
CALM2	5VLS	Green	Supply Present	On	Off
CALM2	24HES	Green	Supply Present	On	Off
CALM2	+24V1	Green	Supply Present	On	Off
CALM2	+24V2	Green	Supply Present	On	Off
CALM2	+24KD1	Green	Supply Present	On	Off
CALM2	+24VISO	Green	Supply Present	On	Off
MTOR2	CG	Green	Watchdog	On	Flashing or Off
MTOR2	ER	Red	Error	Off	On or Flashing
MTOR2	V1	Yellow	FTN Network A	On	Off or Flashing
MTOR2	V2	Yellow	FTN Network B	On	Off or Flashing
MTOR2	1	Green	Ongoing Task	Flashing	Off or On
MTOR2	2	Yellow	Ongoing Task	Flashing	Off or On
MTOR2	E	Green	Entrée (Input)	On or off	
MTOR2	S	Green	Sortie (Output)	On or off	

Board	LED Name	Colour	Meaning	OK state	NOK State
MTOR2	ES	Green	Entrée Securite (Safety	On or off	
MTOR2	SS1	Green	Controle Defaut D	On or off	
CALM2	+5V1	Green	Supply Present	On	Off
CALM2	+5V2	Green	Supply Present	On	Off
CALM2	5VLS	Green	Supply Present	On	Off
CALM2	24HES	Green	Supply Present	On	Off
CALM2	+24V1	Green	Supply Present	On	Off
CALM2	+24V2	Green	Supply Present	On	Off
CALM2	+24KD1	Green	Supply Present	On	Off
CALM2	+24VISO	Green	Supply Present	On	Off
CRCD	SNS1 - 20	Yellow	Lit the corresponding		

Table 3 - SEI Cabinet Indications

Board	Test Point	Nominal Voltage	Maximum Voltage	Minimum Voltage	Ripple
PVF2		24	28.8	21.5	1V pp
Switch		24			
Supply to PAP-CSD Rack		24	21.5	28.8	1V pp
Supply to PES2		24	21.5	28.8	1V pp

Table 4 - SEI Power Supplies

Board	Test Point	Nominal Voltage	Minimum Voltage	Maximum Voltage	Ripple
CALS	5V VME	+5	+4.7	+5.5	100mV pp
CALS	+12V VME	+12	+11.5	+12.5	100mV pp
CALS	-12V VME	-12	-11.5	-2.5	100mV pp
CALS	5V VL	+5	+4.7	+5.5	100mV pp
CALS	24VREG	+24	+23	+25	1V pp

Table 5 - SEI Power Supplies (2)

Board	LED Name	Colour	Function	OK state	NOK State
CLAP	R	Green		Flashing	Off
CLAP	H	Red		Off	On
CLAP	W	Green		On	Off
CLAP	D	Red		Off	On
CLAP	1	Green		Flashing slowly when used as CIC or CIRS and fast when used as a CGL or CVO)	Off
CLAP	2	Red		Off	Flashing Note CIRS Only: Flashes when port is faulty or when in mainten ance mode
CME1	TX	Yellow	Flashing when transmitting data	Flashing	Off
CME1	RX	Yellow	Flashing when receiving data	Flashing	Off
CME1	MA	Green	Link OK	On	Off
CME1	DEF	Red	Fault	Off	On
CME+	E	Red	Error	Off	On
CME+	V (RX)	Yellow	Flashing when receiving data	Flashing	Off
CME+	A (RX)	Green	Receiver Okay	On	Off
CME+	V (TX)	Yellow	Flashing when transmitting data	Flashing	Off
CME+	A (TX)	Green	Transmitter Okay	On	Off
CALS	5V VME	Green	Supply Present	On	Off
CALS	+12V VME	Green	Supply Present	On	Off
CALS	-12V VME	Green	Supply Present	On	Off
CALS	5V VL	Green	Supply Present	On	Off

Board	LED Name	Colour	Function	OK state	NOK State
CALS	24VREG	Green	Supply Present	On	Off
CAP	BFL	Yellow	Board Failure	Flashing	On
CAP	CPU	Green	Processing Unit Correct	Flashing	Off or On
Modem	POWER2	Green	Supply Present	On	Off
Modem	POWER1	Green	Supply Present	On	Off
Modem	POWER	Green	Supply Present	On	Off
Modem	TEST	Green			
Modem	CTS2	Red	On when the modem is	On	Off
Modem	DTR2	Red	On when the connected	On	Off
Modem	CTS1	Red	On when the modem is	On	Off
Modem	DTR1	Red	On to indicate Data	On	Off
Modem	MODE2	Red		Off	
Modem	CD2	Red	On when the B channel		
Modem	MODE1	Red	Off	Off	
Modem	CD1	Red	On when the B channel		
Modem	□	Red	Modem on	On	Off
Modem	Data	Red	Flashes when data is		
Multiplexer	□	Green	Indicates the	On	Off
Multiplexer	TRUNK1	Red	Indicates activation of	Off	On
Multiplexer	TRUNK2	Red	Indicates activation of	Off	On
Multiplexer	CTRL	Green	At least one B channel is active	On	Off
Multiplexer	TEST	Red	Auto-test or alarm	Off	On

Table 6 - Radio Block Centre Cabinet Indications

Board	Test Point	Nominal Voltage	Minimum Voltage	Maximum Voltage	Ripple
PVF		24	28.8	21.5	1V pp
CALS	5V VME	+5	+4.7	+5.5	100mV pp
CALS	+12V VME	+12	+11.5	+12.5	100mV pp
CALS	-12V VME	-12	-11.5	-2.5	100mV pp
CALS	5V VL	+5	+4.7	+5.5	100mV pp
CALS	24VREG	+24	+23	+25	1V pp

Table 7 - Radio Block Centre Cabinet Power Supplies

Board	LED Name	Colour	Meaning	OK state	NOK State
CME1	TX	Yellow	Flashing when transmitting data	Flashing	Off
CME1	RX	Yellow	Flashing when	Flashing	Off
CME1	MA	Green	Optical fibre connected	On	Off
CME1	DEF	Red	Fault	Off	On
CALS	5V VME	Green	Supply Present	On	Off
CALS	+12V VME	Green	Supply Present	On	Off
CALS	-12V VME	Green	Supply Present	On	Off
CALS	5V L	Green	Supply Present	On	Off
CALS	24VREG	Green	Supply Present	On	Off

Table 8 - SILAM Cabinet Indications

Board	Test Point	Nominal Voltage	Maximum Voltage	Minimum Voltage	Ripple
PVF		24	28.8	21.5	1V pp
CALS	5V VME	+5	+4.7	+5.5	100mV pp
CALS	+12V VME	+12	+11.5	+12.5	100mV pp
CALS	-12V VME	-12	-11.5	-12.5	100mV pp
CALS	5V VL	+5	+4.7	+5.5	100mV pp
CALS	24VREG	+24	+23	+25	1V pp

Table 9 - SILAM Cabinet Power Supplies

Board	LED Name	Colour	Meaning	OK state	NOK State
PVF2	NORMAL	Green	Fans Okay	On	Off
CALM2	24HES	Green	Supply Present	On	Off
CALM2	+24V1	Green	Supply Present	On	Off
CALM2	+24V2	Green	Supply Present	On	Off
CALM2	+24KD1	Green	Supply Present	On	Off
CALM2	+24VISO	Green	Supply Present	On	Off
MTOR2	E	Green	Entrée (Input)	On or off repeats	
MTOR2	S	Green	Sortie (Output)	On or off repeats	

MTOR2	ES	Green	Entrée Securite (Safety Input)	On or off repeats input	
MTOR2	SS1	Green	Controle Defaut D (KDI) Sortie Securite (Safety Output)	On or off repeats input condition	
MTOR2	CG	Green	Watchdog	On	Flashing or Off
MTOR2	ER	Red	Error	Off	On or Flashing
MTOR2	V1	Yellow	FTN Network A	On	Off or Flashing
MTOR2	V2	Yellow	FTN Network B	On	Off or Flashing
MTOR2	1	Yellow	Ongoing Task	Intermittently	Off or On
MTOR2	2	Yellow	Ongoing Task	Intermittently	Off or On

Table 10 - Remote Object Controller Cabinet Indications

Board	Test Point	Nominal Voltage	Maximum Voltage	Minimum Voltage	Ripple
PVF2		24	28.8	21.5	1V pp
Supply to PES2		24	21.5	28.8	1V pp

Table 11 - Remote Object Controller Cabinet Power Supplies

Broad	LED Name	Colour	Meaning		
V24	POWER	Green	Power supply present	On - Okay	Off – Fault
V24	B1 TX	Yellow	Logical state of the interface	On - High	Off - Low
V24	B1 RX	Green	Logical state of the interface	On - High	Off - Low
V24	B2 TX	Yellow	**Not used**		
V24	B2 RX	Green	**Not used**		
V24	+	Red	Remote power supply condition	Off - Okay	On -Fuse ruptured
V24	-	Red	Remote power supply condition	Off - Okay	On -Fuse ruptured

Table 12 - Converter ISDN/V24

END

Includes:	Remote Object Controller Cabinets
Excludes:	All other types of Controller Cabinets

GENERAL

The Remote Object Controller cabinet consists of:

a) Cable terminations.

b) One PVF2 fan rack to cool the cabinet.

c) One PES2 rack housing 1 object controller.

d) Two Ethernet switches.

e) Fibre optic termination shelf.

DAILY SERVICES

1. SEI Cabinet

1.1 Check the SEI Cabinet component status as indicated on the Technical Terminal.

SERVICE A

2. Status & Ventilation

2.1 Observe the green LED is illuminated on the PVF2 rack and that no abnormal noise is evident from any of the fans as this might indicate a failing cooling fan.

2.2 Clean the filter of the ventilation system using a vacuum cleaner; it shall be replaced if in poor condition.

SERVICE B

3. Cabinet

3.1 Dust the external surfaces of the cabinet.

3.2 Check the condition of the cabinet, hinges and locks.

3.3 Examine the equipment, including terminals, cable and cable connectors. Look for signs of physical damage, overheating or arcing.

3.4 Check the security of all fixings and connectors and remove any accumulations of dust or other debris.

3.5 Check labels remain clearly legible.

4. System Indications

4.1 Observe the correct illumination of all system LEDs.

5. Earth Bonding

5.1 Measure the resistance between the signalling earth bus bar and each earth terminal, cable shield and surge arrester. The resistance between the bus bar and any earth terminal or cable shield shall be less than 1 ohm when measured with an earth ground tester.

END

Includes:	Radio Block Centre (RBC) Cabinet
Excludes:	All other types of Radio Block Centre Cabinets

GENERAL

The RBC cabinet consists of:

a) Two modem racks.

b) Three PAPR racks.

c) Two multiplexers.

d) Three PVF fan racks.

Before handling any electronic equipment observe ESSD precautions.

DAILY SERVICES

1. Status

1.1 Check the RBC component status as indicated on the MAR1.RBC screen on SILAM and investigate any problems.

4 WEEKLY SERVICE

2. Spares

2.1 Check that spare equipment is available, ready for use, pcb mounted batteries are in date, and that replacements are available for equipment undergoing repair or investigation.

SERVICE A

3. Cabinet

3.1 Clean the filters of the ventilation system using a vacuum cleaner. Replace them ifin poor condition.

3.2 Check the operation of the cooling fans mounted in the PVF fan racks, this shall be carried out by isolating, unplugging and removing one rack at a time. With the fan rack removed, manually rotate each fan to check it rotates freely. Replace the PVF rack and reset the CBs wait for 30 seconds and check that no abnormal noise is evident from any

SERVICE B

4. Cabinet

4.1 Dust the internal and external surfaces of the cabinet.

4.2 Check the condition of the cabinet, hinges and locks.

4.3 Examine the equipment, terminals, cable and cable connectors. Look for signs of physical damage, overheating or arcing.

4.4 Check the security of all fixings and connectors and remove any accumulations of dust or other debris.

4.5 Check labels remain clearly legible.

5. System Indications

5.1 Observe the correct illumination of all system LEDs.

6. Power Supply Voltages

6.1 Measure the following power supply voltages on three CALS boards:

a) +5 VME

b) +12 VME

c) -12 VME

d) +5 VL

e) 24V REG

See NR/SMS/IE00 (Cambrian ERTMS – General) for details of tolerances.

7. Earth Bonding

7.1 Measure the resistance between the main signalling centre earth bus bar and each earth terminal and cable shield. The resistance between the bus bar and any earth terminal or cable shield shall be less than 1 ohm when measured with an earth ground tester.

7.2 Check all doors are securely closed on completion of maintenance.

The cubicle provides EMC protection, any signs of damage or deterioration shall be reported to your supervisor.

PERIODIC TASKS

8. Batteries

8.1 Observe ESSD precautions while carrying out this task.

8.2 Change the battery on the CIER and CCS3 boards in the PAP_CSD rack and on any spare boards or return the complete board to the manufacturer for the battery to be changed.

The date the battery was installed is on a label attached to each battery

END

Includes:	GEST and RCCS Workstations, RCCS, RCCS Printer, RCCS Servers and Computers
Excludes:	All other GEST or RCCS Equipment

DAILY SERVICES

1. Alarms

1.1 Check for alarms and events by interrogation of the RCCS Maintainer Workstation and investigate any problems.

REGULAR SERVICE 1

2. Weekly Service

2.1 Check the computer name on the LCD front panel of each RCCS, GEST, Automatic and Database server is indicated in blue, its normal state. If the computer name is indicated in orange a hardware fault is present which shall be investigated.

REGULAR SERVICE 2

3. Two Weekly Service

3.1 Execute an anti-virus update of the RCCS Maintainer Workstation.

The update is downloaded to a computer with internet access from http://www.avast.com/eng/updates.html .

The download button initiates the download “vpsupd.exe” from Avast which shall be placed onto a memory stick previously scanned and proved clear of any virus for upload to the RCCS Maintainer Workstation.

To upload onto the RCCS Maintainer Workstation insert the memory stick and double click on “vpsupd.exe”. When message “Database updated from x to y” appears, click OK.

REGULAR SERVICE 3

4. Four Weekly Service

Operating System

4.1 Check the contents of the application, security and system logs for any errors and excessive activity using the following path: -

Start > Settings > Control Panel >Administrative Tools > Event Viewer

Any errors found shall be investigated.

Network Time Protocol (NTP)

4.2 Check the NTP to confirm Local Time and Reference time are synchronised. This activity shall be carried out on all servers and workstations.

To carry out this task launch “ntpq.exe” as follows: - Windows Start menu > RCCS > Maintenance > NTP > ntpq:

a) If an error message “ntpq.exe: read: No such file or directory” is raised, this might be due to a large difference between local and reference time.

To correct this error a synchronisation shall be attempted by using the synchronisation tool as follows: - Windows Start menu > RCCS > Maintenance > NTP > Synchronize.

After synchronisation wait for 15 minutes and again launch “ntpq.exe”, if the fault persists further investigation shall be undertaken.

b) In the “ntpq” type “pe” and check there is “*” at the beginning of one line which indicates the current reference clock which can be a GPS-RECEIVER or one of the signalling server names.

If the “*” is not displayed it might be as a result of a computer having been rebooted during the last hour after a long period of being stopped, if this is found the NTP requires synchronising as described above.

ILOG Server “Logical Mapper” Service (Excl GEST Server)

4.3 Check the ILOG Server Logical Mapper service is running by observing the icon. If it is not running stop the RCCS applications and restart the ILOG Server Logical Mapper from Start > Settings > Control Panel >Administrative Tools > Services, then restart the RCCS applications.

RCCS Software - DigCom Equipment

4.4 Check the connection status of the DigCom equipment on all RCCS Servers and work stations (excl GEST Server and workstation) by double clicking on the LAN service blue icon or the serial service yellow icon (Automatic Server only)

Select “Open Spy” in the menu. In the spy window check the status reports for links; when in order they display “Correct” any displaying “Bad” shall be investigated.

RCCS Software - ILOG Connections

4.5 Check the status of the ILOG connections RCCS Servers excluding the GEST Server.

NOTE: *To carry out this task the "x" command shall be executed in the console window of all server applications except the "Watchdog" application.*

The results returned by use of the "x" command shall be compared with those in the Ansaldo STS RCCS Signalling Maintenance Manual; if they are not identical the application shall be restarted.

Network Card

4.6 Check in the Windows system tray that the following network connections are working correctly: -

Network Connections	Servers	Workstations
Local Area Connection	Automatic and Signaling	All
Local Area Connection 2	Disabled	All
Local Area Connection 3	All	NA
Local Area Connection 4	All	NA
Virtual Area Connection	All	All

Table 1 – Network Connections

Memory and Hard Disk Drive

4.7 Check on all RCCS servers and workstations that the available memory is not less than 20% for a 10-minute period.

Check this on the Physical Memory section of the Performance page of the Windows Task Manager by comparing the available Physical memory with the Total Physical memory.

If the available memory drops below 20%, reboot the computer, leave it operational for 4 hours and recheck memory use, if the condition persists, further investigation shall be carried out in accordance with the RCCS Maintenance manual.

4.8 In the computer management administrative tool (Start\Control Panel\Administrative Tools\Computer Management\Sisk Management):

a) Check the state of health of the hard disk drives,

b) Check that the free disk space percentage is not less than 20% for each hard drive,

c) Run the Microsoft Windows Disk Defragmenter tool and if required defragment each hard disk drive in a traffic down period.

d) If the free disk space percentage is less than 20% on one drive, follow procedure described in the RCCS Maintenance manual and check again used disk space; if the problem persists further investigation shall be carried out in accordance with the RCCS Maintenance manual.

<u>RS485 Ports</u>

4.9 Check the functioning of RX/TX LEDs on the RS485 Port. If they do not illuminate momentarily in a two-minute period check the status of the RCCS application.

The red TX and green RX LEDs associated with the "Hot" Automatic Server flashes momentarily and at the same time the green RX LEDs flash on the port associated with the standby Server.

<u>CPU Card</u>

4.10 Check for ten minutes using the task manager that each CPU does not experience a continuous load exceeding 50%.

If any CPU load exceeds 50% for more than 10 minutes, reboot the computer and check again after four hours, if the problem persists further investigation shall be carried out in accordance with the RCCS Maintenance manual.

<u>USB Ports</u>

4.11 Check all USB ports are disabled in software, password protected and fitted with a device to prevent connection of a USB configured device.

SERVICE A

5. Server Switchover

5.1 Manually switch over the GEST, signalling and automatic servers.

NOTE: *This operation stops trains from being signalled and should be carried out in a period when few operations are being carried out.*

6. Virus Check

6.1 Check using current antivirus software that the GEST, signalling and automatic standby servers are free from any virus.

If a virus is found advise your SM(S).

7. General

7.1 Check ventilation fans are running freely on processors and computers.

7.2 Clean all the RCCS and server workstations including the screen, keyboard and mouse.

7.3 Check all the RCCS and server workstations for visual quality of the screens and keyboards.

7.4 Check the RCCS printer for alarms and service following the manufacturer's instructions.

SERVICE B

8. Archive and Delete Files and Directories

8.1 Before deletion of any file, the information shall be burnt onto a DVD using the RCCS Maintenance Workstation, labelled and stored securely on site.

8.2 Delete the files older than 3 months from the "Backups" directory Backup files do not exist on GEST Server or Workstation. The Backup files are only found on: -

a) Signalling Server 1 & 2.

b) Automatic Server 1 & 2 Database Server.

c) Signallers Workstation 1 & 2 Maintenance Workstation.

Using Windows Explorer at each RCCS Server or Workstation, navigate to D:/Backups. The files in the directories are the RCCS application traces.

These are used to investigate faults in the RCCS applications.

8.3 Delete the Reports Directories older than 3 months on the RCCS Database Server.

This is accessed via Windows Explorer – My Computer \ Shared on 'RCCS-db-s'(S:). The files in this directory are the time stamped events/alarms in text format, classified per week directory and day directory.

8.4 Delete the *.ttea files in the TTEA Copy Directory that are older than 3 months on the RCCS Data Base Server.

This is accessed via Windows Explorer – My Computer \ Shared on 'RCCS-db-s'(S:) \ Reports \ Internal Data \ TTEA Copy Dir.

These files are the timetable engineering arrangements backup files and are used in case of cold re-start of the RCCS automatic servers.

PERODIC TASKS

9. General

9.1 Examine the equipment, including terminals, cable and cable connectors. Look for signs of physical damage, overheating or arcing.

9.2 Check the security of all fixings and connectors and remove any accumulations of dust or other debris.

9.3 Check labels remain clearly legible.

9.4 Measure the resistance between the main signalling centre earth bus bar and each earth terminal and cable shield.

The resistance between the bus bar and any earth terminal or cable shield shall be less than 1 ohm when measured with an earth ground tester.

9.5 Check by running the Dell diagnostic tool on each server for any hardware or system incidents that have occurred, record details of any incidents and report them to your supervisor.

9.6 Empty the trace buffer on each server.

END

Includes:	SILAM, SICAM
Excludes:	Technical Terminal (TT), Consultation, Key Management Centre (KMC)

GENERAL

Before handling any electronic equipment observe ESSD precautions.

SAM comprises:

a) One SICAM: Central maintenance equipment.

b) One SILAM: Local maintenance equipment.

c) One Consultation Workstation.

DAILY SERVICES

1. SICAM

1.1 Check the following applications are open and running correctly:

a) Scheduler.

b) Connect silams.

c) Animation silams.

d) Loader.

e) Unloader DbCourant.

f) Unloader DbArchieve.

g) DbCourant dumplog.

h) LanEquipment.

i) Gest Gateway.

2. SILAM

2.1 Check for alarms and events by interrogation of the SILAM Workstation and investigate.

REGULAR SERVICES

3. Weekly Service - SICAM

3.1 Check the contents of the application, security and system logs for any errors and excessive activity, the files are accessed by the following path:-

Start up > Settings > Control Panel > Administration tools > Even viewer.

3.2 Empty the contents of the application, security and system logs following this check.

3.3 Check all tasks are running correctly by launching the "SQL Server Management Studio" using the following path:-

Start > Programs > Microsoft SQL Server 2005 > SQL Server Management Studio.

3.4 Expand the SQL Server tree diagram to access "\SICAM\SQL server Agent\Jobs".

3.5 To check each task is running properly right click the task and choose "View History" For each task.

3.6 Delete the contents of each file following this check.

3.7 Check the status of the Database. This is accessed by the following path:-

Start > Programs > Microsoft SQL Server 2005 > SQL Server Management Studio

3.8 In the toolbar select "New Query", in the query window type "Dbcc Checkdb (DbTempsReel)" and click "Execute" The status of the database is displayed to allow examination of the results.

3.9 In the toolbar select "New Query", in the query window type "Dbcc Checkdb (DbCourant)" and click "Execute" The status of the database is displayed to allow examination of the results.

3.10 When complete, close the query window and the SQL Server Management Studio Window.

3.11 Check that no abnormal noise is evident from any of the cooling fans which might indicate a failing fan.

3.12 Check that spare equipment is available and ready for use in the event of a failure, and that replacements are available for equipment undergoing repair or investigation.

4. Two Weekly Service – Backup the Historic Database

4.1 Extract the incremental back up tape by selecting “SQL Management Studio” and in the list of jobs select “Eject Tape”.

4.2 Insert a “Cleaning Cartridge” tape in the tape drive, it is then drawn in by an automatic mechanism.

4.3 When the tape has been drawn in, two green lights flash on the front panel and the cleaning cycle commences. The process takes approximately 1 minute to complete and the tape is then ejected.

The cleaning cartridge can only be used for a limited number of operations so a record shall be kept of use to enable its replacement.

4.4 Insert a blank tape in the tape drive, it is then drawn in by an automatic mechanism.

4.5 To run the back up in the “SQL Server Management Studio” go to “Jobs” and right click “Backup-DbCourant” and choose “Start Job”. On the front panel of the tape drive the left-hand indicator displays continuously while the right hand indicator flashes.

4.6 While the tape is running right click the task at 30 second intervals and choose “refresh”. The “Status” column indicates if the archiving is progressing. When the archiving is complete the “Status” column displays “success”.

4.7 To confirm the archiving has been successful right click the task and select “View History” which reports either “The job succeeded” or “The job failed”.

If successful, note the information on the exit message (number of pages archived, tape name), write this information on the tape which has automatically eject and place it into storage.

If unsuccessful, repeat the operation.

NOTE: *The SICAM has a storage capacity of 30 days before it overwrites historic data.*

4.8 Reinsert the incremental back-up tape, it is then drawn in by an automatic mechanism.

4.9 On the front panel of the tape drive both indicators flash, wait until they become steady before proceeding.

4.10 Right click “Prepare the tape” and choose “Start job” which cause the right-hand indicator to start flashing whilst the left remains steady.

4.11 While the tape is running right click the task at 30 second intervals and choose "refresh". The "Status" column indicates if the task is progressing. When the task is complete the "Status" column displays "success.

4.12 To confirm the task has been successful right click the task and select "View History" which reports either "The job succeeded" or "The job failed".

If successful, this has completed the initialisation of the tape.

If unsuccessful, repeat the operation.

4.13 Close the "SQL Server Management Studio".

5. Four Weekly Service – Memory and Hard Disk Drive

5.1 Check on servers and workstations that the available memory is not less than 20% for a 10-minute period. Check this on the Physical Memory section of the Performance page of the Windows Task Manager by comparing the available Physical memory with the Total Physical memory.

If the available memory drops below 20%, reboot the computer, leave it operational for 4 hours and recheck memory use. If the condition persists, further investigation shall be carried out in accordance with the Maintenance manual.

In the computer management administrative tool (Start\Control Panel\Administrative Tools\Computer Management\Sisk Management):

a) Check the state of health of the hard disk drives,

.

b) Check that the free disk space percentage is not less than 20% for each hard drive.

c) Run the Microsoft Windows Disk Defragmenter tool and if required defragment each hard disk drive in a traffic down period.

d) If the free disk space percentage is less than 20% on one drive, follow procedure described in the Maintenance manual and check again used disk space. If the problem persists, further investigation shall be carried out in accordance with the Maintenance manual.

SERVICE A

6. SILAM Cabinet and SICAM

6.1 Clean the filters of the ventilation system using a vacuum cleaner. They shall be replaced if in poor condition.

6.2 Check the operation of the cooling fans mounted in the PVF fan racks, this shall be carried out by isolating, unplugging and removing one rack at a time. With the fan rack removed manually rotate each fan to check it rotates freely. Replace the PVF rack and reset the CBs. Repeat the process for each rack in turn.

6.3 Check ventilation fans are running freely on workstation processors.

6.4 Clean the workstation screens, keyboards and mice.

6.5 Check the visual quality of the workstation screens and keyboards.

SERVICE B

7. SILAM Cabinet

7.1 Dust the external surfaces of the cabinet.

7.2 Check the condition of the cabinet and its hinges and locks.

7.3 Examine the equipment, terminals, cable and cable connectors. Look for physical damage, overheating, arcing.

7.4 Check the security of all fixings and connectors and remove accumulations of dust or other debris.

7.5 Check labels remain clearly legible.

8. Indications

8.1 Observe the correct illumination of all system LEDs.

9. Power Supplies

9.1 Measure the following power supply voltages on three CALS boards:

a) +5 VME.

b) +12 VME.

c) -12 VME.

d) +5 L.

e) 24V REG.

See NR/SMS/PartC/IE00 (Cambrian ERTMS – General) for details of tolerances.

9.2 Measure the resistance between the main signalling centre earth bus bar and each earth terminal and cable shield. The resistance between the bus bar and any earth terminal or cable shield shall be less than 1 ohm when measured with an earth ground tester.

9.3 Check all doors are securely closed on completion of maintenance.

9.4 The cubicle provides EMC protection, any signs of damage or deterioration shall be reported to your supervisor.

END

Includes:	SEI and Local Object Controllers (MTOR)
Excludes:	Remote Object Controllers (MTOR)

GENERAL

The SEI cabinet contains the following:

a) One PAP-CSD rack which is the Processing Unit of the SEI.

b) Four PES2 racks, each one housing 3 object controllers.

c) Three PVF2 fan racks to cool the cabinet.

d) Two Ethernet switches linking modules of the different racks to the two FTN links.

DAILY SERVICE

1. SEI Cabinet

1.1 Check the SEI Cabinet component status as indicated on the Technical Terminal.

REGULAR SERVICE

2. System

2.1 Observe the green LED is illuminated on each of the three PVF2 racks and that no abnormal noise is evident from any of the fans which might indicate a failing cooling fan.

2.2 Check that spare equipment is available and ready for use, and that replacements are available for equipment undergoing repair or investigation.

SERVICE A

3. Filters

3.1 Clean the filters of the ventilation system using a vacuum cleaner; they shall be replaced if in poor condition.

SERVICE B

4. Cabinet

4.1 Dust the internal and external surfaces of the cabinet.

4.2 Check the condition of the cabinet and its hinges and locks.

4.3 Examine the equipment, terminals, cable and cable connectors. Look for physical damage, overheating or arcing.

4.4 Check the security of all fixings and connectors and remove accumulations of dust or other debris.

4.5 Check labels remain clearly legible.

5. Power Supplies

5.1 Measure the following power supply voltages on three CALS boards:

a) +5 VME.

b) +12 VME.

c) -12 VME.

d) +5 L.

e) 24V REG.

See NR/SMS/PartC/IE00 (Cambrian ERTMS – General) for details of tolerances.

6. System Indications

6.1 Observe the correct illumination of all system LEDs.

7. Earth Bonding

7.1 Measure the resistance between the main signalling centre earth bus bar and each earth terminal and cable shield. The resistance between the bus bar and any earth terminal or cable shield shall be less than 1 ohm when measured with an earth ground tester.

7.2 Check all doors are securely closed on completion of maintenance.

The cubicle provides EMC protection, any signs of damage or deterioration shall be reported to your supervisor.

PERODIC TASK

8. Batteries

Observe ESSD precautions while carrying out this task

8.1 Change the battery on the CIER and CCS3 boards in the PAP_CSD rack and on any spare boards.

END

Includes:	Technical Terminal, Consultation Workstation
Excludes:	All other Technicians Terminal or Workstations

REGULAR SERVICE

1. Memory and Hard Disk Drives

1.1 Check on all servers and workstations that the available memory is not less than 20% for a 10-minute period.

Check this on the Physical Memory section of the performance page of the Windows Task Manager by comparing the available Physical memory with the Total Physical memory.

If the available memory drops below 20%, reboot the computer, leave it operational for 4 hours and recheck memory use, if the condition persists, further investigation shall be carried out in accordance with the Maintenance manual.

1.2 In the computer management administrative tool (Start\Control Panel\Administrative Tools\Computer Management\Sisk Management):

a) Check the state of health of the hard disk drives.

b) Check that the free disk space percentage is not less than 20% for each hard drive.

c) Run the Microsoft Windows Disk Defragmenter tool and if required defragment each hard disk drive in a traffic down period.

d) If the free disk space percentage is less than 20% on one drive, follow procedure described in the Maintenance manual and check again used disk space; if the problem persists further investigation shall be carried out in accordance with the Maintenance manual.

SERVICE A

2. Equipment

2.1 Check ventilation fans are running freely.

2.2 Clean the screen, keyboard and mouse.

2.3 Check the visual quality of the screen and keyboard.

2.4 Check all USB ports are disabled in software, password protected, and each USB is fitted with a device to prevent connection of a USB configured device.

SERVICE B

3. Equipment

3.1 Examine the equipment, terminals, cable and cable connectors, in particular look for signs of physical damage, overheating or arcing.

3.2 Check the security of all fixings and connectors and remove any accumulations of dust or other debris.

3.3 Check labels remain clearly legible.

END

Includes:	Terminal servers (Also known as a MOXA converter), Ethernet Switches, TRUST serial converter, TRUST modem and Remote Access Server (RAS)
Excludes:	All other Terminal Servers or related equipment

REGULAR SERVICE

1. Clock

1.1 Check the NTP clock has a GPS Lock indication displayed as a full stop in the bottom right of the display and the time is correct.

SERVICE A

2. Equipment

2.1 Examine the equipment, terminals, cable and cable connectors, in particular look for signs of physical damage, overheating or arcing.

2.2 Check the security of all fixings and connectors and remove any accumulations of dust or other debris.

2.3 Check labels remain clearly legible.

END

Includes:	CATS Signaller and supervisor workstations, CATS Printer, CATS servers and computers.
Excludes:	All other CAT based equipment

GENERAL

REGULAR SERVICE

1. Function Test

1.1 Carry out a functional test of the CATS system. This is to include a functional test of the GSMR and telephone concentrator.

SERVICE A

2. CAT Server

2.1 Check the computer name on the LCD front panel of each CATS server is indicated in blue, the normal state. If the computer name is indicated in orange a hardware fault is present which shall be investigated.

2.2 Check the CATS system time to confirm all parts of the CATS system are synchronised and the time is correct. This activity shall be carried out on all servers and workstations.

3. Operating System

3.1 In the Operating Systems check the contents of the application, security and system logs for any errors and excessive activity using the following path:-

Start > Settings > Control Panel >Administrative Tools > Event Viewer.

Any errors found shall be investigated.

4. Memory and Hard Disk Drives

4.1 Check on all CATS servers and workstations that the available memory is not less than 20% for a 10-minute period. Check this on the Physical Memory section of the Performance page of the Windows Task Manager by comparing the available Physical memory with the Total Physical memory.

If the available memory drops below 20%, reboot the computer, leave it operational for 4 hours and recheck memory use, if the condition persists, further investigation shall be carried out in accordance with the RCCS Maintenance manual.

In the computer management administrative tool (Start\Control Panel\Administrative Tools\Computer Management\Sisk Management):

a) Check the state of health of the hard disk drives.

b) Check that the free disk space percentage is not less than 20% for each hard drive.

c) Run the Microsoft Windows Disk Defragmenter tool and if required after this analysis defragment each hard disk drive.

d) If the free disk space percentage is less than 20% on one drive, follow procedure described in the RCCS Maintenance manual and re-check the used disk space. If the problem persists further investigation shall be carried out in accordance with the RCCS Maintenance manual.

5. CPU Card

5.1 Check for ten minutes using the task manager that each CPU does not experience a continuous load exceeding 50%. If any CPU load exceeds 50% for more than 10 minutes, reboot the computer and check again after four hours. If the problem persists further investigation shall be carried out in accordance with the RCCS Maintenance manual.

6. USB Ports

6.1 Check all USB ports are disabled in software, password protected and fitted with a device to prevent connection of a USB configured device.

7. Virus Check

7.1 Check using current antivirus software that the GEST, signalling and automatic standby servers are free from any virus. If a virus is found advise your SM(S).

8. Final

8.1 Check ventilation fans are running freely on processors and computers.

8.2 Clean all the CATS and server workstations including the screen, keyboard and mouse.

8.3 Check all the CATS and server workstations for visual quality of the screens and keyboards.

8.4 Check the CATS printer for alarms and service following the manufacturer's instructions.

SERVICE B

9. Equipment

9.1 Examine the equipment, terminals, cable and cable connectors. Look for signs of physical damage overheating or arching.

9.2 Check that all fixings and connectors are secure and remove accumulations of dust or other debris.

9.3 Check labels remain clearly legible.

9.4 Measure the resistance between the main signalling centre earth bus bar and each earth terminal and cable shield. The resistance between the bus bar and any earth terminal or cable shield shall be less than 1 ohm when measured with an earth ground tester.

END

Includes:	SEI-CLSS (Ferriby to Gilberdyke)
Excludes:	All other Interlockings

DAILY SERVICE

1. Technicians Terminal

1.1 Check the Technicians Terminal for alarms/alerts for the previous 36 hours and action accordingly.

This can be carried out remotely at the TTD or the TTC.

1.2 Observe the visual quality of the Technicians Terminal.

SERVICE B

2. Power Supply and Earth Check (external)

2.1 Observe that the Green 'DC ok' LED is illuminated on the 24 V DC PULS supply unit, if not, replace unit.

2.2 Carry out NR/SMS/PartB/Test/053 (ELD Function Test) or NR/SMS/PartB/Test/051 (Busbar Earth Test).

3. PVF Racks (Internal)

3.1 Check that the PVF2's front panel indicator is illuminated Green.

4. Board Batteries

4.1 Check that the batteries on the CIER and CCS3 boards are in date and record.

PERIODIC TASK

5. Filters (Internal)

5.1 Replace the ventilation system filters (Figure 1) in the air guides of the cabinets.

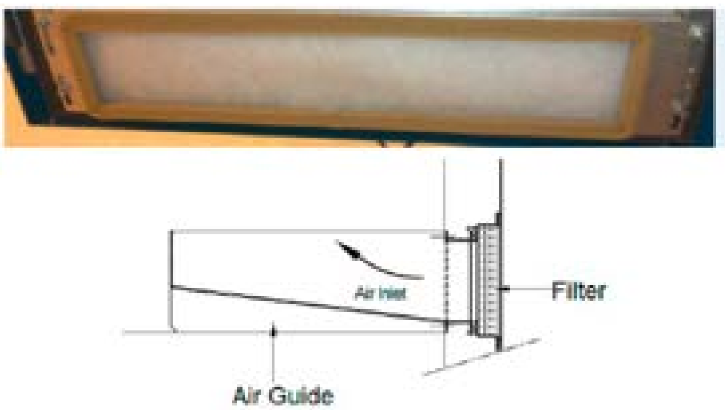


Figure 1 - Ventilation system filter

6. Batteries

Arrange for the replacement of batteries on the CIER and CCS3 boards, including spares, record the details.

These batteries can only be replaced by sending the CIER and CCS3 board to the supplier, this is not a task that the Technician can carry out.

END

Includes:	Atlas 200 Radio Block Centre (RBC) and Maintenance Supervision System (MSS)
Excludes:	All other RBC's, MSS's and Network Transmission Gateway

GENERAL

Do not connect unauthorised test equipment to a working 2oo3 platform system.

The use of an ESD wrist strap is mandatory for any maintenance of RBC equipment.

More information on this system can be found in the ALSTOM documents: System and Subsystem Description, Control Centre Maintenance Manual, Control Centre Operational Manual, and MSS HMI Operational Manual.

DAILY SERVICES

1. MSS Servers and Clients

1.1 For each MSS Client Gateway and Wyse Terminal, check that the menu bar is accessible, that the alarm viewer works, and that command icons respond to mouse clicks.

1.2 Using any MSS Wyse Terminal, check that the three coloured health indicator is correctly animated.

1.3 Check the status of every connection is healthy. Rectify any faults as necessary.

1.4 Check system status by examining the Alarms List for any outstanding faults. Investigate and rectify any faults as necessary.

1.5 Check the time is correctly displayed and that no faults are indicated in the MSS Server state windows.

1.6 Check that active Temporary Speed Restrictions and Unconditional Emergency Stops match those recorded in the operations log.

1.7 On completion of tasks, log off from the MSS HMI Console.

1.8 Clean and tidy the work area as required.

REGULAR SERVICE 1

2. MSS Client Gateways, MSS Servers, Wyse Terminals, KVM Switch, and NTP Server.

2.1 Check for correct operation of all MSS Wyse Terminals by logging on to the system. Rectify or escalate any defects as required as corrective maintenance. On completion, log off.

2.2 Check that the NTP Time Server is synchronised to the broadcast MSF clock. Investigate and rectify any defects as necessary as corrective maintenance.

2.3 Check that the clock of the Master MSS server is in line with the broadcast time and date displayed on the NTP time server by checking the time displayed in the top right-hand corner of the MSS HMI.

2.4 Check that all MSS Client Gateway clocks are within 15 seconds of the NTP time and date. If not, refer to Second Line Maintenance.

2.5 Check that the RBC is properly synchronised to the MSS Server time.

2.6 Check for correct operation of the KVM switch by selecting each connected channel.

2.7 Check for correct event recording and dormant balise failures by examining the Historian archives for the previous 7 days stored on the MSS Client Gateway. Investigate and rectify any faults as necessary.

3. RBC

3.1 Check for correct operation of the cooling fans. Investigate and rectify any faults as necessary as corrective maintenance.

REGULAR SERVICE 2

4. MSS Servers

4.1 Check the health of each MSS Server's hardware.

4.2 Check the air-cooling vent filters are clean. If necessary, clean or replace the filter in accordance with manufacturer's instructions.

4.3 Check that the cooling fans are rotating.

5. MSS Client Gateways and Wyse Terminals

5.1 Check the health of the hardware for the MSS Gateways and Wyse Terminals in accordance with manufacturer's instructions.

5.2 Dust and clean the Client Gateway / Wyse Terminal keyboards and VDU screens as required.

This should be done using a soft cloth moistened with a detergent solution. Wring out the cloth before use to remove excess detergent solution.

5.3 Check moisture does not enter equipment apertures and is dried off surfaces as soon as possible using a dry lint-free cloth. Do not use abrasive cleaners or pads.

SERVICE B

6. MSS Servers, Client Gateways, Wyse Terminals and RBC Cubicle

6.1 Examine the equipment, terminals, cables and cable connectors. Particularly look for security, physical damage, overheating and arcing. Rectify as necessary.

7. Equipment Cabinets

7.1 Dust the external surfaces of the cabinet.

7.2 Check the condition of the cabinet, hinges and locks.

7.3 Examine the equipment, including terminals, cable and cable connectors. In particular, look for signs of physical damage, overheating or arcing. Rectify as necessary.

7.4 Check the security of all fixings and connectors and remove any accumulations of dust or other debris.

7.5 Check labels remain clearly legible.

PERIODIC TASK 1

8. RBC Cubicle (site without air conditioning)

8.1 Replace each fan tray unit.

PERIODIC TASK 2

9. RBC Cubicle (site with air conditioning)

9.1 Replace each fan tray unit, site temperature range shall be between 18 - 27°C otherwise treat as unheated.

PERIODIC TASK 3

10. RBC Cubicle

10.1 Replace the three USB keys (flash drives) loaded with the specific application data and the interlocking software.

PERIODIC TASK 4

11. MSS Cubicle

11.1 The MSS Servers and Client Gateways shall be restarted.

This should be done in turn (e.g. one item at a time, waiting for it to recover before restarting the next).

END

Includes:	Atlas 200 ETCS Enclosure (LEU) and Balise (Alstom)
Excludes:	All other LEU's and Balises

GENERAL

Any maintenance or operating difficulties shall be reported to your SM(S) as corrective maintenance.

An ETCS site may include:

a) Lineside Electronic Unit (LEU) enclosure containing Micro-coder encoding equipment, MIPS200 switched mode power supply, and interfaces.

b) A balise group of at least 2 Balises. If a LEU is provided, then one or more Balises will be switchable and connected to the LEU with a disconnection box and cables.

c) Mounting beam for each balise.

Dormant Balise Failures

Balise failures remain dormant until they are attempted to be read by a train.

Certain safety features used in degraded signalling system / ETCS system modes rely on messages transmitted from specific Balises therefore maintenance processes have to check that all of these specific Balises are regularly proven as read.

If traffic patterns mean that some of these Balises are not regularly read by a train, they have to be tested with a BEPT. Refer to the Area Specific Balise Maintenance Manual for details on affected Balises and the procedure and periodicity of these tests.

SERVICE B

1. LEU Enclosure (Switchable Balise Only)

1.1 Remove any fire risks (e.g. oily waste, paper etc).

1.2 Check for security and signs of damage.

1.3 Dust and examine interior.

1.4 Check micro-coder vents are clear.

1.5 Check the security of accessible terminals and cable glands and look for signs of water ingress.

1.6 Check the effectiveness of the door seal and latches and lock in keeping the door seal tight against the enclosure. Adjust as necessary.

1.7 Lubricate locks, latches, and hinges.

1.8 Examine earth connections. If in doubt, test continuity and resistance.

1.9 Check that each configuration key is securely chained to its Micro-coder.

2. Disconnection Box (Switchable Balises Only)

2.1 Remove any fire risks (e.g. oily waste, paper etc.) from the vicinity of the disconnection box and cables.

2.2 Check the Balise disconnection box is properly fixed to the mounting stake / pole and look for signs of water ingress.

2.3 Examine the terminals inside the disconnection box. Clean and protect as necessary.

2.4 Examine cables and glands for security and damage.

2.5 Lubricate locks.

3. Balise

3.1 Examine Balise and mounting beam. Check that there is no visible damage, signs of excessive wear or cracks visible.

3.2 Remove any fire risks (e.g. oily waste, paper etc.) from the vicinity of the Balise.

3.3 Check that the Balise and mounting beam are correctly aligned.

3.4 Check the tab washer system – the tab washers are securely seated on the plastic tab washer retention plate and the tabs interface correctly with the bolt head.

3.5 Where the mounting beam is held in place by rail clips, check these are correctly installed and secure.

3.6 Where the mounting beam is fixed to the surface of the sleeper, check bolts or screws remain secure. Report any damaged or rotten sleepers or those with defective fastenings to your SM(S).

3.7 Check that balise labels are securely fastened to the balise (and in the case of a full size Vortok mounting bracket, on the bracket).

3.8 Using the Balise, Encoder Programming and Test Tool (BEPT), test the Balise signal level – 4 or 5 bars indicates an acceptable signal level.

If the signal levels are about or lower the acceptable level inform your SM(S) to arrange its replacement.

3.9 “For switchable Balises” check the cable connections are secure, that the cable is secured to the track bed/sleeper and it is connected to the disconnection box.

END

Includes:	Atlas 200 ETCS Network Transmission Gateway (NTG)
Excludes:	Radio Block Centre & Fixed Telecoms Network

GENERAL

Do not use an Avometer (or any similar meter) on the Ohms x 100 range on the NTG system. The 15V DC output from the meter on this range can damage electronic circuits. Similarly, do not use any form of buzzer or lamp for continuity testing on the system.

The use of protective gloves is mandatory for any maintenance procedures which require manual access to NTG equipment.

DAILY SERVICE

1. Equipment Room

1.1 Check that the chassis LEDs (one for each slot available for board insertion) are GREEN for used slots, and UNLIT for unused slots. A RED indication suggests a faulty card in the relevant slot. Investigate and rectify as necessary.

1.2 Check that the Diagnostic Board ‘Diag’ LED is blinking green. Any other indication suggests a Diagnostic Board fault. Investigate and rectify as necessary.

1.3 Check that the Diagnostic Board ‘FAN’ LED is extinguished. Any other indication suggests a failure of one or more cooling fans. Investigate and rectify as necessary.

1.4 Check that the Diagnostic Board ‘PSU’ LED is extinguished. Any other indication suggests a power supply failure. Investigate and rectify as necessary.

1.5 Check that the Diagnostic Board ‘TEMP’ LED is extinguished. Any other indication suggests that the NTG is overheating. Investigate and rectify as necessary.

1.6 Check that each Power Supply Board ‘Power’ LED is GREEN. Any other indication suggests a power supply failure. Investigate and rectify as necessary.

1.7 Check that each Power Supply Board ‘Fault’ LED is extinguished. Any other indication suggests a power supply failure. Investigate and rectify as necessary.

1.8 Check system status by examining the Diagnostic LCD for any fault messages. The text under normal operating conditions should match the installed software version as recorded in the System Release Note.

1.9 Check that both Power Bank Interrupter lamps are illuminated on the rear of the NTG. Investigate and rectify any faults as necessary.

1.10 Clean and tidy the work area as required.

REGULAR SERVICE 1

2. Fans

2.1 Confirm that the cooling fans are rotating by checking that there is vertical air flow from each fan unit – air is brought in from beneath the chassis and expelled at the top. Confirm there are no obstructions above or below the chassis.

2.2 Check the air-cooling fan filters are clean. If necessary, clean the filter.

SERVICE B

3. Final Checks

3.1 Examine the equipment, cables and cable connectors. Particularly look for security, physical damage, overheating and arcing. Rectify as necessary.

3.2 Check the main power supply.

END

Includes:	Thameslink Radio Block Centre (RBC) System only
Exclude:	All other Radio Block Centre types and systems

DAILY SERVICES

1 Visual Status

1.1 Check the RBC component status as indicated on the RBC Technician's Facility screen for alarms and investigate any problems.

(Note: access to the RBC TF can be via the RBC TF-L in LBER, or via the RBC TF-R in Arch 886).

If a fault or problem is reported on the TF or is otherwise suspected, further analysis might be required by removing the front cover of the RBC, exposing the RBC's three lanes and their associated LED indications.

Each Lane (A, B and C) is arranged (left to right as viewed front on) with the following 'blade' card modules:

MPM, SIOM, DPM, TBSLAN.

(Note: there are only two TBSLAN cards per RBC processor; one associated with lane A and one associated with lane C).

MPM and SIOM card have 3 possible LED indications (shown green above) that provide indication of the status of each lane: Green, Orange and Red.

- Green LED: RBC lane is in correct operation mode
- Orange LED: RBC lane is operating with a non-critical fault
- Red LED: RBC lane has a critical failure

In the event of a card failure or lane fault, cards should be replaced with the issued spare cards as per the SMTH process.

ROUTINE TASK

2 Ventilation and Cooling fans

2.1 Clean the filters of the ventilation system using a vacuum cleaner; they shall be replaced if in poor condition.

2.2 Check the operation of the cooling fans mounted in the PVF fan racks, this shall be carried out by isolating, unplugging and removing one rack at a time.

2.3 With the fan rack removed manually rotate each fan to check that it rotates freely. Reconnect the rack and fan and wait for 30 seconds to check that no abnormal noise is evident from any of the fans as this may indicate an imminent failure. Repeat the process for each fan rack in turn.

3 Cabinet

3.1 Dust the internal and external surfaces of the cabinet.

3.2 Check the condition of the cabinet, hinges and locks.

3.3 Examine the equipment, terminals, cable and cable connectors; in particular look for signs of physical damage, overheating or arcing.

3.4 Check the security of all fixings and connectors, and remove any accumulations of dust or other debris.

3.5 Check all labels remain clearly legible.

3.6 Observe the correct illumination both in terms of colours and the brightness of all system LEDs.

4 Power Supply Voltages and Earth Bonding

4.1 Measure and check for the following power supply voltages:

a) RBC Processor – Dual Power Supply - 110V AC

b) Stratus TCC FTS – 110V AC

c) Network Switch and RBC RIF – Dual Power Supply 48V DC

d) RBC Technician's Facility – 110V AC

4.2 Measure the resistance between the main signalling centre earth bus bar and each earth terminal and cable shield.

The resistance between the bus bar and any earth terminal or cable shield shall be less than 1 ohm when measured with an earth ground tester.

4.3 Check all doors are securely closed on completion of maintenance.

Note: The cubicle provides EMC protection, any signs of damage or deterioration shall be reported to your supervisor.

End

Includes:	NCL Radio Block Centre (RBC) System only
Excludes:	All other Radio Block Centre types and systems

GENERAL

Before undertaking any work within an existing/operational RBC cubicle, the Signaller shall be informed before doing so.

The ESD wrist strap shall be worn while carrying out tasks within the RBC Cubicle.

DAILY SERVICES

1. Visual Status

1.1 Check the RBC component status as indicated on the RBC Technician's Facility screen for alarms and investigate any problems.

1.2 If a fault or problem is reported on the TF or is otherwise suspected, further analysis might be required by removing the front cover of the RBC, exposing the RBC's three lanes and their associated LED indications (Figure 1).

Figure 1

Each Lane (A, B and C) is arranged (left to right as viewed front on) with the following 'blade' card modules:

MPM, SIOM, DPM, TBSLAN.

NOTE: *there are only two TBSLAN cards per RBC processor; one associated with lane A and one associated with lane C).*

MPM and SIOM card have 3 possible LED indications (shown green above) that provide indication of the status of each lane: Green, Orange and Red.

a) Green LED: RBC lane is in correct operation mode.

b) Orange LED: RBC lane is operating with a non-critical fault.

c) Red LED: RBC lane has a critical failure.

In the event of a card failure or lane fault, cards should be replaced with the issued spare cards as per the SMTH process.

SERVICE A

2. Ventilation and Cooling fans:

All working shall be carried out in accordance with general instruction for staff working on S&T Equipment.

2.1 Clean the filters of the ventilation system using an anti-static vacuum cleaner, replaced if in poor condition.

2.2 Check the operation of the cooling fans mounted in the PVF fan trays, this shall be carried out by isolating, unplugging and removing one tray at a time.

2.3 With the fan tray removed manually rotate each fan to check that it rotates freely. (An aerosol duster may be used to rotate the fan).

Reconnect the tray and fan and wait for 30 seconds to check that no abnormal noise is evident from any of the fans as this might indicate an imminent failure.

Repeat the process for each fan tray in turn.

3. Cabinet

3.1 Dust the internal and external surfaces of the cabinet.

3.2 Check the condition of the cabinet, hinges, and locks.

3.3 Examine the equipment, terminals, cable, and cable connectors; in particular look for signs of physical damage, overheating or arcing.

3.4 Check the security of all fixings and connectors and remove any accumulations of dust or other debris.

3.5 Check all labels remain clearly legible.

3.6 Observe the correct illumination both in terms of colours and the brightness of all system LEDs.

3.7 Visually check Earth Bonding.

3.8 Check all doors are securely closed on completion of maintenance.

NOTE: *The cubicle provides EMC protection, any signs of damage or deterioration shall be reported to your supervisor.*

END

Includes:	ARAMIS Workstation and Cubicles
Excludes:	All other ARAMIS equipment and server-based equipment.

Software updates and data updates shall only be carried out by Thales staff only.

Cubicle earth terminal shall remain bonded to the equipment room earth point, as per the as built drawings. If disturbed during maintenance, verify that the connection and routing are restored before the equipment is returned to service.

Cable routes shall be preserved as originally specified in the as built drawing. Never re-route cables during maintenance.

It should be noted that the firewalls have LEDs that show the status of each of the individual PSU whereas Nagios is currently only able to determine the combined Power Supply Units (PSU) status.

For Additional information see NR/SMS/Appendix/19 (General Information on the ARAMIS System).

DAILY SERVICE

1. Nagios Checks

1.1 Using the Nagios application to check the headline pages (mainly the host groups screen) to determine if any monitored parameter has crossed its alert threshold.

All alerts shall be investigated by using the Nagios application to drill down into the system information.

Any alert which is not investigated / rectified should reported to the SM(S).

REGULAR TASK 1

2. Disk Space Check

2.1 Check the common storage VM where log files are stored to verify their is should sufficient disk space.

2.2 Log files which require archiving shall be extracted and placed in the appropriate archiving area.

SERVICE A

3. System Status Checks

3.1 The following equipment shall be inspected for damage and any dirt, debris, damage and unusual noises:

- Client PC - Dell Precision 7910 Rackmount – Hard Drive & Fans.
- Server - Dell PowerEdge R630 Rackmount - Hard Drive & Fans.
- Maintenance Blade Server – Hard Drive & Fans.
- Server Storage SAN - HP MSA 2040 – Hard Drive & Fans.
- Network Core Switch - Cisco Nexus 5672UP – Fans.
- Network Access Switch - Cisco Catalyst 2960XR-24TS-I – Fans.
- Network Management Switch - Cisco Catalyst 2960XR-48TS-I – Fans.
- Firewall - CISCO ASA 5545-X WITH FIRE POWER Services – Fans.

SERVICE B

4. Workstation Monitors

4.1 The workstation monitors should be cleaned with anti-static screen cleaner and a soft lint-free non-abrasive cloth.

Apply only light pressure when dusting the liquid crystal display (LCD) screen.

5. Workstation Keyboard & Mouse

5.1 Clean as required with a soft cloth dampened with detergent solution.

Do not use any glass cleaner or equivalent type. Squeeze out to remove excessive detergent from the cloth before use.

Do not allow moisture to enter equipment apertures and dry off surfaces as soon as possible using a dry lint-free cloth.

Do not use abrasive cleaners.

6. Client PC Cubicles

The maintainer should not possess mobile phones / radio equipment or metal objects whilst undertaking this task.

These tasks can be carried out without power isolation.

6.1 Using a dry lint-free soft cloth remove gently dust from the cubicle without disturbing any buttons or switches on the equipment, cabling or its terminations.

Do not use abrasive cloth or pads.

Where additional cleaning is required, use a soft cloth dampened with a detergent solution squeezing out excessive detergent before use.

6.2 On completion of this task, Check the front and rear doors are closed tight to prevent access of dust.

7. Visual inspection of equipment terminations

Workstation Equipment

7.1 Check cables from monitors, keyboard and mouse are secure to the amulet zero clients and there are no signs of cable stress or abrasions.

Client PC Cubicles

7.2 Front of cubicle - check all modules are correctly seated and secure.

7.3 Back of the cubicle - check all cables are correctly seated and plugs tight and secure.

END

Mobile telephones that are switched on shall not be brought in close proximity of operational electronic Interlocking's, it can interfere with the system processors

SSI /CBI INTERLOCKINGS

Commonly Used Abbreviations

Abbreviation	Meaning
CBI	Computer Based Interlocking
DMPM	Diagnostic Multiprocessor Module
DLI	Datalink Interrogator
DLM	Data Link Module
LDT	Long Distance Terminal
MPM	Multiprocessor Module
PC	Personal Computer
PPM	Panel Processor Module
SSI	Solid State Interlocking
TFM	Trackside Function Module
TP	Terminal Processor
TT	Technicians Terminal
VDU	Video Display Unit (Monitor)

General

Consideration should be given to the effects on SSI and CBI performance of any alterations or adjustments to the source power supply.

The correct operation of electronic interlocking's is reliant on having an efficient earthing system that is maintained within its designed parameters.

Equipment spares should be clearly labelled and stored in anti-static bags or boxes in a safe location.

Each system should have an onsite log book to record maintenance activities and system status information.

If controls are applied to or removed from electronic interlocking's, written records shall be made and retained.

Technicians' Terminals

The Mk1 terminals have now all been replaced with Mk2 terminals.

Event Logger

Tape loggers have now all been were replaced with the TTLR optical disc PC based recorders.

Optical Disc Handling, Storage and Rotation

Optical Discs can come in write only or a rewritable format.

The Optical Disc should be handled carefully and removed from service if found to be damaged.

They should be stored in an authorised location, away from any heat or damp and should be kept away from any magnetic fields.

Rewriteable Optical Discs are used in rotation to store data for a given period (this is usually seven days). The disc containing the oldest data should be used as the next replacement (Local instructions can vary this).

Where the technicians' terminal is at an unmanned site, the disc should be changed in accordance with local instructions.

Keyboard Maintenance

Keyboards should be held upside down when dusted.

VDU Screen Cleaning

Screens should be cleaned using an anti-static VDU cleaner following the manufacturer's instructions.

Printer

Printer paper and ribbons/toners should be changed as detailed in the printer manufactures instructions.

Printout Retention

A paper copy of the fault printout should be retained in a safe place for a given period (usually fourteen days).

Modems

The modem self-test procedure should be carried out according the manufacturer's instructions.

Correct Date and Time

The date and time can be corrected by using an option from the COMMAND MENU. Some SSI tech terms use the Althorn clock and therefore do not need adjusting.

Interlocking Cubicle

The interlocking cubicle contains the following equipment:

a) Interlocking Multiprocessor Modules.

b) Diagnostic Multiprocessor Modules.

c) Panel Processor Modules.

d) Data Link Modules.

e) Long Distance Terminal Modules.

f) Line Connection / Termination Units.

Trackside Equipment

Trackside locations can contain the following equipment:

a) Signal Modules.

b) Point Modules.

c) Data Link Modules.

d) Long Distance Terminal Modules.

e) Line Connection / Termination Units.

Point Modules

Open/loose links/terminations to the point drive can result in high DC voltages being present on them if the point's module is energized by commands from the interlocking. Newer installations incorporate a resistor across the links to avoid this.

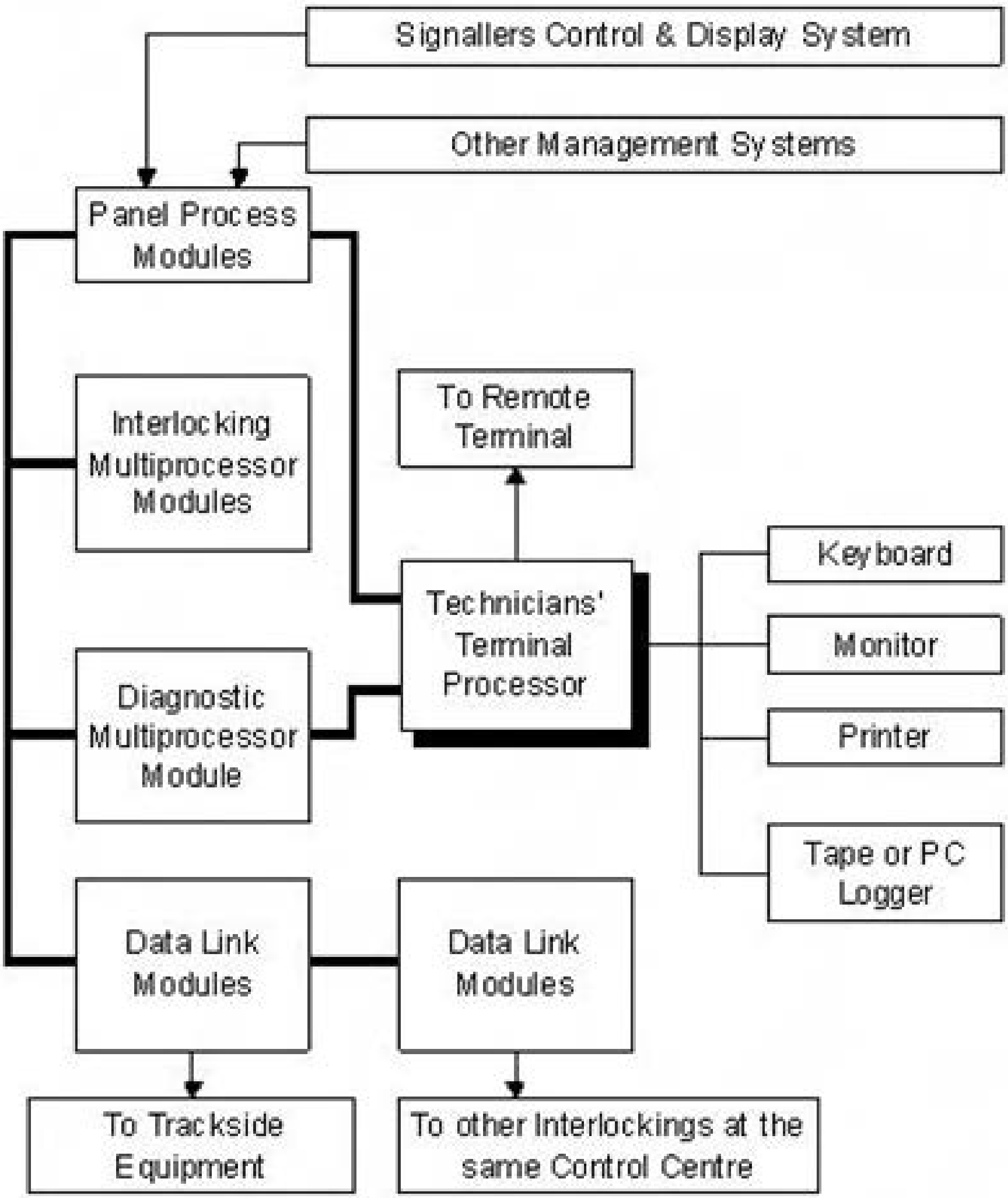


Figure 1 – Block Layout of SSI Interlocking

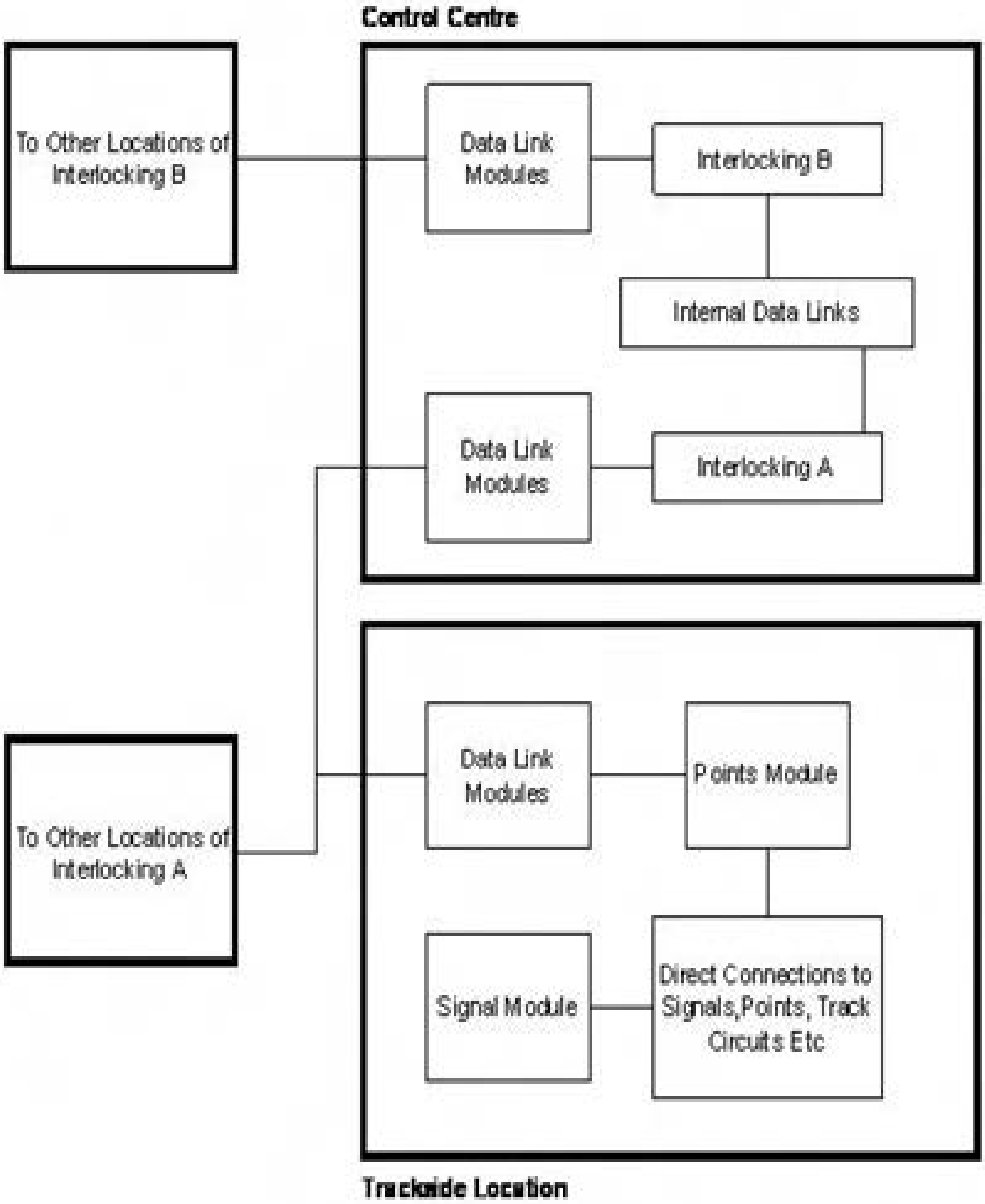


Figure 2 – Block Layout of SSI System

WESTRACE ELECTRONIC INTERLOCKINGS

General

Westrace is a modular computer based system for local interlockings. Each object controller within the system controls a signalling function. Extra modules can be added to increase the system's capacity. It can be connected to communicate to a control center, monitoring or to other Westrace systems over Ethernet TCP/IP networks (WAN).

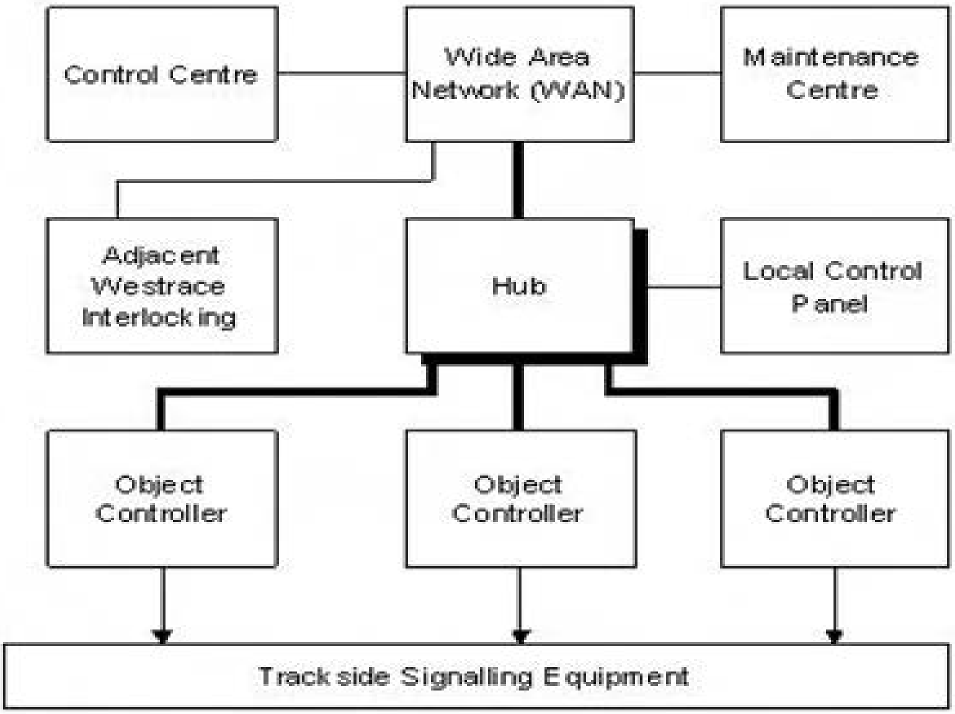


Figure 3 – Block Layout of a Westrace System

WESTLOCK ELECTRONIC INTERLOCKINGS

General

Westlock is a fourth-generation computer-based interlocking, based on SSI, with greatly enhanced hardware and new software tools to aid design, testing, and maintenance.

A Westlock interlocking can take the place of one or more existing SSIs, with no need to replace the trackside infrastructure.

Every Westlock Interlocking requires the following sub- systems:

a) a Central Interlocking Processor (CIP)

b) a local Technician's Workstation (TW(L)

c) one or more Trackside Interfaces (TIF)

d) Zero or one Control System Gateway (CSG) depending upon the Control System.

The CIP and TIF sub-systems are based on a range of modules that are configured to produce the functionality required for each sub-system.

The Technician's Workstation and Control System Gateway are Compact PCI based equipment.

Field equipment uses modules inherited from the SSI system, i.e. Data Link Modules (DLM), Long Distance Terminals (LDT), Signal Modules, and Points Modules. Communication between field equipment is via trackside data links.

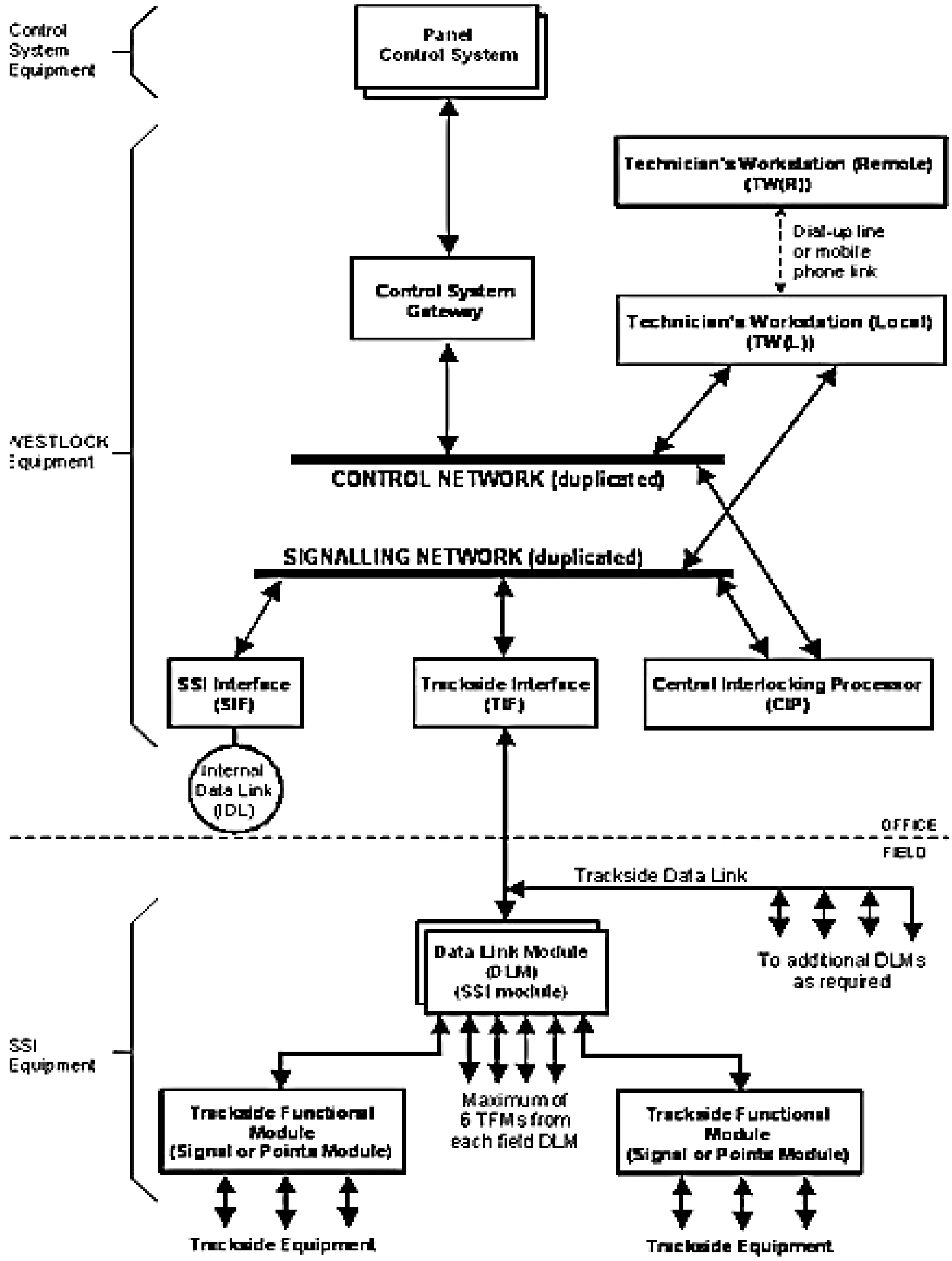


Figure 4 – Typical Westlock Interlocking

SMARTLOCK ELECTRONIC INTERLOCKINGS

General

Smartlock is a computer-based interlocking, designed specifically as a successor to SSI. The system offers updated facilities for the maintainer and improved application engineering tools for test and incident analysis.

The system retains the trackside communications architecture from SSI.

A Smartlock interlocking can take the place of one or more existing SSI, with no need to replace the trackside infrastructure.

Every Smartlock Interlocking requires the following sub-systems as a minimum:

a) a Central Interlocking (CIXL);

b) one or two Trackside Interface Communications Cubicles (TICC);

c) a Support System (SSys)

The CIXL provides a 2-out-of-3 safety computer configured to execute the interlocking logic rules. This also contains the I/O required to communicate with the signallers control system and with the TICC.

The TICC is responsible for managing the trackside communications and contains up to four pairs of gateways and their associated front ends. The TICC also accommodates pairs of SSI Datalink Modules (DLM) or Long Distance Terminals (LDT).

The SSys comprises a dual redundant server (SSer) and one or more client terminals, in addition to a time source and switches and routers for the networks in the system.

The Support system provides the diagnostic, logging and technician control facilities via local client terminals located in the SCC or connected by a LAN within the signalling
centre, a printer and where required remote client terminal facilities.

The trackside interface to the signalling objects is by use of SSI technology, i.e. DLM, LDT, Signal Modules and Points Modules.

Communication between field equipment is via trackside data links.

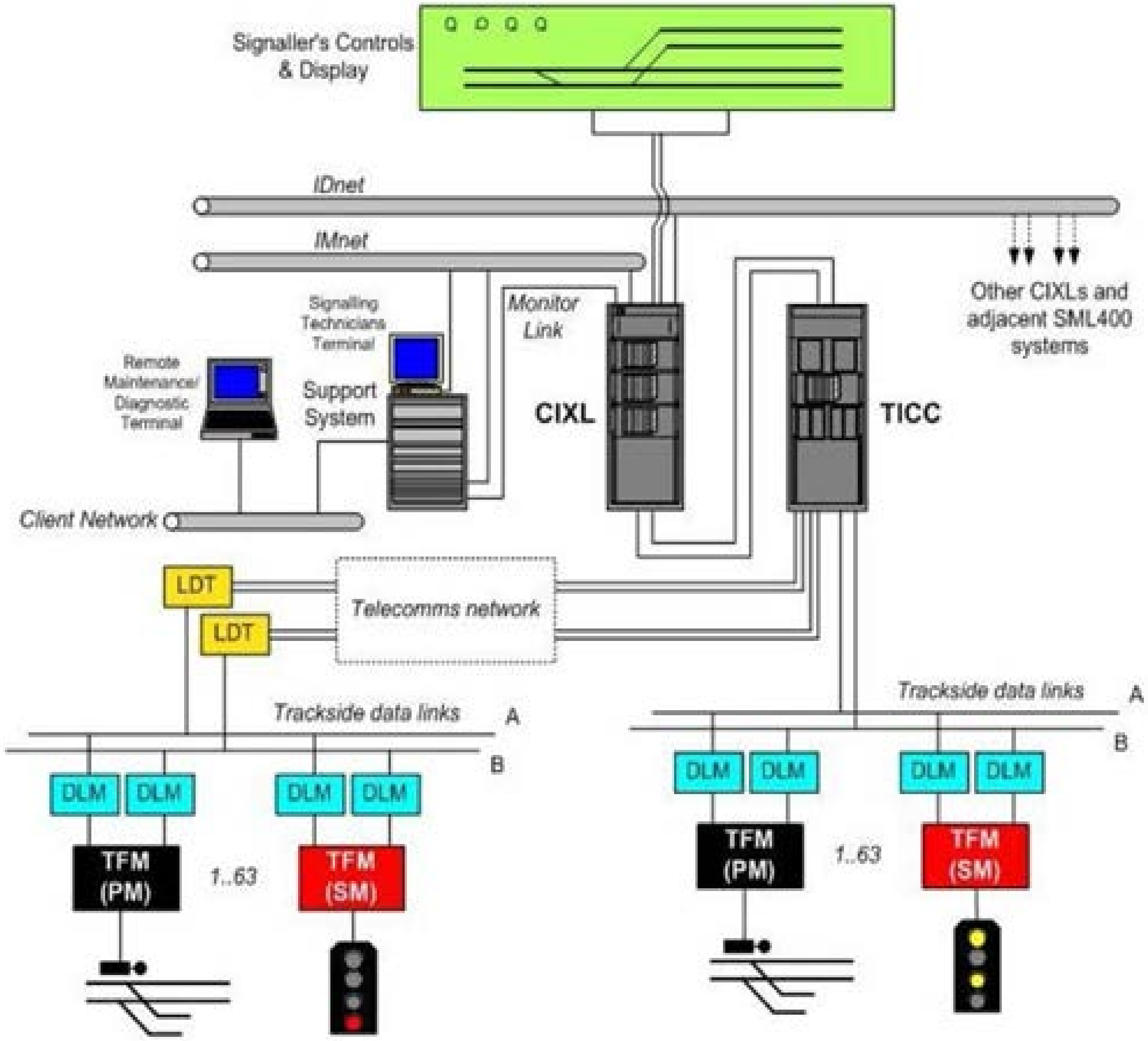


Figure 5 – Typical SMARTLOCK Interlocking

VITAL HARMON LOGIC CONTROLLER

The Vital Harmon Logic Controller (VHLC) is a Computer Based Interlocking (CBI) capable of driving signal aspects, controlling points and interfacing with other equipment such as track circuits.

It is a microprocessor based replacement for conventional relay-based interlocking systems intended to significantly reduce the number of vital relays needed to control a particular section of the railway.

As well as for signal interlocking control, VHLCs can be used at level crossings to undertake crossing control functions. VHLC systems are designed to operate in a distributed control configuration rather than a centralised control configuration.

As such, VHLC systems are located in trackside REBs close to the area of railway for which control is being provided. Non-vital communication links are provided between the VHLC and the associated controlling signal box.

The VHLC system architecture employs two microprocessors in a checked-redundant configuration to provide security against random component failures.

The VHLC consists of a cabinet, as shown in Figure 6 below, within which a series of modules, as described below, are contained. These modules shall be installed within slots in the cabinet and plug into corresponding connectors on the “back board”.

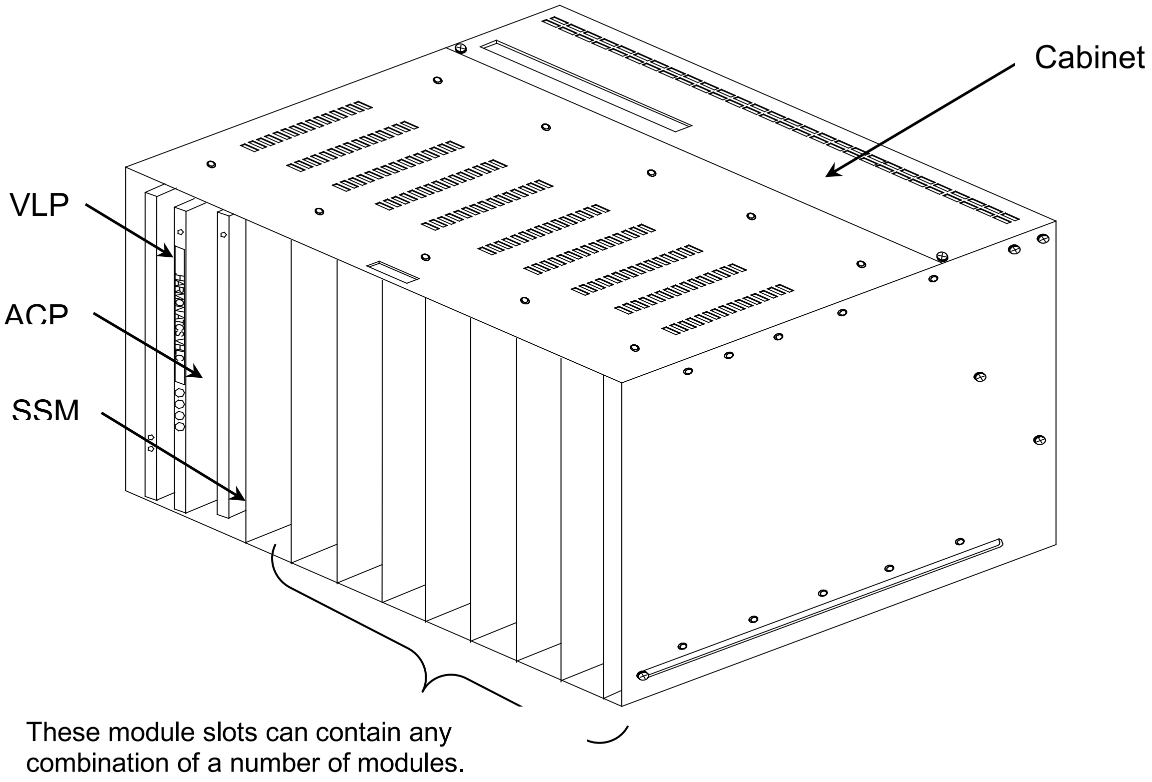


Figure 6 – VHLC Cabinet

Vital Logic Processor

The VLP shall always be inserted into the first module slot.

This is the central processor module for the VHLC and it holds the vital executive software for the system. The Vital Logic Processor (VLP) handles all of the processing necessary for the safe interpretation of inputs, the vital delivery of outputs, the evaluation of vital data and the testing of all vital input and output (I/O) and internal VHLC circuitry. The VLP has two processors, which constantly check and verify each other's safe operation.

Auxiliary Communications Processor

The ACP shall be installed in the second module slot.

The Auxiliary Communication Processor (ACP) handles all of the communication tasks for the VHLC. It contains a battery backed memory for logging diagnostic information or events at the interlocking. An important part of the ACP is the sixteen character, four button, Control/Display Unit (CDU) that can be used during system set-up and to access diagnostic information. There is also a port available for interfacing with a portable PC if necessary.

Site Specific Module

The SSM shall be installed in the third module slot and is set back from all other modules.

The Site Specific Module (SSM) contains the application logic, system configuration data and set-up data applying to a particular site. This information is stored on electronically programmable read only memory (EPROM).

Vital General Purpose Input Output Module

The Vital General Purpose Input Output Module (VGPIO) provides eight vital relay driver outputs and eight vital general purpose voltage sensing inputs. It is, therefore, two modules stacked together, the lower module processes the inputs whilst the upper module processes the outputs. Each VHLC unit can utilise up to nine VGPIO modules in slots 4 to 12. Connection to the backboard is made via a cable with a keyed connector, thereby, preventing any other module from being installed in a slot wired for a VGPIO.

Vital General Purpose Input Module

The Vital General Purpose Input Module (VGPI) has either eight (8VGPI) or sixteen (16VGPI) vital inputs and these are functionally identical to those found on the VGPIO. Each VHLC unit can utilise up to nine VGPI modules in slots 4 to 12. Connection to the backboard is made via a cable with a keyed connector, thereby preventing any other module being installed in a slot wired for a VGPI.

Non Vital Input Output Module

Each Non Vital Input Output Module (NVIO) contains sixteen non-vital, bi polar relay driver outputs and 16 non-vital, general purpose voltage sensing inputs. Each VHLC unit can utilise up to nine NVIO modules in slots 4 to 12. Connections to the NVIO are made using a cable with a keyed connector, thereby preventing other modules from being installed in a slot wired for a NVIO.

Vital Signal Driver Alternating Current (110V AC) Module

The Vital Signal Driver Alternating Current Module (VSDAC) provides 12 outputs for driving lamps or other types of equipment load. Each output is capable of supplying 0.8 Amps RMS continuous current, with the exception of outputs 4, 5 and 12 which are capable of supplying 1.5 Amps RMS continuous current.

The load of the entire module shall not exceed 9 Amps RMS. The VSDAC module does not generate the voltage required for the VSDAC outputs, instead it contains electronic switches to connect the output to the supply voltage. Each VHLC unit can utilise up to five VSDAC modules in slots 4 to 12. Connection to the backboard is made via a cable with a keyed connector, thereby preventing any other module being installed in a slot wired for a VSDAC.

Backboard

The backboard provides an interface between all plug-in modules, the power supply and Serial Interface Modules. However, the two sides of the backboard serve different purposes. The front of the backboard, which can be seen from the inside of the cabinet, houses a number of keyed connectors. These prevent a module from being inserted in the wrong module slot. It also houses a number if identification jumpers.

These are used to set the VHLC Chassis identification so that it is the same as that contained within the safety logic. This feature prevents modules from being installed in the wrong VHLC system. Alternatively, some modules use Dual Inline Package (DIP) switches to perform this task. The rear of the backboard, which is visible from the back of the cabinet, houses the power supply and Serial Interface Modules (SIM).

Power Supply Module

The +5VDC Power Supply Module converts the incoming +12VDC power supply to +5VDC for use by the internal electronics of the system. The switch for controlling power to the VHLC logic is located on this module. There can still be power supplied to the I/O modules when this is switched to off.

Serial Interface Module

Several types of Serial Interface Module (SIM) are available for the VHLC, such as the Current Loop Adaptor (CLA), which provides an interface between a local control panel and the VHLC, and the RS-232 Interface Module, which provides an isolated serial interface for communicating with the VHLC using RS-232 protocol.

Vital Signal Driver AC Standard Shunt

The Vital Signal Driver AC (VSDAC) Standard Shunt unit is used in conjunction with the VHLC at interlocking sites to reduce the voltage that is induced on the input lines to the VSDAC Module and to reduce the effects of capacitive coupling.

End

Includes:	Technicians' terminal and interlocking cubicle
Excludes:	TFM, DLM and Datalinks

DAILY SERVICES

NOTE: *The tasks in this section relate to the Technicians' terminal equipment.*

1. Printer

1.1 Check the printer paper supply and reload as required.

1.2 Request a fault summary printout and liaise with the signalling fault control if action is required. The printout shall be kept for a minimum of fourteen days.

2. Tape Logger (where fitted)

2.1 Check tape logger for the following:

a) The power switch is illuminated.

b) Both the red 'READY' indicators are illuminated.

c) The red 'BUSY' indicator is illuminated for the selected drive.

2.2 Where provided, remove the standby tape and load a replacement tape.

See NR/SMS/PartC/IS00 Electronic Interlockings – General).

3. PC Based Logger (where fitted)

3.1 Check the power is on to the PC.

3.2 Check that the rotating activity indicator is spinning and the active drive indicator light for activity.

If there is little SSI activity, log data can be generated by requesting a background scan from the Technician's control menu.

4. General

4.1 Check that on completion of the tasks, that the keyboard is locked.

4.2 Check that the work area is clean and tidy.

REGULAR SERVICES

NOTE: *The tasks in this section relate to the Technicians' terminal equipment.*

5. Printer

5.1 Check the quality of the printout and replace printer ribbon/cartridge if required.

6. Tape Logger (where fitted)

6.1 Check that the air-cooling vent is clean and clear of obstructions.

6.2 Clean the read/write heads.

6.3 Check that logger is recording correctly by reading back data from the tape.

7. PC Based Logger (where fitted)

7.1 Check the air-cooling vent filter is clean. If necessary clean or replace as per the manufacturer's instructions.

7.2 Observe that any fans are rotating (where possible).

7.3 Access the Command Menu of the Technician's terminal and select Option three (Eject Logging Tape/Disc & Set to Standby).

This facility allows the operator to remove the tape/disc that is currently in use.

NOTE: *Check the standby tape/disc is inserted in the recording device and that the corresponding READY Indication is illuminated prior to selecting this option.*

7.4 On selecting option three the following is displayed on the screen:

a) "Enter option * 3 Following selection correct? 3Y" Press the [Y] key to confirm that this is the correct option.

b) The current logging tape/disc shall be ejected and logging shall continue on the standby tape/disc.

c) Remove the ejected tape/disc and replace it with a new standby tape/disc. The ejected tape/disc can now be used on the analysis machine to confirm system is logging data correctly.

7.5 Check (where installed) the Graphical Replay feature is functioning properly by running any recorded data on the Graphical Replay terminal.

8. Technicians' Terminal

8.1 Observe that all the system 'healthy' indicators are illuminated.

8.2 Check that the keyboard is locked before dusting.

8.3 Observe with the VDU switched on that the integral indicator is illuminated and the quality of the display is satisfactory. Check the correct time and date is displayed (adjust if necessary).

SERVICE A

9. Interlocking Cubicle

9.1 Dust the equipment and clean the cubicle. Check that the area around the cubicle is clean and tidy.

9.2 Examine the equipment, terminals, cable, and cable connectors. Particularly look for physical damage, overheating and arcing.

9.3 On the MPM, PPM and DMPM check that the memory modules are securely fitted and sealed (not on Mk1 interlockings). Observe the following indications are illuminated and showing a steady light:

Front Panel

a) All System Indicators.

b) Rear Panel.

c) Power.

d) Fused supply (not on the PPM).

e) System.

All rear panel indicators are red.

9.4 On the DLM Observe that the red power indicators are illuminated and showing a steady light.

9.5 On the LDT Observe that the following red indicators are illuminated and showing a steady light.

Power.

System.

PCM Tx Clock.

PCM Rx Clock.

PCM Rx Line.

Data from SSI.

Data to SSI.

Data to PCM.

NOTE: *In the site logbook any LED indications that are not illuminated and report them to your supervisor.*

SERVICE B

Record all the following tasks in the logbook.

10. Technicians' Terminal

10.1 Dust the equipment and clean the inside of the Technicians' terminal pedestal.

10.2 Examine the equipment, terminals, cable, and cable connectors. Particularly look for physical damage, overheating and arcing.

10.3 Where a spare terminal is provided, check its function by substitution with the working unit.

11. PC Based Logger (where fitted)

11.1 Check the operation of the spare PC based logger by substitution with the working unit.

12. Modem

12.1 Observe that the power indicator is illuminated.

12.2 Perform the self-test procedure (if this is provided).

13. Function Tests

13.1 If relay controlled, apply the NR/SMS/PartB/Test/060 (Emergency Signals on Control (ESOC) Test), where provided. Confirm correct operation.

This task is not required where the emergency signals on control is hard wired in the power circuit. The 'All Signals On' button should be pressed for a minimum of 15 seconds.

PERIODIC TASKS

14. Technicians' Terminal

Anti-static precautions shall be taken for this task.

14.1 Replace the battery on the memory board. The suggested method is by substitution with a spare memory board where the battery has already been replaced.

During memory board change the logging & the control facility of the Technicians' terminal is lost. Immediately prior to the start of the work, note the current state of the faults on the printer and the applied Technician controls.

Remove the logging tape/disc according to local procedures and power down the Technicians' terminal. Substitute the spare memory board with the working memory board Re power the Technicians' terminal and examine the VDU screen.

The clock should be operational. Try operating the menu system. It should be possible to change from option to option.

Check that the time, configuration, and terminal name are set up properly. Change them if necessary, using the menu options.

END

Includes:	Westrace Electronic Interlockings
Excludes:	All other type of Electronic Interlockings

General

Do not use an Avometer (or any similar meter) on the Ohms x100 range on the Westrace system. The 15V DC output from the meter on this range might damage the electronic circuits.

Similarly, do not use any form of buzzer or lamp for continuity testing on the system.

This NR/SMS covers all Westrace systems for first line maintenance only. All other equipment at the installation is covered by its own relevant NR/SMS.

More information on this system can be found in the Westrace Equipment Manual and the Westrace Diagnostic User Guide.

SERVICE A

1. Event Logging PC and Printer

1.1 Check the event logging PC is switched on and correctly connected to the printer and modem.

1.2 Check the printer is operational and has paper and ink/toner.

1.3 Request a printout and check for any outstanding faults. Investigate and clear as necessary.

1.4 Check that the area is clean and tidy. Remove any rubbish and debris.

2. Interlocking Equipment

2.1 Check all cubicles, housings, cases, boxes and cable troughs are secure and undamaged.

2.2 Check for any fault indications on the cards Investigate and rectify any faults as necessary.

2.3 Check all equipment doors are closed.

SERVICE B

3. Interlocking Equipment

3.1 Measure (where accessible) the power supply voltages. Compare these with previous readings; any variations or deficiencies are to be investigated as corrective maintenance.

3.2 Examine the EMC gaskets; any found damaged shall be replaced at the earliest opportunity.

3.3 Examine the EMC bond cables and connection points. Check they are clean, secure, undamaged and not in any way degraded. Any defects found shall be undertaken as corrective maintenance.

4. WESTLOCK Trackside Equipment (Zone Controller), if provided

4.1 Remove and test each Surge Suppression Cassette using the Surge Cassette Test Unit.

4.2 If the Surge Suppression Cassette fails, rectify as corrective maintenance.

PERIODIC TASKS

5. Interlocking Equipment

5.1 Replace the Lithium battery within the Diagnostic Module (DM). Technical support staff and/or equipment specialists may manage this task separately.

END

Includes:	CIP and TIF cubicles, Technicians' Workstation, Technicians' Facility and CSG
Excludes:	Lineside TFM, DLM and Datalinks

Do not use an Avometer (or any similar meter) on the Ohms x100 range on the Westlock system. The 15V DC output from the meter on this range can damage the electronic circuits. Similarly, do not use any form of buzzer or lamp for continuity testing on the system.

This NR/SMS covers all Westlock systems for first line maintenance only. All other equipment at the installation is covered by its own relevant NR/SMS.

More information on this system can be found in the Westlock Technician's Workstation manuals.

REGULAR SERVICES

1. Technicians' Workstation or Technicians' Facility

1.1 Check the TW or TF is functioning and ready for use.

Failure of a peripheral device such as the TW/TF monitor will not be apparent until the system is used to diagnose a fault.

1.2 Check the fault list for any unexpected reports.

Critical and Non-Critical faults are reported to the Signaller. Warnings or minor faults which do not affect the operation of the railway but may provide an early warning of a developing problem are shown in the TW/TF fault list.

1.3 Where fitted, check the paper supply and reload as required. Check the printer's output for legibility. If necessary, replace the printer cartridge following instructions in printer manufacturer's handbook.

1.4 Technicians' Workstation (TW): Check disks are fitted in both removable logging drive ports.

A disk may have been removed for incident investigation and not replaced. Rotation of disks through a pool of spares is not required.

1.5 Technicians' Facility (TF) – Local only: Unscrew the thumbscrew on the front of the PC and check disks are fitted in both removable logging drive ports.

The logging drives on a TF-Local are fitted to the front of the unit. The removable drive fitted to the rear contains the operating system and shall not be removed. No logging drives are fitted to TF-Servers or TF-Remotes.

1.6 As required, clean and tidy the work area.

2. Westlock interlocking (including CIP/TIF/FEP network switches and routers)

2.1 Check all ports and cabling for any unexpected changes or additions. Check that no additional equipment has been plugged into normally unused ports or that any cables have been re-routed via extra items of equipment. Any such items might pose a security risk and shall be escalated.

SERVICE A

3. Technicians' Workstation or Control System Gateway (where fitted) Compact PCI based equipment.

3.1 Check that the air-cooling vent filter is clean. If necessary clean or replace the filter in accordance with manufacturer's instructions.

3.2 Check that the cooling fans are rotating.

<u>Technicians' Workstation Only</u>

3.3 Check that the quality of the display is acceptable.

3.4 Check that the correct time is displayed at the bottom right corner of the display screen. Time is derived from a connected radio clock. If time is incorrect, investigate radio clock receiver fault.

4. Technicians' Facility or Control System Gateway (where fitted) BlueChip PC based equipment.

4.1 Check that the air-cooling vent filter is clean. If necessary clean or replace the filter in accordance with manufacturer's instructions.

4.2 Check that the cooling fans are operating.

4.3 Print and review Technician controls applied to the interlocking. Comparison should be made with site logbook for consistency. Any discrepancies shall be investigated and escalated. Retain a paper copy for reference until the next review.

5. FEP Module Changeover

5.1 Check the Standby OK LED on both PMs is Green.

5.2 Check the Ethernet A and Ethernet B Activity LEDs are both flashing Yellow.

5.3 If both steps 5.1 and 5.2 are true then press the Changeover button on the active PM.

5.4 After two seconds check the Active LED on the previously active PM is Off and Green on the new active PM.

If the changeover fails and the active PM does not swap then this shall be escalated.

6. WESTLOCK Trackside Equipment (Zone Controller), if provided

6.1 Check captive screws are tight on the PM, RSA and SOM110 modules.

6.2 Where 24V DC Power Module is fitted, observe that all the system 'healthy' indicators are illuminated, as follows:

Unit	Indication	Normal State
24V DC Power Supply	DC OK	Green steady
24V DC Buffer (if fitted)	Status	Green steady
24V DC Buffer (if fitted)	Diagnosis	Off
24V DC Buffer (if fitted)	Check Input Voltage	Off

Table 1 – Module Indications

SERVICE B

7. Technicians' Workstation or Technicians' Facility

7.1 Examine the equipment, terminals, cables, and cable connectors. Particularly look for physical damage, overheating, and arcing. Rectify as necessary as corrective maintenance.

7.2 Clean and dust keyboards and VDU screens as required, using a soft cloth moistened with a detergent solution. Wring out the cloth before use to remove excess detergent solution.

7.3 Carry out NR/SMS/PartB/Test/060 (Emergency Signals On Control (ESOC) Test) for the Westlock system.

More information on this can be found in the Technician's Workstation Technical Manual, Technician's Controls, ESOC Wizard section.

8. Control System Gateway

8.1 Examine the equipment, terminals, cables, and cable connectors. Particularly look for physical damage, overheating and arcing. Rectify as necessary as corrective maintenance.

8.2 Clean and dust the keyboard and VDU screen on the KVM unit as required, using a soft cloth moistened with a detergent solution. Wring out the cloth before use to remove excess detergent solution.

Do not allow any moisture to enter any equipment apertures. Dry off surfaces as soon as possible using a dry lint-free cloth. Do not use abrasive cleaners or pads.

9. WESTLOCK Cubicle

9.1 Examine the equipment, terminals, cables, and cable connectors. Particularly look for physical damage, overheating and arcing. Rectify as necessary as corrective maintenance.

PERIODIC TASK 1

10. Technicians' Facility or Control System Gateway (where fitted) BlueChip PC based equipment

10.1 Remove and replace the lithium battery.

Refer to NR/SMS/Appendix/11 (General Information on the Siemens Westlock Interlocking and Zone Controller).

PERIODIC TASK 2

11. Technicians' Workstation or Control System Gateway (where fitted) Compact PCI based equipment

11.1 Remove and replace the lithium battery.

Refer to NR/SMS/Appendix/11 (General Information on the Siemens Westlock Interlocking and Zone Controller).

PERIODIC TASK 3

12. WESTLOCK CIP and TIF Main Processors

12.1 After 14 years from the date of manufacture, Main Processor modules (MPs) used in the CIP and TIF shall be replaced with serviceable spares.

Refer to NR/SMS/Appendix/11 (General Information on the Siemens Westlock Interlocking and Zone Controller).

END

Includes:	CIXL, TICC, SSys and SmartIO
Excludes:	Lineside TFM, DLM and Datalinks

GENERAL

Do not use an Avometer (or any similar meter) on the Ohms x100 range on the Smartlock system.

The 15V DC output from the meter on this range damages the electronic circuits. Similarly, do not use any form of buzzer or lamp for continuity testing on the system.

This NR/SMS covers all Smartlock systems for first line maintenance only. All other equipment at the installation is covered by its own relevant NR/SMS.

More information on this system can be found in the ALSTOM Transport, Smartlock System and Subsystem Description, Smartlock Maintenance Manual, SMARTLOCK Operation Manual and Smartlock HMI Operation Manual.

DAILY SERVICES

1. Support System

1.1 Using any client terminal, check that the three coloured health indicator is correctly animated.

1.2 Check system status by examining the Alarms List for any outstanding faults.

Investigate and rectify any faults as necessary.

1.3 On completion of tasks, log off from the terminal.

1.4 Clean and tidy the work area as required.

REGULAR SERVICES

2. Support System

2.1 Check for correct event recording by examining current data from the support server.

2.2 Check that the NTP server was last synchronised with MSF within the last week.

Investigate and rectify any defects as necessary as corrective maintenance.

2.3 Check that clocks of both Support Servers are in line with the broadcast time and date displayed on the NTP time server. Rectify any defects as necessary.

2.4 Check for correct operation of the KVM switch by selecting each of the Support Servers and the local client and gateway PCs.

3. Remote Client

3.1 Check for correct operation of the remote client terminal by logging on to the system.

Rectify or escalate any defects as required as corrective maintenance.

On completion, log off.

4. Central Interlocking

4.1 Check for correct operation of the cooling fans. Investigate and rectify any faults as necessary as corrective maintenance.

SERVICE A

5. Support System

5.1 Check all printers' output for legibility. If necessary, replace printer consumables following instructions in printer manufacturer's handbook.

5.2 Check the air-cooling vent filters are clean. If necessary, clean or replace the filter in accordance with manufacturer's instructions.

5.3 Check for correct operation of the graphical event replay facilities by downloading a period of logged data and performing a replay.

5.4 Dust and clean the Client Terminal keyboards, VDU screens and Signaller's Alarm Screen as required using a soft cloth moistened with a detergent solution.

Wring out the cloth before use to remove excess detergent solution.

Check moisture does not enter equipment apertures and is dried off surfaces as soon as possible using a dry lint-free cloth. Do not use abrasive cleaners or pads.

6. Remote Client

Dust and clean keyboards, VDU screens and router as required.

SERVICE B

7. Equipment Cubicles

7.1 Examine the equipment, terminals, cables and cable connectors. Particularly look for security, physical damage, overheating and arcing. Rectify as necessary.

7.2 Clean the exterior surfaces and dust the interior of equipment cubicles using a dry lint free cloth.

7.3 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

7.4 As provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

7.5 As provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This will be necessary if the operation has become intermittent or jerky.

7.6 As provided, check the Althorn (formally Rugby) clock for correct operation.

7.7 Check that the cubicle doors are closed when cleaning the exterior and check leads, and connectors are not disturbed during cleaning.

8. Function Tests

8.1 NR/SMS/PartB/Test/060 (Emergency Signals on Control (ESOC) Test) - Smartlock.

END

SERVICE A

1. Cleaning

1.1 Clean the outside of the cabinet using a dry lint-free cloth.

1.2 Check that that the system ventilation holes are uncovered and unclogged. Clean if necessary.

1.3 Check for foreign material inside the VHLC cabinet. Remove if safe to do so, or report these findings as corrective maintenance.

1.4 Dust the inside of the cabinet.

2. Visual Checks – Front of Cabinet

2.1 Check that the VHLC is securely mounted.

2.2 Check that all modules are fully seated within the cabinet.

2.3 Check for any visual damage. Report any damage as corrective maintenance so that replacement can be arranged as necessary.

2.4 Check that the green “Health” LED is illuminated on all modules.

2.5 Check that the eight yellow “Status” LEDs on the VLP Module are visually active. These should be lit sequentially in rapid succession.

3. Visual Checks – Rear of Cabinet

3.1 Check that the Power Supply Module is securely fastened.

3.2 Interlockings only, check that the CLA Module is securely fastened.

3.3 Check that both the +5Vdc Pow,er Supply and Battery LEDs are illuminated on the +5V Power Supply Module.

3.4 Interlockings only, check that the data LED indicators are active on the CLA Module when the Local Control Panel is operated.

3.5 If fitted, check that all Serial Interface Modules (SIM) are securely mounted and that the data transmit/receive LEDs are active.

3.6 Check that all serial cables are securely fastened to the modules.

3.7 Check that all I/O connectors are securely fastened and that the cable restraining bars are effective.

SERVICE B

4. Component Checks

4.1 Interlocking only, Check that all modems and PSDs, associated with the VHLC are functioning correctly and that the modem transfer audio levels are correct.

5. Voltage Tests

5.1 Carry out the VHLC VOLTAGE TEST (152)

Appendix A

Remote Interrogation

The VHLC Data Logger has the capability to be remotely interrogated, such that system operation and fault data can be down loaded from the Logger and interpreted by an appropriately competent engineer.

A detailed description of how to carry out this process can be found in the appropriate manufacturer’s proprietary manual.

End

Includes:	Siemens SIMIS-W Interlocking
Excludes:	All other Siemens and other Interlocking Types

General

Mobile phones shall be switched off within 3 meters of electronic equipment or an equipment cubicle when any of the doors are open.

Cubicles provide electrostatic protection for the contained electronic equipment. Front and rear doors shall be kept closed at all times except when undertaking maintenance.

Retainers/jackscrews on the system cable retainers shall only be finger tight. Any corrective maintenance issues shall be undertaken as detailed in NR/SMS/PartA/A02 (Preventative & Corrective Maintenance).

DAILY SERVICE

1. Service & Diagnostic Terminal (S&D)

1.1 Check that the S&D terminal is correctly and securely connected to the Interlocking.

1.2 Request the fault list and check for any outstanding faults. Rectify or report.

1.3 Check that the work area is clean and tidy.

SERVICE A

2. Interlocking Cabinet(s)

2.1 Check that the cubicle doors are securely closed and as necessary locked. Inform your SM(S) if doors are found open.

2.2 Check that the cabinet earthing is securely mechanically connected.

2.3 Check that all the cable shields are securely mechanically connected to earth.

2.4 Check that there are no permanently illuminated RED LEDs on any of the SIMIS-W core components. Rectify or report.

2.5 Check that the “RF” LED is illuminated on all three VESUV3 boards in the IIC/OMC. Rectify or report.

3. Interlocking Cabinet Fans

Rectify or report any problems as corrective maintenance.

3.1 Check whether the operating voltage is present. The green LED at the front of the fan shall be illuminated.

3.2 Check the fan speed is O.K. The red LED at the front of the fan shall be extinguished.

3.3 Check that when the blue button is pressed, the red LED illuminates. Check that the fan fault has been registered on the S&D computer and then clear the fault from the log.

3.4 Check and if necessary clean or exchange the filter mats.

4. Service & Diagnostic Terminal (S&D) Data Base

Recording media can be a memory stick or a formatted floppy disk depending on the system hardware.

4.1 Back up the data on the S&D terminal to an external recording media using the following method:

a) Click the TRS button to start the backup (to abort while running, click the TRC button). Click the Execute button.

b) Connect the recording media to the S&D terminal and Click the CDI button to confirm that the media has been connected.

c) The data now copies to the recording media.

If there is a problem click the TRR button to repeat the last successful back up process e.g. when the recording media becomes defective or gets lost.

5. Final

5.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

5.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

6. Interlocking Cubicle(s)

6.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

6.2 Check that the cubicle doors are closed when cleaning the exterior. Do not disturb leads and connectors during cleaning.

7. Interlocking Equipment

7.1 Carefully dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

Retainers/jackscrews on the system cable retainers shall only be finger tight.

8. All Signals on Test

<u>Bournemouth</u>

8.1 Carry out an “All Signals on Test”, This test is carried out in liaison with the Signaller. There are 2 systems to be tested.

a) The first is on screen and these are divided into three areas (Bournemouth, Christchurch and Branksome).

b) The second is manual buttons, these are located at each end of the console, which has signals on.

The “All Signals On” button shall be pressed for a minimum of 5 seconds.

<u>Havant</u>

8.2 Carry out an “All Signals on Test”. This test is carried out in liaison with the Signaller. There are 2 systems to be tested

a) The first is on screen and these are divided into seven areas.

- Havant SGRC
- Ditcham SGRC
- Farlington Triangle SGRC
- Portchester SGRC

- Fratton SGRC
- Southsea SGRC
- Harbour SGRC

b) The second is two Manual All Signals on Buttons on the Emergency Consoles.

The “All Signals On” button shall be pressed for a minimum of 5 seconds.

NOTE: *Once the emergency Manual Button(s) have been operated the signals can only be replaced to normal working via the individual area VICOS SGRC.*

9. Final

9.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

9.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

SERVICE A

No possession arrangements are required to perform Service A, as all the tasks performed during this service are non-intrusive.

1. Cleaning

1.1 Clean the outside of the cabinet using a dry lint free cloth.

1.2 Check that the system ventilation holes are uncovered and unclogged. Clean if necessary.

1.3 Check for foreign material inside the HXP-3 cabinet. Remove if safe to do so, or report these findings as corrective maintenance.

2. Visual Checks

2.1 Check that the HXP-3 is securely mounted.

2.2 Check that the equipment covers are properly installed.

2.3 Check that all modules are fully seated within the cabinet.

2.4 Check for visual damage to modules. Replace as necessary. Report any damage as corrective maintenance so that replacement can be arranged as necessary.

2.5 Check that there is no visual damage to external cables. Report any damage as corrective maintenance so that replacement can be arranged as necessary.

2.6 Check that there is a spare fuse on each TLM and RYD Module.

2.7 Check that the real time clock on the HXP-3 is consistent with the time stated on the associated VHLC unit. If this is not the case, contact your SM(S) for further instructions.

3. System Parameter Checks

Each of these tests is carried out via the Information Display Keypad (IDK) located on the front of the HXP-3 and recorded on the appropriate record card.

For system status codes refer to Appendix E.

3.1 Check that the STANDBY/AUTO/NORMAL switch on the TLM module is in the AUTO (centre) position.

3.2 Check that the NORMAL system is active. If the STANDBY system is active, arrange for the event logger to be interrogated to determine when the system changeover occurred and under what conditions.

Check that any corrective action is carried out and changeover to the NORMAL system before continuing.

3.3 Select Track #1 by pressing the TRACK SEL button; this toggles the display between Track #1 and Track#2.

3.4 Check and record the RX value.

a) Press the MONITOR SEL button.

b) Type the number 1 for RX.

c) Press the ENTER button.

d) The current RX value shall be displayed. This value shall be between 95 and 105. If this is not the case when the test is carried out, the RX value can be adjusted by referring to the procedure in Appendix A.

3.5 Check and record the Track Circuit Phase angle (PHASE) value.

a) Press the MONITOR SEL button.

b) Type the number 2 for the Track Circuit Phase angle value.

c) Press the ENTER button.

d) The current Track Circuit Phase angle value is displayed. This alternates with the compensated Phase angle if Phase Compensation (P-Comp) has been applied. The latter figure shall be preceded by the letter C.

e) The Track Circuit Phase angle shall be greater than 32. Values of less than 45 shall be reported to your SM(S).

f) Refer to Appendix B for instructions on how to adjust the Track Circuit Phase angle by using Phase Compensation.

3.6 Check and record the Ballast Compensation (BC) parameter.

a) Press the MONITOR SEL button.

b) Type the number 5, for Ballast Compensation parameter.

c) Press the ENTER button.

d) The current Ballast Compensation parameter is displayed.

e) Refer to the procedure in Appendix C of this document for instructions on how and why to adjust the Ballast Compensation parameter.

3.7 Check and record the Highest Stable RX (HS) and corresponding Track Circuit Phase angle values.

a) Press the MONITOR SEL button.

b) Type the number 6, for the Highest Stable RX value.

c) Press the ENTER button.

d) The Highest Stable RX and corresponding Track Circuit Phase angles are shown alternately.

3.8 Check and record the Lowest Stable Phase (LP) and corresponding RX values.

a) Press the MONITOR SEL button.

b) Type number 7, for the Lowest Stable Phase angle.

c) Press the ENTER button.

d) The Lowest Stable Phase angle and corresponding RX values are shown alternately.

3.9 Check and record the Transmitter Check TC value.

a) Press the MONITOR SEL button.

b) Type the number 9, for the Transmitter Check value.

c) Press the ENTER button.

d) The current Transmitter Check value is displayed. This shall normally be between “430” and “470”.

e) Values outside this range indicate a high impedance connection to the island track.

f) Refer to the procedure in Appendix D for instructions on how to make adjustments to the Transmitter Check value.

3.10 Check and record the current Phase Compensation (P-COMP) value.

a) Press the OPTION button.

b) Type the number 10 for Phase Compensation Adjustment.

c) The current Phase Compensation value is displayed.

d) Record the current Phase Compensation value.

e) When ballast conditions deteriorate to the extent that the HXP-3 goes into low phase condition, it is necessary to adjust the Phase Compensation value.

Refer to the procedure in Appendix B of this document for instructions on how to carry out such an adjustment.

3.11 Check and record the RX-Potentiometer (RX-POT) value.

a) Press the MONITOR SEL button.

b) Type the number 12, for the RX- Potentiometer value.

c) Press the ENTER button.

d) The current RX-Potentiometer value is displayed. This shall be within the range of “50” to “500”.

The RX-POT value should alternate with the compensated RX-POT value in instances where the Auto-RX function is in use.

3.12 Check and record the Approach Length value.

a) Press the MONITOR SEL button.

b) The value of Approach Length is displayed in the “ADJUST” window.

3.13 Check and record the Warning Time (WT) value.

a) Press the MONITOR SEL button.

b) The vale of Warning Time is displayed in the “ADJUST” Window.

3.14 Check and record the Track Enable (TK-ENA) value.

a) Press the OPTION button.

b) Type the number 1 for Track Enable.

c) Press the ENTER button.

d) The current value of Track Enable shall now be displayed in the “ADJUST” window.

e) Record the value on the ‘Crossing Location Record’.

3.15 Check and record the Frequency (TK-FD) value.

a) Press the OPTION button.

b) The current Frequency value shall now be displayed in the “ADJUST” window.

3.16 Check and record the Constant Warning/Motion Detect (CW-MD) value.

a) Press the OPTION button.

b) The current value shall now be displayed in the ‘ADJUST’ window.

3.17 Check and record the False Shunt RX (FS-RX) and False Shunt Timer (FS-TMR) values.

a) Press the OPTION SEL button.

b) Type in the number 20, for False Shunt Timer.

c) Press the ENTER button.

d) The current value of FS-RX shall now be displayed in the 'ADJUST' window.

e) While the FS-RX value is still on display, press the up arrow to display FS-TM.

3.18 Check and record the Approach Release RX (AR- RX) and Approach Release Timer (AR-TMR) values.

a) Press the OPTION SEL button.

b) Type in the number 22, for Approach Release Timer.

c) Press the ENTER button.

d) The current value of AR-RX shall now be displayed in the 'ADJUST' window.

e) While the AR-RX value is still on display, press the up arrow to display AR-TM.

3.19 Check that the values recorded in tasks 3.12 to 3.18 above match those on the "HXP Setup" sheet within the wiring diagrams.

3.20 Press the TRACK SEL button to display Track #2 and repeat steps 3.4 to 3.19 for Track #2 (if fitted).

SERVICE B

4. NORMAL/STANDBY Transfer Check

4.1 Set the Minute Timer switch on the TLM to 1 minute.

4.2 Toggle the STANDBY/AUTO/NORMAL switch on the TLM to the NORMAL (down) position.

4.3 Check that the MDR LED is on.

4.4 Toggle the STANDBY/AUTO/NORMAL switch to the AUTO position.

4.5 Temporarily install a mini shunt on both pins of the W14 jumper located on the front edge of the Normal System CPU module. It shall be noted that installing a mini shunt in this way can call the crossing.

4.6 Check that the MDR LED goes off as the MDR Drive ‘drops out’.

4.7 Check that power is transferred to the Standby System after a delay of 1 minute.

4.8 Temporarily install a mini shunt on both pins of the W14 jumper located on the front edge of the Standby System CPU module.

4.9 Check that the MDR drive is not energised and that the MDR LED is not illuminated.

4.10 Verify that power is transferred to the Normal System after a delay of 1 minute.

4.11 Move the mini shunt to the storage position on the W14 jumper for both the Normal and Standby System CPU modules. See Figure 1.

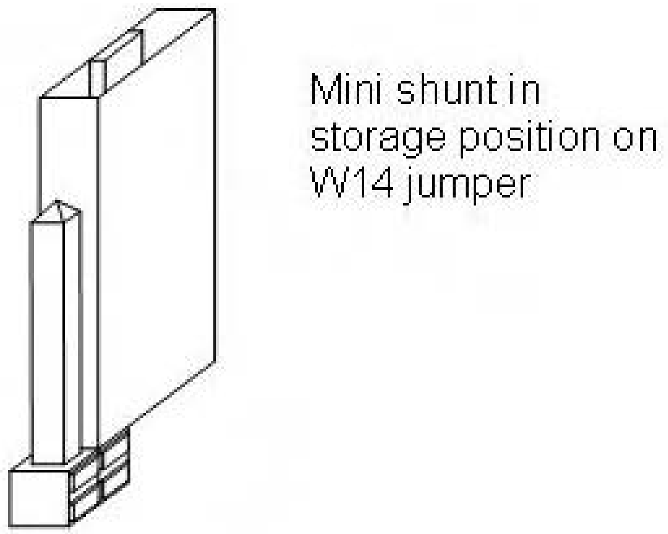


Figure 1 – Mini Shunt

4.12 Toggle the STANDBY/AUTO/NORMAL switch to the normal position to reselect the Normal System and allow the unit to clear (MDR on).

4.13 Reset the Minute Timer to the delay time specified on the setup sheet.

4.14 Press the MONITOR SELECT button on the IDK until the SD mode is selected and press the ENTER key, and then press SHIFT followed by CLEAR to delete all the diagnostic codes from the memory.

4.15 Toggle the STANDBY/AUTONORMAL switch to the AUTO position.

5. RSI Failure Transfer Check

5.1 Toggle the STANDBY/AUTO/NORMAL switch to the NORMAL position to select the Normal System and allow the unit to clear (MDR on).

5.2 Toggle the STNADBY/AUTO/NORMAL switch to the AUTO position.

5.3 Remove the Normal system RSI Module for Track 1.

5.4 Check that power is transferred to the Standby system after a delay of 30 seconds.

5.5 Re-install the Normal System RSI Module for Track 1.

5.6 Remove that Standby System RSI Module for Track 1.

5.7 Check that the power is transferred to the Normal System after a delay of 30 seconds.

5.8 Allow the unit to clear (MDR on).

5.9 Re-install the Standby System RSI module.

5.10 Temporarily connect the jumper wire between that ISL+ and ISL- terminals.

5.11 Check that the TLM transfers power to the Standby System after a delay of 45 seconds.

5.12 Check that the TLM transfers power back to the Normal System after a delay of 60 seconds.

5.13 Remove the jumper wire from ISL1+ and ISL- terminals.

5.14 Temporarily toggle the STANDBY/AUTO/NORMAL switch to the NORMAL position to re-select the Normal System.

5.15 Toggle the STANDBY/AUTO/NORMAL switch to the AUTO position.

5.16 Where necessary, repeat steps 5.3 to 5.15 removing the RSI modules for track 2.

6. Tests

6.1 NR/SMS/PartB/Test/151 (Harmon Crossing Processor (HXP-3 Tests)).

APPENDIX A

These tasks need only be carried out on an as-and-when required basis.

7. RX Adjustment

7.1 Press the TRACK SEL button to select the correct Track.

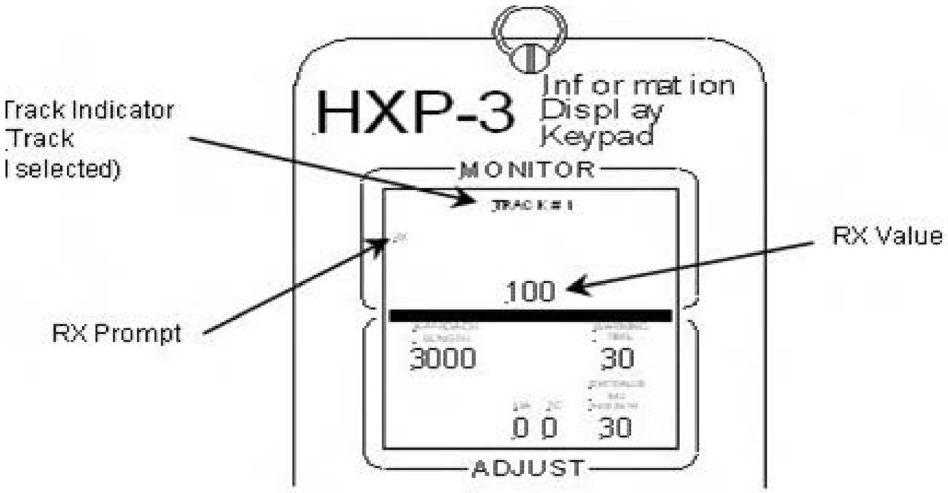


Figure 2 – HXP-3 Information Display – RX Prompt

7.2 Press the MONITOR SEL button until the RX prompt and value are displayed as shown in figure 2.

7.3 Toggle the ADJUST ENABLE switch on the TRM for Track selected. The value for RX can go blank while the ADJUST ENABLE switch is toggled.

If the password is not enabled, the display can prompt the operator for password entry.

7.4 When the approach is clear, rotate the RX POT knob to adjust the value of RX of 100.

7.5 Consult section 5.4.1 of IM Harmon Crossing Processor HXP-3 Instruction Manual for information on how to return RX to 100 in situations where this has not previously been possible. This may require an additional competence assessment to complete this task

7.6 After RX is set, press the MONITOR SEL button until the PHASE prompt is displayed, as shown in Figure 3.

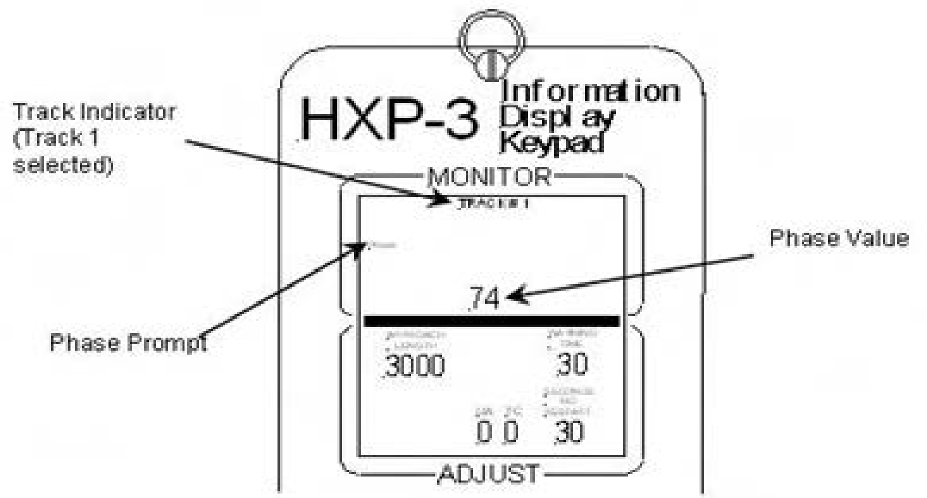


Figure 3 – HXP-3 Information Display - Phase Prompt

7.7 If the value displayed for Phase angle is below 45 degrees refer to Appendix C for corrective action.

7.8 If the current value for Phase Compensation is not 0 degrees, the display of the compensated Phase angle value (preceded by the letter “C”) can alternate with the current Phase value in the Monitor area.

7.9 Record the new RX-POT value on the record card.

APPENDIX B

These tasks need only be carried out on an as-and-when required basis.

8. Phase Compensation

8.1 Press the MONITOR SEL button until RX is selected, as shown in Figure 4.

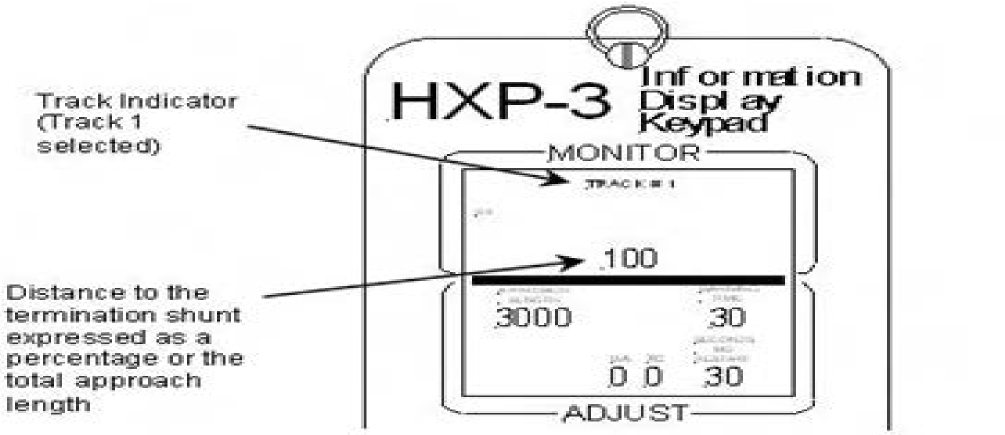


Figure 4 – HXP-3 Display Information RX

8.2 Place a hard wire test shunt at the termination and note the RX level.

8.3 Make sure the HXP-3 is not in High Signal or Low Phase because of a bad termination shunt before proceeding.

8.4 Move the hard wire test shunt to 90 percent out on the appropriate approach.

8.5 Verify that the RX drops by 5 or more when compared to the RX noted in 8.2 before proceeding.

8.6 Press the MONITOR SEL button until PHASE is selected as shown in Figure 4.

8.7 If the current value of Phase Compensation is not 0 degrees, the display of the compensated Phase angle value (preceded by letter “C”) can alternate with the current Phase value in the Monitor area.

8.8 If the Phase Angle is greater than 32 degrees, begin by adjusting the Ballast Compensation, as detailed in Appendix C of this report.

8.9 If the Phase Angle is less than or equal to 22 degrees, it is necessary to change the Track frequency or the application. This may require an additional competence assessment to complete this task

8.10 If the Phase angle is between 23 degrees and 32 degrees, press the OPTION button until option 10 is selected, the OPTION prompt flashes and “P- COMP” is displayed. This is shown in figure 5.

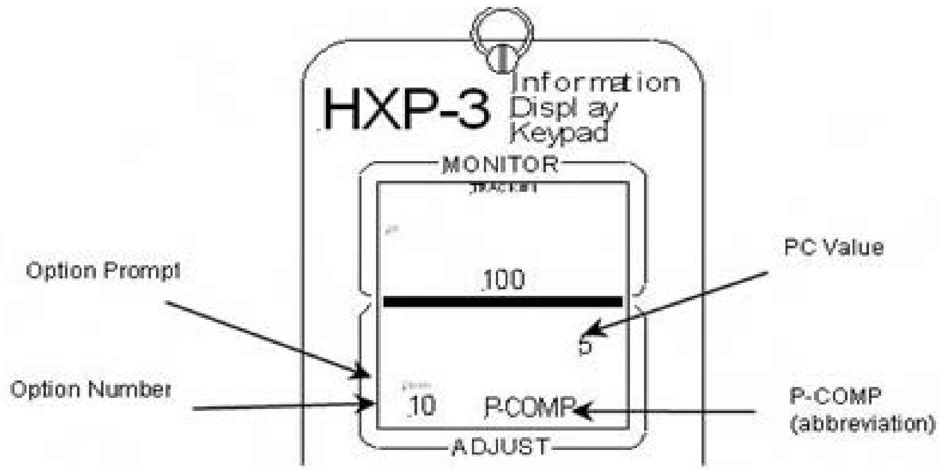


Figure 5 – HXP-3 Display Information P-COMP

8.11 Enter the password and Press the ENTER button until the abbreviation “P-COMP” and the TRACK indicator begin to flash and the OPTION prompt stops flashing. When the PC value is enabled for adjustment, the Monitor area of the IDK changes to display the PHASE prompt and the current Phase angle as shown in figure 6.

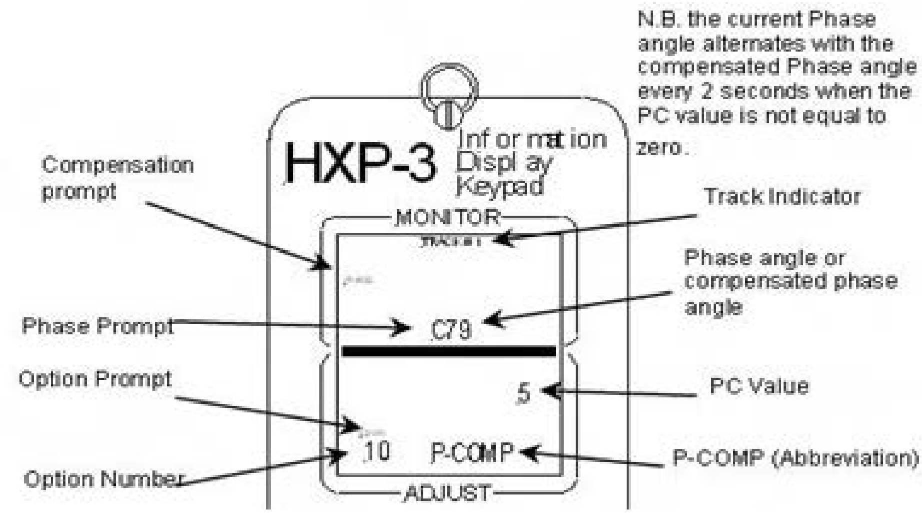


Figure 6 – HXP-3 Display Information

8.12 Type in the amount of compensation in degrees required to return the phase angle to 33 degrees.

8.13 Press and hold the ENTER button until the abbreviation “P-COMP” and the TRACK indicator stop flashing.

8.14 Press the MONITOR SEL button until RX is selected.

8.15 If the value for RX is not 100 following the Phase Compensation adjustment, use the Ballast Compensation adjustment, explained in Appendix C, to return RX to 100.

8.16 Record the new Phase Compensation value on the record card.

APPENDIX C

The Ballast Compensation Adjustment compensates for variations in RX due to widely changing ballast conditions. Ideally, the RX should stay as close to “100” as possible in all ballast conditions, to provide consistent warning times and accurate train speed data.

The Ballast Compensation shall be adjusted when the RX changes by a value of 5 or more, in either direction, from “100” due to changes in ballast conditions.

The highest stable RX and lowest stable phase value are displayed on the IDK to assist in determining the correct ballast compensation adjustment.

If the RX increases when the Phase angle decreases and the RX decreases when the Phase angle increases, decrease the BC value by a factor of 2 for every RX change of 1.

For example: If RX increases to “115” when the Phase angle decreases (deteriorating ballast” and the RX decreases to “100” when the Phase angle increases (improving ballast), decrease the BC value from “160” to “130.”
If the RX decreases when the Phase angle decreases and the RX increases when the Phase angle increases, increase the BC value by a factor of 2 for every RX change of 1.

For example: If RX decreases to “85” when the Phase angle decreases (deteriorating ballast) and the RX increases to “100” when the Phase angle increases (improving ballast), increase the BC value from “160” to “190”.

The following procedure explains how to carry out such an adjustment and need only be performed on an as-and- when required basis.

9. Ballast Compensation Adjustment

9.1 Press the OPTION button until Option 9 is selected, as shown in Figure 7, the OPTION Prompt flashes and "BC" is displayed.

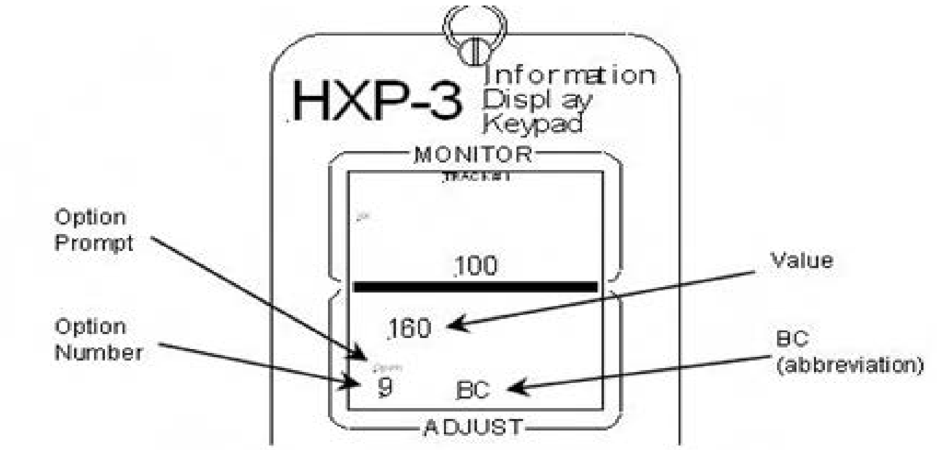


Figure 7 – HXP-3 Display Information Option 9

9.2 Press the ENTER button and type in this password.

9.3 Press the ENTER button until the abbreviated "BC" and the TRACK indicator begin to flash and the OPTION prompt stops flashing.

9.4 Type in the required value for ballast compensation.

9.5 Press the ENTER button until the abbreviation "BC" and the TRACK indicator stop flashing.

9.6 Follow the instructions in Appendix A to re-adjust RX to '100'.

9.7 Toggle the H/L RST switch on the CPU module to reset the HS and LP memory.

9.8 Record the new Ballast Compensation Value on the record card.

APPENDIX D

These tasks need only be carried out on an as-and-when required basis.

10. TC Adjustment

The Transmitter Check (TC) value shall never be adjusted without first verifying that there has been no degradation of any part of the Island e.g., track and associated cabling.

10.1 To view the TC value in the Monitor Area on the IDK display, press the MONITOR SEL button, followed by the number 9 and the enter button.

10.2 Press ADJUST SEL until the present value of TC begins to flash.

10.3 Press the ENTER button until the TC prompt begins to flash and the value stops flashing.

10.4 Press the 2 (up arrow) button to increase the TC number, and hence decrease the TC value, until the TC value falls below 470.

10.5 Press and hold the ENTER button until the TC prompt stops flashing to complete the adjustment.

APPENDIX E

11. Remote Interrogation

The HXP-3 Data Logger has the capability to be remotely interrogated, such that system operation and fault data can be down loaded from the Logger and interpreted by an appropriately competent engineer.

A detailed description of how to carry out this process can be found in the appropriate manufacturer's proprietary manual.

12. Fault Finding using The hPX-3 status codes

Select SD on the IDK in order to view any diagnostic codes have been stored by the HXP-3.

There are three types of diagnostic code that can be displayed. The diagnostic code number, description of the diagnostic code and suggested action is provided in the following tables.

When the suggested action is "check module", this means replace the module temporarily to determine if a fault in the original module caused the code to be displayed. If the code disappears, the original module shall be repaired. If the code is still present, reinstall the original module and check all alternative causes.

13. Status codes

These are identified by the presence of the letter "F" preceding the code number on the IDK. These all cause the HXP-3 to reset.

CODE	DESCRIPTION	SUGGESTED ACTION
F1	CPU memory malfunction.	Check CPU module.
F2	CPU memory malfunction.	Check CPU module.
F3	CPU memory malfunction.	Check CPU module.
F50	System failed to initialise properly.	Check CPU module.
F60	SIM RAM memory test malfunction.	Check SIM module.
F70	Track 1 TRM frequency was not detected.	Check Master/Slave switch. If OK then replace TRM.
F71	Track 2 TRM frequency was not detected.	Check Master/Slave switch. If OK then replace TRM.
F80	Track 1 TRM frequency phase out of range.	Make sure Track frequency is set equal to incoming frequency on Master/Slave terminals.

CODE	DESCRIPTION	SUGGESTED ACTION
F81	Track 2 TRM frequency phase out of range.	Make sure Track frequency is set equal to incoming frequency on Master/Slave terminals.
F100	CPU malfunction (Loop time failure).	Check CPU module.
F101	CPU memory malfunction.	Check CPU module.
F102	CPU memory malfunction.	Check CPU module.
F103	CPU memory malfunction.	Check CPU module.
F104	CPU strapped in program position.	Remove program strap on CPU module.
F105	CPU ROM sockets U8 and U9 are not empty.	Remove Memory ICs from CPU ROM sockets U8 and U9.
F120	Track 1 filters would not tune correctly.	Check Track 1 TRM.
F121	Track 2 filters would not tune correctly.	Check Track 2 TRM.
F150	Local parameters set to default by operator.	Program local parameters if required.
F200	CPU RAM memory test malfunction.	Check CPU module.
F201	CPU FLASH memory test malfunction.	Check CPU module.
F202	CPU EPROM memory test malfunction.	Check CPU module.
F203	CPU NVRAM memory test malfunction.	Check CPU module.
F204	RYD NVRAM memory test malfunction.	Check RYD module.
F205	RMM NVRAM memory test malfunction.	Check RMM module.
F206	Self test malfunction.	Check CPU module.
F207	Local parameter restore malfunction.	Check CPU module.
F208	Local parameter restore malfunction.	Check CPU module.
F209	CPU memory malfunction.	Check CPU module.
F210	Detected corrupt local parameters. The unit is forced to reset in an attempt to recover. If not possible, parameters will be set to defaults.	Reset local parameters.
F215	CPU non-volatile RAM data test malfunction.	Check CPU module.
F216	RYD non-volatile RAM data test malfunction.	Check RYD module.

CODE	DESCRIPTION	SUGGESTED ACTION
F217	RMM non-volatile RAM data test malfunction.	Check RMM.
F220	Cabinet number malfunction.	Check CPU module. If satisfactory, replace chassis.
F221	Cabinet type ID malfunction.	Check CPU module. If satisfactory, replace chassis.
F222	Track 1 Frequency Select switches (S3 and S4) malfunction.	Check Frequency Select switches (S3 and S4), Track 1 TRM and CPU module (actuators 1 to 5 shall be set to the same position on S3 and S4). If satisfactory, replace chassis.
F223	Track 2 Frequency Select switches (S7 and S8) malfunction.	Check Frequency Select switches (S7 and S8), Track 2 TRM and CPU module (actuators 1 to 5 shall be set to the same position on S7 and S8). If satisfactory, replace chassis.
F224	Vital Communications selection (Actuator 4) malfunction on System Configuration switches (S5 and S6).	Check System Configuration switches (S5 and S6), RYD module and CPU module (actuator 4 on S5 and S6 shall be in the off position). If satisfactory, replace chassis.
F225	CW/MD switch malfunction.	Check CW/MD switch and CPU module. If satisfactory, replace RYD module.
F226	Track 1 Normal Approach/Short Approach selection (Actuator 1) malfunction on System Configuration switch (S5).	Check Normal Approach/Short Approach selection, RYD module, and CPU module (Actuator 1 on S5 shall be in the correct position). If satisfactory, replace chassis.
F227	Track 2 Normal Approach/Short Approach selection (Actuator 1) malfunction on System Configuration switch (S6).	Check Normal Approach/Short Approach selection, RYD module, and CPU module (Actuator 1 on S6 shall be in the correct position). If satisfactory, replace chassis.
F228	Track 1 Short Approach/Very short Approach selection (Actuator 2) malfunction on System Configuration switch (S5).	Check Short Approach/ Very Short Approach selection, RYD module and CPU module (Actuator on S5 shall be in the correct position). If satisfactory, replace chassis.
F229	Track 2 Short Approach/Very short Approach selection (Actuator 2) malfunction on System Configuration switch (S6).	Check Short Approach/ Very Short Approach selection, RYD module and CPU module (Actuator on S6 shall be in the correct position). If satisfactory, replace chassis.
F230	+5 volt power supply malfunction.	Check RYD module.
F231	+15 volt power supply malfunction.	Check RYD module.
F232	-15 volt power supply malfunction.	Check RYD module.
F233	20 KHz malfunction.	Check RYD module.

CODE	DESCRIPTION	SUGGESTED ACTION
F240	HL/RST switch malfunction.	Check CPU module.
F241	AXD Module self test malfunction.	Check AXD module.
F242	AXD Module self test malfunction.	Check AXD module.
F243	Track 1 TRM self test malfunction.	Check Track 1 TRM.
F244	Track 2 TRM self test malfunction.	Check Track 2 TRM.
F245	Track 1 TRM Adjust Enable switch malfunction.	Check Track 1 TRM.
F246	Track 2 TRM Adjust Enable switch malfunction.	Check Track 2 TRM.
F247	RMM self test malfunction.	Check RMM.
F250	MDR, AAR Terminal.	Check RYD module.
F251	AX 1, AAR Terminal self test malfunction.	Check AXD module.
F252	AX 2, AAR Terminal self test malfunction.	Check AXD module.
F253	AXD 3 AAR Terminal self test malfunction.	Check AXD module.
F254	CPU memory malfunction.	Check CPU module.
F255	CPU memory malfunction.	Check CPU module.
F256	CPU memory malfunction.	Check CPU module.
F257	CWE 1 AAR Terminal self test malfunction.	Check RYD module.
F258	CWE 2 AAR Terminal self test malfunction.	Check RYD module.
F259	ISL 1, AAR Terminal self test malfunction.	Check RYD module.
F260	ISL 2, AAR Terminal self test malfunction.	Check RYD module.
F261	AUX AAR, Terminal self test function.	Check RYD module.
F262	Track 1 disable, AAR terminal indicates malfunction.	Check RYD module. If satisfactory, replace chassis.
F263	Track 2 disable, AAR terminal indicates malfunction.	Check RYD module. If satisfactory, replace chassis.
F270	Track 1 frequency has changed.	No action required.
F271	Track 2 frequency has changed.	No action required.
F275	Track 1 TRM was installed while unit was running.	No action required.
F276	Track 2 TRM was installed while unit was running.	No action required.
F280	Self test malfunction.	Check CPU and RYD modules.

CODE	DESCRIPTION	SUGGESTED ACTION
F285	MD only switch failure.	Check actuator 3 on S5 and S6 on HXP-3s; S6 standby and S7 on HXP-3Rs and S5 &S6 standby and S14 &S14 normal on HXP-3R2s.
F286	Switch settings are established for PMD-3D or PMD-3R2 operation and a SIM is installed.	Check actuator 3 on system configuration switch.
F287	Switch settings are NOT established for PMD-3D pr PMD-3R2 operation or a SIM is not installed.	Check SIM for proper installation.
F290	SIM fails to run.	Check SIM.
F291	SIM installed while unit running.	Check SIM.
F300	Self test malfunction.	Check CPU module.
F301	Self test malfunction.	Check CPU module.
F350	MD self test malfunction.	Check RYD and CPU module.
F351	AX 1 self test malfunction.	Check AXD module and CPU module.
F352	AX 2 self test malfunction.	Check AXD module and CPU module.
F353	AX 3 self test malfunction.	Check AXD module and CPU module.
F354	Self test malfunction.	Check CPU module.
F355	Self test malfunction.	Check CPU module.
F356	Self test malfunction.	Check CPU module.
F358	AXD module 1 self test malfunction.	Check AXD module and CPU module.
F359	Self test malfunction.	Check CPU module.

Table 1 – Status Codes

14. Condition codes

These are identified by the presence of the letter "C" preceding the code number on the IDK. These do not cause a reset, but can cause the MDR output to drop.

CODE	DESCRIPTION	SUGGESTED ACTION
C500	CPU module memory malfunction.	Check CPU module.
C510	Track 1 TRM Filter tuning malfunction.	Check Track 1 TRM.
C511	Track 1 TRM Frequency out of range.	Check frequency setting.
C515	Track 2 TRM Filter tuning malfunction.	Check Track 2 TRM.
C516	Track 2 TRM Frequency out of range.	Check frequency setting.
C520	Track 1 TRM MUX malfunction.	Check Track 1 TRM.

CODE	DESCRIPTION	SUGGESTED ACTION
C521	Track 1 TRM Frequency malfunction.	Check Track 1 TRM.
C522	Track 1 TRM Current malfunction.	Check Track1 TRM.
C523	Track 1 TRM Transmitter voltage saturation.	Check for open Track wires and check Track 1 TRM.
C524	Track 1 TRM Receiver saturation.	Check Track 1 TRM.
C525	Track 1 TRM Receiver amplitude malfunction.	Check Track 1 TRM.
C526	Track 1 TRM Transmitter amplitude malfunction.	Check Track 1 TRM.
C527	Track 1 TRM Transmitter current malfunction.	Check Track 1 TRM.
C528	Track 1 TRM Receiver phase malfunction.	Check Track 1 TRM.
C529	Track 1 TRM Transmitter phase malfunction.	Check Track 1 TRM.
C530	Track 1 TRM Transmitter current phase malfunction.	Check Track 1 TRM.
C531	Track 1 TRM Transmitter current saturation.	Check transmitter tail cables and check Track 1 TRM.
C540	Track 2 TRM MUX malfunction.	Check Track 2 TRM.
C541	Track 2 TRM MUX malfunction.	Check Track 2 TRM.
C542	Track 2 TRM current malfunction.	Check Track 2 TRM.
C543	Track 2 TRM Transmitter voltage saturation.	Check for open Track wires and check Track 2 TRM.
C544	Track 2 TRM Receiver saturation.	Check Track 2 TRM.
C545	Track 2 TRM Receiver amplitude malfunction.	Check Track 2 TRM.
C546	Track 2 TRM Transmitter amplitude malfunction.	Check Track 2 TRM.
C547	Track 2 TRM Transmitter current malfunction.	Check Track 2 TRM.
C548	Track 2 TRM Receiver phase malfunction.	Check Track 2 TRM.
C549	Track 2 TRM Transmitter phase malfunction.	Check Track 2 TRM.
C550	Track 2 TRM Transmitter current phase malfunction.	Check Track 2 TRM.
C551	Track 2 TRM Transmitter current situation.	Check transmitter tail cables and check Track 2 TRM.

CODE	DESCRIPTION	SUGGESTED ACTION
C560	Voltage difference between the transmitter and receiver was detected too large.	Transmitter tail cables can have high impedance (tail cables too longs).
C600	Track 1 High Signal detection.	A high signal occurs when RX is "110" or above. An open Track circuit (not a Track tail cable) will normally cause the HXP-3 to go into High Signal detection. An open that causes High Signal detection can be a bad termination shunt, open insulated joint coupler, bad bond or broken rail.
C601	Track 2 High Signal detection.	A high signal occurs when RX is "110" or above. An open Track circuit (not a Track tail cable) will normally cause the HXP-3 to go into High Signal detection. An open that causes High Signal detection can be a bad termination shunt, open insulated joint coupler, bad bond or broken rail.
C602	Track 1 Low Phase detection.	A low phase can be caused by; a bad termination shunt; a bad insulated joint coupler; a Track battery within the approach that does not have a reactor installed; a Track Relay less than 1 ohm without a reactor in service with one lead of the coil; bad gauge rods or switch rods or; improper application of frequency overlapping an existing motion detector or bad ballast conditions.
C603	Track 2 Low Phase detection.	A low phase can be caused by; a bad termination shunt; a bad insulated joint coupler; a Track battery within the approach that does not have a reactor installed; a Track Relay less than 1 ohm without a reactor in service with one lead of the coil; bad gauge rods or switch rods or; improper application of frequency overlapping an existing motion detector or bad ballast conditions.
C605	Reset switch on CPU module was pressed.	No action required.
C606	Track 1 Phase Compensation adjustment is preventing low phase condition.	No action required unless phase compensation cannot prevent low phase condition. Check phase.
C607	Track 2 Phase Compensation adjustment is preventing low phase condition.	No action required unless phase compensation cannot prevent low phase condition. Check phase.

CODE	DESCRIPTION	SUGGESTED ACTION
C610	Track 1, phase decreasing with approaching train.	Check for a high impedance rail connection within the HXP-3 approach.
C611	Track 2, phase decreasing with approaching train.	Check for a high impedance rail connection within the HXP-3 approach.
C612	Track 1 transmitter detected motion but receiver did not.	A high resistance can exist in the receiver Track wires. Check the R1 and R2 Track wires.
C613	Track 2 transmitter detected motion but receiver did not.	A high resistance can exist in the receiver Track wires. Check the R1 and R2 Track wires.
C620	Track 1, the voltage level difference between the receiver and the transmitter was detected too large.	Check for broken receiver tail cables and check Island circuit.
C621	Track 1, the voltage level at the receiver was detected to be greater than the transmitted voltage.	Check Track tail cables, Island circuit and TRM.
C622	Track 1 TC was detected in saturation.	Transmitter tail cables can have high impedance (tail cables too long), adjust TC as described in Appendix D of this document.
C630	Track 2, the voltage level difference between the receiver and the transmitter was detected too large.	Check for broken receiver tail cables and check Island circuit.
C631	Track 2, the voltage level at the receiver was detected to be greater than the transmitted voltage.	Check track tail cables, Island circuit and TRM.
C632	Track 2 TC was detected in saturation.	Transmitter tail cables can have high impedance (tail cables too long), adjust TC as described in Appendix D of this document.
C640	Track 1 TC phase out of range.	Check transmitter/receiver wire connections. If satisfactory, check TRM.
C641	Track 2 TC phase out of range.	Check transmitter/receiver wire connections. If satisfactory, check TRM.
C645	Track 1 erratic shunting was detected.	No action required.
C646	Track 2 erratic shunting was detected.	No action required.
C650	Track 1 was placed in MD made due to RX dropping below "74" for 10 minutes while phase was greater than 60.	Check for shunt approach. Possible that no action is required as a train has stopped on the approach.

CODE	DESCRIPTION	SUGGESTED ACTION
C651	Track 2 was placed in MD made due to RX dropping below "74" for 10 minutes while phase was greater than 60.	Check for shunt approach. Possible that no action is required as a train has stopped on the approach.
C655	Track 1 was placed into MD mode due to phase less than 60 and RX less than "74".	Check for resistive shunt in the approach.
C656	Track 21 was placed into MD mode due to phase less than 60 and RX less than "74".	Check for resistive shunt in the approach.
C660	Track 1 ringing due to shunt detection.	Check for shunt in the approach.
C661	Track 2 ringing due to shunt detection.	Check for shunt in the approach.
C665	Memory malfunction.	Check CPU module.
C666	Memory malfunction.	Check CPU module.
C667	Track 1 secondary detection occurred.	For information purposes only.
C668	Track 2 secondary detection occurred.	For information purposes only.
C670	Remote train data sequence number out of range.	Check RS-485 communications link.
C700	Track 1 enable, disable terminal and TRM installed don't agree.	If a Track is enabled or disabled, three adjustments shall be made: Track enable shall be set through the IDK; AAR disable terminals shall not be strapped to enable a Track or strapped to disable a Track.
C701	Track 2 enable, disable terminal and TRM installed don't agree.	If a Track is enabled or disabled, three adjustments shall be made: Track enable shall be set through the IDK; AAR disable terminals shall not be strapped to enable a Track or strapped to disable a Track.
C702	No active or functioning TRM unit.	Check TRM module(s).
C710	CPU module memory malfunction.	Check CPU module.
C711	CPU module non-volatile memory malfunction.	Check CPU module.
C712	RYD module non-volatile memory malfunction.	Check RYD module.
C713	RMM non-volatile memory malfunction.	Check RMM.
C715	Memory malfunction.	RMM, RYD and CPU module. Check RYD module.

CODE	DESCRIPTION	SUGGESTED ACTION
C716	Memory malfunction.	RMM, RYD and CPU modules.
C720	Track 1 TRM ID malfunction.	Check Track 1 TRM.
C721	Track 2 TRM ID malfunction.	Check Track 2 TRM.
C722	AXD ID malfunction.	Check AXD module.
C723	AXD ID malfunction.	Check AXD module.
C731	AX 1, zero offset is set for either Track 1 or Track 2 but not both.	If setting offset to zero, the offset for both Tracks shall be set at zero.
C732	AX 2, zero offset is set for either Track 1 or Track 2 but not both.	If setting offset to zero, the offset for both Tracks shall be set at zero.
C733	AX 3, zero offset is set for either Track 1 or Track 2 but not both.	If setting offset to zero, the offset for both Tracks shall be set at zero.
C734	CPU memory malfunction.	Check CPU module.
C735	CPU memory malfunction.	Check CPU module.
C736	CPU memory malfunction.	Check CPU module.
C740	Track 1, set to AX mode, offset distance equals zero (AX will be the same as MDR).	No action required unless offset distance should not be zero.
C741	Track 1, set to AX mode, offset distance equals zero (AX will be the same as MDR).	No action required unless offset distance should not be zero.
C742	Track 1 RX POT has been set to 49 due to corrupted local parameters. The HXP-3 will ring continuously.	Adjust to RX for Track 1 and check approaches.
C750	Normal system TRM Adjust Enable switch held down too long.	Check Normal System TRM
C751	Standby System TRM Adjust Enable switch held down too long.	Check Standby System TRM
C760	Occurs with track 2 disabled in software version 2.00, but does not ring the box. Corrected in software version 2.10.	No action required.
C761	AC rail to rail noise level is too high.	Check for AC interference.

Table 2 – Condition Codes

15. Non-vital codes

These are identified by the presence of the letter "n" preceding the code number on the IDK. These do not cause any action of the relay drives.

CODE	DESCRIPTION	SUGGESTED ACTION
n800	CPU clock error.	Check CPU module.
n801	RMM clock error.	Check RMM.

CODE	DESCRIPTION	SUGGESTED ACTION
n802	CPU clock has been updated by RMM clock.	Can occur with new module installation. If condition persists, check RMM and CPU module.
n810	RMM RAM data test malfunction.	Check RMM.
n820	SIM processor was reset.	No action required.
n821	HCA-3 installed with Port 3 configured.	Free port 3 for HCA-3.

Table 3 – NON Vital Codes

END

Includes:	WRSL Level Crossing Predictor (GCP3000)
Excludes:	All other types of Level Crossing Predictor

Remote Interrogation

The SEARII Event Recorder has the capability to be remotely interrogated, such that system operation and fault data can be downloaded from the recorder and interpreted by a competent person.

A detailed description of how to carry out this process can be found in the manufacturer's proprietary manual.

SERVICE A

No equipment possession arrangements are required to perform Service A, as all the tasks performed during this service are non-intrusive.

1. Cleaning

1.1 Clean the outside of the cabinet using a dry lint free cloth.

1.2 Check that the system ventilation holes are uncovered and unclogged. Clean if necessary, using a dry lint free cloth.

1.3 Check for foreign material inside the GCP3000 cabinet. Rectify if safe to do so or report.

2. Visual Checks

2.1 Check that the GCP3000 is securely mounted and the equipment covers are correctly installed.

2.2 Check that all modules are fully seated within the cabinet.

2.3 Visually check for damage to modules and external cables. Report any damage as a corrective maintenance requirement.

2.4 Check that the real time clock on the SEAR II Event Logger unit by examining the associated display. If this is not the case, contact your SM(S) for further instructions.

2.5 Check that all teeth are present on each Surge Arrestor. If any teeth are missing, report as a corrective maintenance requirement.

3. System Parameter Checks

Each of these tests is carried out via the Level Crossing Predictor Keypad (LCPK) located on the front of the GCP3000 and should be recorded on the record card.

During all of the following tests, the values shown will alternate between TRACK 1 and TRACK 2 when the button is pressed. The relevant Track will be indicated on the Level Crossing Predictor Display (LCPD).

3.1 Press the SYSTEM STATUS key.

3.2 Check and record the EZ value.

3.3 Check and record the EX value. Values of less than 45 should be reported immediately as a corrective maintenance issue.

3.4 Press the DOWN ARROW key.

3.5 Check and record the value of EX when EZ was highest.

3.6 Press the DOWN ARROW key.

3.7 Check and record the value of EZ when EX was lowest. The lowest EX value is indicated in the display as “LX”.

3.8 Press the DOWN ARROW key.

3.9 Check and record the value of the Transmit Current (this value is updated every ½ second).

3.10 Press the DOWN ARROW key.

3.11 Check and record the value of the Transmit Voltage (this value is updated every ½ second).

3.12 Press the DOWN ARROW key.

3.13 Check and record the value of the +/- 5 Volt Power Supply (this value is updated every ½ second).

3.14 Press the DOWN ARROW key

3.15 Check and record the value of the +/- 8 Volt Power Supply (this value is updated every ½ second).

3.16 Press the DOWN ARROW key.

3.17 Check and record the value of the +/- 15 Volt Power Supply (this value is updated every ½ second).

3.18 Press the ERROR key. If errors have occurred, note the error numbers.

A full list of all errors is shown in Appendix A. Any error that occurs more than three times shall be investigated. Note especially 'Frequency', 'Low EX', 'High EZ', 'EX Processing' and 'Self-Check' errors which occur frequently as these might be indicative of poor shunting.

3.19 Press the DOWN ARROW key until all errors have been displayed and note each error.

3.20 Clear the Error Memory by undertaking the following:

a) Press the SYSTEM RESET key. 'SYSTEM RESET' is displayed in the LCPD.

b) Press and hold the SYSTEM RESET key for approximately 3 seconds until 'PRESS ENTER TO CLEAR ERRORS' is displayed in the LCPD.

c) Press the ENTER key.

d) If 'ERROR <0>' is displayed, there are no active errors. Proceed to Step 3.21.

e) If one or more errors are still active, these should be corrected before proceeding.

3.21 Press the HISTORY key.

When the HISTORY key is pressed, 'HISTORY T1

<01> WARNING TIME: **' is displayed in the LCPD. The value shown in the angled brackets indicates the train number. On a single track LCP, the previous 20 train moves are recorded.

On a 2 track LCP, the previous 10 train moves are recorded. Note: '**' represents an unknown value.

3.22 Note the WARNING TIME.

Any warning times shorter than the minimum warning time for the crossing under test should be immediately reported as a corrective maintenance issue.

3.23 Press the NEXT key and note the DETECTED SPEED.

3.24 Press the NEXT key. Note the AVERAGE SPEED.

3.25 Press the NEXT key and note the DETECTED SPEED.

3.26 Press the NEXT key. Note the ISLAND SPEED.

NOTE: *Any very low or excessively high recorded speeds found in 3.22 to 3.26 shall be investigated as this might be indicative of poor shunting or faulty rail connections or shunts.*

3.27 If necessary, press the TRACK 2 key and repeat steps 3.1 to 3.26 for TRACK 2.

3.28 Observe the status lights on each module and confirm that each module is working correctly by reference to the table in Appendix B.

SERVICE B

4. Tests

4.1 NR/SMS/PartB/Test/155 (WRSL Level Crossing Predictor (GCP3000) Tests.

APPENDIX A - Error Codes

This table lists all the error codes displayed by the LCP with possible causes.

Error Code	Text Displayed	Description	Possible Cause
8007	-15 Volt Supply	-15 Volt Power Supply Out of Range	80013 Relay Drive Module
8008	+15 Volt Supply	+15 Volt Power Supply Out of Range	80013 Relay Drive Module
8111	T1 XMIT Voltage	Track 1 Transmitter Voltage Too Low	80012 Transceiver Module or High Voltage on Track
8112	T1 XMIT Voltage	Track 1 Transmitter Voltage Too High	80012 Transceiver Module or High Voltage on Track
8113	T1 XMIT Current	Track 1 Transmit Current Low	80012 Transceiver Module, Transmit Track Wires
8114	T1 XMIT Current	Track 1 Transmit Current High	80012 Transceiver Module, Transmit Track Wires
8115	T2 XMIT Voltage	Track 2 Transmitter Voltage Too Low	80012 Transceiver Module or High Voltage on Track

Error Code	Text Displayed	Description	Possible Cause
8116	T2 XMIT Voltage	Track 2 Transmitter Voltage Too High	80012 Transceiver Module or High Voltage on Track
8117	T2 XMIT Current	Track 2 Transmit Current Low	80012 Transceiver Module, Transmit Track Wires
8118	T2 XMIT Current	Track 2 Transmit Current High	80012 Transceiver Module, Transmit Track Wires
8200	Frequency	Processor Frequency Out of Range	80214 Processor Module
8201	T1 Frequency	Track 1 Frequency Out of Range	80012 Transceiver Module
8202	T2 Frequency	Track 2 Frequency Out of Range	80012 Transceiver Module
8203	T1 XMT Frequency	Track 1 Transmitter Frequency Out of Tolerance	80214 Processor Module
8204	T2 XMT Frequency	Track 2 Transmitter Frequency Out of Tolerance	80214 Processor Module
8300	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (Slot M3)
8301	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (Slot M4)
8411	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (for T1) or 80214 Processor Module
8412	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (for T2) or 80214 Processor Module
8413	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (for T1) or 80214 Processor Module
8414	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (for T2) or 80214 Processor Module
8421	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (for T1) or 80214 Processor Module
8422	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (for T2) or 80214 Processor Module
8431	T1 Self-Check	Track 1 Self-check Not Successful	80013 Relay Drive Module or 80214 Processor Module
8432	T2 Self-Check	Track 2 Self-check Not Successful	80013 Relay Drive Module or 80214 Processor Module
8007	-15 Volt Supply	-15 Volt Power Supply Out of Range	80013 Relay Drive Module
8008	+15 Volt Supply	+15 Volt Power Supply Out of Range	80013 Relay Drive Module
8111	T1 XMIT Voltage	Track 1 Transmitter Voltage Too Low	80012 Transceiver Module or High Voltage on Track
8112	T1 XMIT Voltage	Track 1 Transmitter Voltage Too High	80012 Transceiver Module or High Voltage on Track
8113	T1 XMIT Current	Track 1 Transmit Current Low	80012 Transceiver Module (Slot M3), Transmit Track Wires

Error Code	Text Displayed	Description	Possible Cause
8114	T1 XMIT Current	Track 1 Transmit Current High	80012 Transceiver Module (Slot M3), Transmit Track Wires
8115	T2 XMIT Voltage	Track 2 Transmitter Voltage Too Low	80012 Transceiver Module or High Voltage on Track
8116	T2 XMIT Voltage	Track 2 Transmitter Voltage Too High	80012 Transceiver Module or High Voltage on Track
8117	T2 XMIT Current	Track 2 Transmit Current Low	80012 Transceiver Module (Slot M4), Transmit Track Wires
8118	T2 XMIT Current	Track 2 Transmit Current High	80012 Transceiver Module (Slot M4), Transmit Track Wires
8200	Frequency	Processor Frequency Out of Range	80214 Processor Module
8201	T1 Frequency	Track 1 Frequency Out of Range	80012 Transceiver Module (Slot M3)
8202	T2 Frequency	Track 2 Frequency Out of Range	80012 Transceiver Module (Slot M4)
8203	T1 XMT Frequency	Track 1 Transmitter Frequency Out of Tolerance	80214 Processor Module
8204	T2 XMT Frequency	Track 2 Transmitter Frequency Out of Tolerance	80214 Processor Module
8300	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (Slot M3)
8301	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (Slot M4)
8411	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (for T1) or 80214 Processor Module
8412	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (for T2) or 80214 Processor Module
8413	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (for T1) or 80214 Processor Module
8414	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (for T2) or 80214 Processor Module
8421	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (for T1) or 80214 Processor Module
8422	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (for T2) or 80214 Processor Module
8431	T1 Self-Check	Track 1 Self-check Not Successful	80013 Relay Drive Module or 80214 Processor Module
8432	T2 Self-Check	Track 2 Self-check Not Successful	80013 Relay Drive Module or 80214 Processor Module
8007	-15 Volt Supply	-15 Volt Power Supply Out of Range	80013 Relay Drive Module
8008	+15 Volt Supply	+15 Volt Power Supply Out of Range	80013 Relay Drive Module
8111	T1 XMIT Voltage	Track 1 Transmitter Voltage Too Low	80012 Transceiver Module or High Voltage on Track

Error Code	Text Displayed	Description	Possible Cause
8112	T1 XMIT Voltage	Track 1 Transmitter Voltage Too High	80012 Transceiver Module or High Voltage on Track
8113	T1 XMIT Current	Track 1 Transmit Current Low	80012 Transceiver Module (Slot M3), Transmit Track Wires
8114	T1 XMIT Current	Track 1 Transmit current high	80012 Transceiver Module (Slot M3), Transmit Track Wires
8115	T2 XMIT Voltage	Track 2Transmitter Voltage Too Low	80012 Transceiver Module or High Voltage on Track
8116	T2 XMIT Voltage	Track 2Transmitter Voltage Too High	80012 Transceiver Module or High Voltage on Track
8117	T2 XMIT Current	Track 2 Transmit Current Low	80012 Transceiver Module (Slot M4), Transmit Track Wires
8118	T2 XMIT Current	Track 2 Transmit Current High	80012 Transceiver Module (Slot M4), Transmit Track Wires
8200	Frequency	Processor Frequency Out of Range	80214 Processor Module
8201	T1 Frequency	Track 1 Frequency Out of Range	80012 Transceiver Module (Slot M3)
8202	T2 Frequency	Track 2 Frequency Out of Range	80012 Transceiver Module (Slot M4)
8203	T1 XMT Frequency	Track 1 Transmitter Frequency Out of Tolerance	80214 Processor Module
8204	T2 XMT Frequency	Track 2 Transmitter Frequency Out of Tolerance	80214 Processor Module
8300	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (Slot M3)
8301	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (Slot M4)
8411	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (for T1) or 80214 Processor Module
8412	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (for T2) or 80214 Processor Module
8413	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (for T1) or 80214 Processor Module
8414	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (for T2) or 80214 Processor Module
8421	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (for T1) or 80214 Processor Module
8422	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (for T2) or 80214 Processor Module
8431	T1 Self-Check	Track 1 Self-check Not Successful	80013 Relay Drive Module or 80214 Processor Module
8432	T2 Self-Check	Track 2 Self-check Not Successful	80013 Relay Drive Module or 80214 Processor Module
8007	-15 Volt Supply	-15 Volt Power Supply Out of Range	80013 Relay Drive Module

Error Code	Text Displayed	Description	Possible Cause
8008	+15 Volt Supply	+15 Volt Power Supply Out of Range	80013 Relay Drive Module
8111	T1 XMIT Voltage	Track 1 Transmitter Voltage Too Low	80012 Transceiver Module or High Voltage on Track
8112	T1 XMIT Voltage	Track 1 Transmitter Voltage Too High	80012 Transceiver Module or High Voltage on Track
8113	T1 XMIT Current	Track 1 Transmit Current Low	80012 Transceiver Module (Slot M3), Transmit Track Wires
8114	T1 XMIT Current	Track 1 Transmit Current High	80012 Transceiver Module (Slot M3), Transmit Track Wires
8115	T2 XMIT Voltage	Track 2 Transmitter Voltage Too Low	80012 Transceiver Module or High Voltage on Track
8116	T2 XMIT Voltage	Track 2 Transmitter Voltage Too High	80012 Transceiver Module or High Voltage on Track
8117	T2 XMIT Current	Track 2 Transmit Current Low	80012 Transceiver Module (Slot M4), Transmit Track Wires
8118	T2 XMIT Current	Track 2 Transmit Current High	80012 Transceiver Module (Slot M4), Transmit Track Wires
8200	Frequency	Processor Frequency Out of Range	80214 Processor Module
8201	T1 Frequency	Track 1 Frequency Out of Range	80012 Transceiver Module (Slot M3)
8202	T2 Frequency	Track 2 Frequency Out of Range	80012 Transceiver Module (Slot M4)
8203	T1 XMT Frequency	Track 1 Transmitter Frequency Out of Tolerance	80214 Processor Module
8204	T2 XMT Frequency	Track 2 Transmitter Frequency Out of Tolerance	80214 Processor Module

APPENDIX B - Status Lights

This table shows the meaning of the status lights on the front of each module. The top row of LEDs on all cards should be illuminated and steady at all times.

Module	Ind.	Meaning
80012 Transceiver	STA	Light steady = module operational. Flashing = problem on module or track.
	PRD	Motion Indicator. Normally lit – extinguished when inbound motion is detected (meaningless when train on the Island Track).
80013 Relay Drive	STA	Light steady = module operational. Flashing = problem on module.
80016 DAX	STATUS	Light steady = module operational. Flashing = problem on module or track.

Module	Ind.	Meaning
80020 Control Interface	n/a	Status LED above keyboard: Light steady = interface operational Flashing = problem on keyboard interface PCB
80115 Data Recorder	STATUS	Light steady = module operational. Flashing = problem on module or track.
	LO BATT	Light steady = on-board lithium battery voltage is normal. Flashing = battery is low.
80211 Intelligent Processor Island	STATUS	Light steady = module operational. Flashing = problem on module.
	ACT	Activity indicator. Flashes when processor is operational, and programming is running. If the indicator is either lit steadily or is extinguished, the processor has failed.
	DISPLAY	Four-character alphanumeric display. See Intelligent Processor Island Display Messages in Appendix C for further details.
80214 Processor 80214 Processor	STA	Light steady = module operational. Flashing = problem on module.
	ACT	Activity indicator. Flashes when processor is operational, and programming is running. If the indicator is either lit steadily or is extinguished, the processor has failed.
	NETWORK ACTIVITY	Lit during Echelon LAN communication.
	SERVICE	Flashes when the SERVICE REQUEST push button on the module is pressed and when the network is accessed.
80265 SEAR Interface	STATUS	Light steady = module operational. Flashing = problem on module.
	NETWORK ACTIVITY	Lit during Echelon LAN communication.
	SERVICE	Flashes when the SERVICE REQUEST push button on the module is pressed and when the network is accessed.

APPENDIX C - Intelligent Processor Island Display Messages

Message Displayed	Time Message Displayed	Comments
BOOT	9 seconds	System Start: • After power up After calibration • After errors corrected
Software version display	5 seconds	Appears when the BOOT process is complete.
REL (release)	2 seconds	After the push button is held for 2 seconds. Release and press button to initiate automatic calibration.
ARMD (armed)	2 seconds	Ready to calibrate. Follows REL on the display. Press button immediately to commence automatic calibration.

Message Displayed	Time Message Displayed	Comments
CAL*	4 seconds	Appears when automated calibration is in progress. NOTE: (*) in the CAL* message is a rotating bar indicating that calibration is in progress.
DONE	Momentary	Appears momentarily at the end of the calibration process before the BOOT process.
Operating frequency e.g. 10.0 Pickup Delay Time Setting e.g. PU+4 (pickup delay 4 secs)	Operating frequency alternates with Pickup Delay Time. Frequency displayed for 8 seconds, then Pickup Delay Time for 2 seconds.	Displayed during normal operation.
FAIL	Remains until calibration select push button is pressed and calibration tried again.	Appears when the automated calibration process does not run to completion. Repeat calibration or replace the card.
CALR	Flashes intermittently	Appears if the frequency selection is changed but the IPI has not been recalibrated for the new frequency.
FRQ?	Flashes intermittently	Indicates that the frequency selection jumper has been removed or that there is more than one frequency selected on the 19-position header.
SIG (signature)	Momentary	On-frequency interference. Check for interference from other track circuits etc.
LOS	Approximately 10 seconds	Appears whenever the IPI detects a loss of train shunting in the island area.

APPENDIX D - Intelligent Processor Island Internal Failure Error Codes

Error Code	Error Description	Action Indicated
BATT	Battery voltage out of range.	Check battery condition.
CALC	Calibration parameters are corrupted.	Try recalibration. Replace the IPI module if the problem persists.
CRIT	Critical check failure.	Replace the IPI module if the problem persists.
GB	Guard Band failure.	Replace the IPI module if the problem persists.
HWSW	Hardware/software incompatibility.	Replace the IPI module if the problem persists.
IRO	Island Relay Output failure.	Replace the IPI module if the problem persists.
ISRX	Interrupt Service Routine failure.	Replace the IPI module if the problem persists.
PHLT	Programmed Halt.	Replace the IPI module if the problem persists.
PIRO	Primary Island Relay Output waveform failure.	Replace the IPI module if the problem persists.
PS_I	Intermediate power supply output incorrect.	Replace the IPI module if the problem persists.
PS5A	5-Volt analogue supply output incorrect.	Replace the IPI module if the problem persists.
PS5D	5-Volt digital supply output incorrect.	Replace the IPI module if the problem persists.
PS25	Internal reference supply voltage incorrect.	Replace the IPI module if the problem persists.
RAM	RAM failure.	Replace the IPI module if the problem persists.
ROM	ROM failure.	Replace the IPI module if the problem persists.
SIRO	Secondary Island Relay Output waveform failure.	Replace the IPI module if the problem persists.

APPENDIX E - Typical Problems

NOTE: *Over 75% of problems that are likely to be encountered are related to the track infrastructure or rail connections. Always expect a problem with the track before assuming that there is a problem with the LCP.*

Cannot Calibrate

The most likely cause is incorrect track lead connection. Check for the following:

- XMT1 and RCV1 must be connected to the same rail.
- The transmit leads should be the shortest run from the equipment housing.
- All required links (specially to check terminals) are correctly fitted.
- All track connections are secure.

Poor Linearisation

An installation that requires high a linearisation value may be caused by the following:

- A tuneable by-pass coupler too close to the crossing.
- An adjacent Frequency shunt too close to the crossing.
- Another track circuit connection loading an approach.

Low EX (9011 and 9013 Errors)

The LCP cannot operate with EX < 39 except when specifically set up with Low EX Adjustment. If Low EX is experienced, this might be caused by:

- Faulty bonds.
- Defective insulated joint couplers.
- Faulty or missing battery chokes in other track circuits on the approach.
- Defective point rodding insulation or sleeper pad insulation.
- An open circuit termination shunt.
- An adjacent Frequency narrow band shunt too close to the crossing.

High EZ (9015 and 9016 Errors)

The LCP initiates the crossing warning sequence if EZ exceeds 115. The most likely causes for this are as follows:

Open circuit termination shunts #1

Test by shunting with a hardwire shunt:

- EZ should not change by more than 2 for a wide band shunt.
- EZ should not change by more than 35 for a narrow band shunt.

#1 If the crossing is fitted with treadles to provide protection against railhead contamination, 9015/9016 errors can be consistent with operation of the treadle.

Repeated failures of this nature should still be investigated, however, as it is indicative of problems in the track infrastructure probably caused by rust or leaves.

Defective insulated joint couplers

Test by shunting each side of the joint(s) with a hardwire shunt:

- EZ should not vary by more than 2 for a wide band shunt
- EZ should not vary by more than 3 for a tuneable joint coupler.

Open or high resistance rail bonds

Test by shunting at the 50% point with a hard wired shunt:

- If EX increases, the bond is between the strike-in point and the shunt.
- If EX decreases, the bond is between the shunt and the level crossing.
- Repeat the test at intermediate locations until the faulty bond has been located.

END

Includes:	Signalling Network Layer 2 and Layer 3 switches
Excludes:	All other types of Network Switch

GENERAL

Visible light is used for transmitting data through the fibre optic system. A small beam is emitted; however, the intensity can cause permanent eye damage.

Do not look into the open connectors of a fibre optic termination or use magnifying equipment to observe the light.

Test before touch! Prior to touching any network equipment, use a Volt Pen or Volt Meter to test that there is no Voltage Potential to the Cubicle itself or the housing of the network switch.

Signalling Network switches carry vital signalling data critical to the effective operation of the railway.

Disconnection or failure of any of these devices could impact the availability of live signalling equipment.

Liaison with the signaller is required to minimise risk to railway operation by carrying out tasks during periods of low train movements.

Anti-static precautions should be taken when handling network switches.

SERVICE A

1. General Maintenance

1.1 Check that the cubicle housing the equipment is accessible and that the doors are not obstructed.

1.2 Check that there is Earth continuity between the switch and the cubicle Earth point.

1.3 Check that all Earth connections are secure.

1.4 Clear away any debris that has built up around the switches within the cubicle.

1.5 Check the exteriors of the network switch for signs of corrosion and damage.

1.6 Check all handles and locks are secure and in good working order.

1.7 Check that all switch identity numbers, warning labels/signs are correctly displayed and legible as indicated in the design records.

1.8 Check cabling and patch cords are correctly routed, and free from insulation damage (e.g., kinking / chafing / wire ties / rodent damage).

1.9 Check that cable entry apertures and rodent protection is intact and cables are secured by their associated clamping supports.

The cable clamping should be fitted to check that short circuits cannot occur if the cable is pulled from outside.

1.10 Check that all cabling plug couplers are free from damage and secure.

1.11 Confirm that the SYS or SYST LED on the front of the switch is illuminated green, which indicates that the switch is operating normally.

An amber or red LED indicates a system fault and shall be reported for investigation.

2. Fan Maintenance (Cisco 3850 and 3750-X Only)

2.1 Perform a visual inspection of the switch to confirm that the fan module LED (indicated by the 1 marker in the figure 1) is an illuminated green LED.

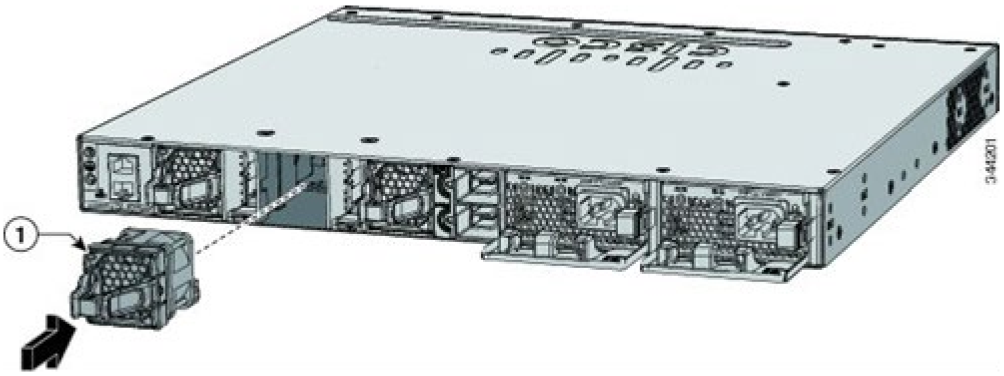


Figure 1 - Fan module

2.2 If a fan fails to show an illuminated green LED, it needs replacing.

This can be done on a live switch by pinching the retaining clips and pulling backwards. The replacement is pushed back into the vacant slot and the retaining clips should click to confirm it is correctly seated. The green LED will now be illuminated.

SERVICE B

3. General Maintenance

3.1 Remove any dust, dirt or infestations.

The accumulation of dust and debris on electronic equipment has the following adverse effects:

a) It increases the working temperature of the equipment, thus reducing the reliability and working life of the equipment in accordance to the Arrhenius effect.

b) The moisture and corrosive elements that are present in the dust can cause premature board failure due to the corrosion of the electronic or mechanical components.

3.2 Check that the relevant drawings are present, correctly stored and legible.

3.3 Check switches for signs of overheating, contamination, damage or failure.

END

When undertaking corrective or preventative maintenance at a level crossing, be aware of the effect of your activities on the operation of the level crossing and what is observed by the public (especially road traffic).

If the work you intend to carry out might result in an incorrect sequence of operation (e.g. one barrier raised, one lowered with red lights operating at an AHBC) then you shall obtain the Signallers permission and their assurance that no trains will approach the level crossing.

When setting up a safe system of work, always take into account the additional risk from road traffic.

Remember NO person is authorised to permit ANY vehicle over a level crossing when the red road lights (wig-wags) are operating.

It is good practice to minimise the amount of times a crossing is seen operating by the public, without the passage of a train.

The last function of maintenance is to test and observe that the equipment operates correctly and correct indications are received at the monitoring/controlling point or DCI.

1. Abbreviations

The following abbreviations are used in respect to level crossings:

Abbreviation	Meaning
AHBC	Automatic Half Barrier Crossing
ABCL	Automatic Barrier Crossing Locally Monitored
AFBCL	Automatic Full Barrier Crossing Locally Monitored
AOCL	Automatic Open Crossing Locally Monitored
AOCL+B	Automatic Open Crossing Locally Monitored plus Barriers
AOCR	Automatic Open Crossing Remotely Monitored
CCTV	Closed Circuit Television
MSL	Miniature Stop Light Crossing
MCB	Manually Controlled Barriers
MCB-OD	Manually Controlled Barriers with Obstacle Detector
MCB-CCTV	Manually Controlled Barriers With CCTV
MB	Manned Barriers
MG	Manned Gates
RB	Remote Barriers
TOB	Traincrew Operated Barriers
SOB	Staff Operated Barriers

Abbreviation	Meaning
OCB	On Call Barriers
UWC	User Worked Crossing
OC	Open Crossing
ATC	Another Train Coming
DCI	Drivers Crossing Indicator (DRL/DWL)
DRL/DWL	Drivers Red Light / Drivers White Light
N	Nearside (left when viewed from the direction of road traffic)
O	Offside (right when viewed from the direction of road traffic)
Y	The side of the Xing next to the up line #
Z	The side of the Xing next to the dn line #

#: On some BR Mk.1 crossings (Penguins) the Y&Z meanings are the other way around, check the diagrams

2. General

More information on level crossing equipment can be found in NR/SMS/Appendix/03.

The crossing section order will give details of the arrangements required at each individual location.

Manually or remotely (CCTV) controlled crossings are interlocked with protecting signals that can only be cleared when the crossing is proved down.

Gated crossings can be mechanically interlocked with protecting signals.

Automatic half barrier crossings are not protected by signals but may have signal controls. There are locations when a signal on the approach to an automatic crossing will be showing a proceed aspect with the barriers still raised. Check with the diagrams.

Automatic barrier or open crossings that are locally monitored do not have indications going to a monitoring signal box. A DWL gives indication to the driver that the crossing is operating and that they may proceed if the crossing is clear.

Crossing on footpaths or occupation roads are usually gated or open and have protection dependant on the usage and the sighting of trains (signs, telephones, MSL).

If there is any doubt over the type and/or operation of any level crossing, ask your SM(S).

3. Permission to Work at Automatic Level Crossings

Before you take an automatic level crossing that is monitored from a signal box on local control you shall reach an understanding with the Signaller at the monitoring signal box of what you are doing and have their permission.

At an automatic level crossing that is locally monitored you shall check that there are no trains approaching before you take local control. If telephones are provided at this type of crossing inform the Signaller what you are doing.

4. Permission to Work at CCTV Monitored Manned Barrier Level Crossing

Before you take a CCTV monitored manned barrier level crossing on local control, or do any work on the cameras that will disrupt the Signallers' view of the crossing, you shall reach an understanding with the Signaller at the monitoring signal box of what you are doing and obtain their permission.

5. Permission to Work at Manned Barrier Level Crossing with Obstacle Detector

Before you take an MCB-OD level crossing on local control, local crossing clear mode or undertake intrusive work on the RADAR or LIDAR systems, you shall reach an understanding with the Signaller at the monitoring signal box of what you are doing and have their permission.

6. Local Control Units

Local Control Units (LCU) are fitted at all modern manual and automatic crossings, although some older MCBs do not have them.

On newer installations that have door proving, a working/failed indication to the monitoring signal box will be given when the LCU door is unlocked.

On older installations that do not have door proving, it is when the 'raise' switch/button is operated. Check the diagrams if you are unsure before unlocking any LCU door.

On newer LCU installations there is a guide on the back of the door that states the door can only be closed when the switch is in the auto position. If this is missing report this as corrective maintenance.

On CCTV monitored manned barrier crossings check the manual/auto lower and/or raise switch on the Signallers control panel (if fitted) are in the manual position before local control is taken.

On automatic controlled level crossings, it is good practice when giving local control back to lower the barriers first then turn the switch to the auto position or press the auto button.

The barriers should then rise (providing all the controlling circuits have reset and there is no approaching train). If the LCU has door proving, 'barriers raised' indication is restored to the monitoring signal box when the door is closed and locked.

On older installations without door proving 'barriers raised' indication is restored when the auto button/switch is operated.

On BR Mk.1 AHBC LCUs, do not use the control arm to operate the auto button, as this will sometimes not fully engage the contacts. Always press the auto button first then operate the control arm.

On manned barriers (if fitted) and CCTV monitored manned barriers that have an LCU with door proving, lower the barriers then switch to the auto position and lock the control unit door. The Signaller will then raise the barriers from the signal box.

On LCUs without door proving, with the barriers raised operate the switch/button to the auto position. The light by the raise switch/button should then be extinguished and the Signaller will have their indications back.

7. BR Specification 843 Barrier Units

These types of units have a proving micro switch on the operators' door (rear of unit); if this door is unlocked indications to the monitoring signal box will be broken. There is no proving switch on the front door of these units. If these units are used on Rural Barriers there is no door proving switch provided on the back door.

On automatic barrier crossings locally monitored (ABCL), automatic open crossing locally monitored plus barriers (AOCL+B), automatic full barrier crossings locally monitored (AFBCL) and some manually controlled barriers (check the design details) the barriers packs fitted are coloured blue. These units are designed so that you have to energize the valve in order to lower the barrier.

Under no circumstances shall a blue coloured pack be fitted to any form of automatic half barrier crossing (AHBC).

8. Automatic Sequence Testing

On early types of BR Mk1&2 automatic level crossings the automatic sequence is controlled by the ATC and strike in treadles, the track circuit controls provide confirmation only.

Some of these designs require both of the treadles at the ATC and strike in to be proved reverse in order for the sequence to operate correctly. If you are unsure of the crossing mode of automatic operation check the diagrams before you attempt an automatic sequence test.

On crossings usually fitted with BR 843 spec barriers units, the automatic sequence is controlled by the track circuits. The strike in treadles provide a cut out for the track circuit feed only. Again, check the diagrams to establish the crossing mode of automatic operation.

Any automatic level crossing with bi-direction controls requires the exit track circuit to be shunted along with the operation of the exit treadle to correctly run the automatic sequence.

On most newer installations of automatic level crossings there is also directional proving in the controls. These designs can usually be identified by the exit treadles being mounted approximately 20 metres from the IRJ of the last controlling track circuit, if unsure check the diagrams.

With this circuitry on a sequence test the opposing exit treadle should be operated in the correct sequence whilst shunting the track circuits to ensure correct automatic operation of the crossing.

If the crossing has other features that will affect the automatic operation (e.g. signal controls, stopping/non stopping selection) check the diagram for how to simulate automatic operation for the maintenance test without these functions (e.g. shunting the controlling track circuit after the signal only, so the crossing operates immediately).

On early designs of crossing (which work from treadle operation) this may not be possible. In these cases, inform your SM(S) of the circumstances.

9. Level Crossing Annual Testing

It is advisable that the annual full test is conducted under a possession of the level crossing and a road closure.

10. Circuit Controller Band Settings

Band	Made Between
DN KR	0° and 4°
HJPR / RER	42° and 90° (#)
MR	0° and 83°
UP KR	81° and 90°

#: The HJPR band on some installations may be set to make sooner than 42°. Check the diagrams for the correct setting for the installation you are at.

The overlap between the UP KR band making and the MR band breaking is provided so that if the barrier moves from the vertical position, it can drive up again without the road lights operating.

On barrier units that use limit switches in place of circuit controllers, refer to the diagrams for the positions of the cams.

It is good practice after altering settings to verify them on manual operation before using power.

11. Typical Road Signs at Level Crossings

The diagrams shown in figures 1 - 6 are a general guide only to the more common level crossing layouts.

They are all shown with additional risk signs that may not be present at all installations.

Always refer to the section order and ground plan for the correct configuration and layout at each individual location.

12. Manually Controlled Barriers

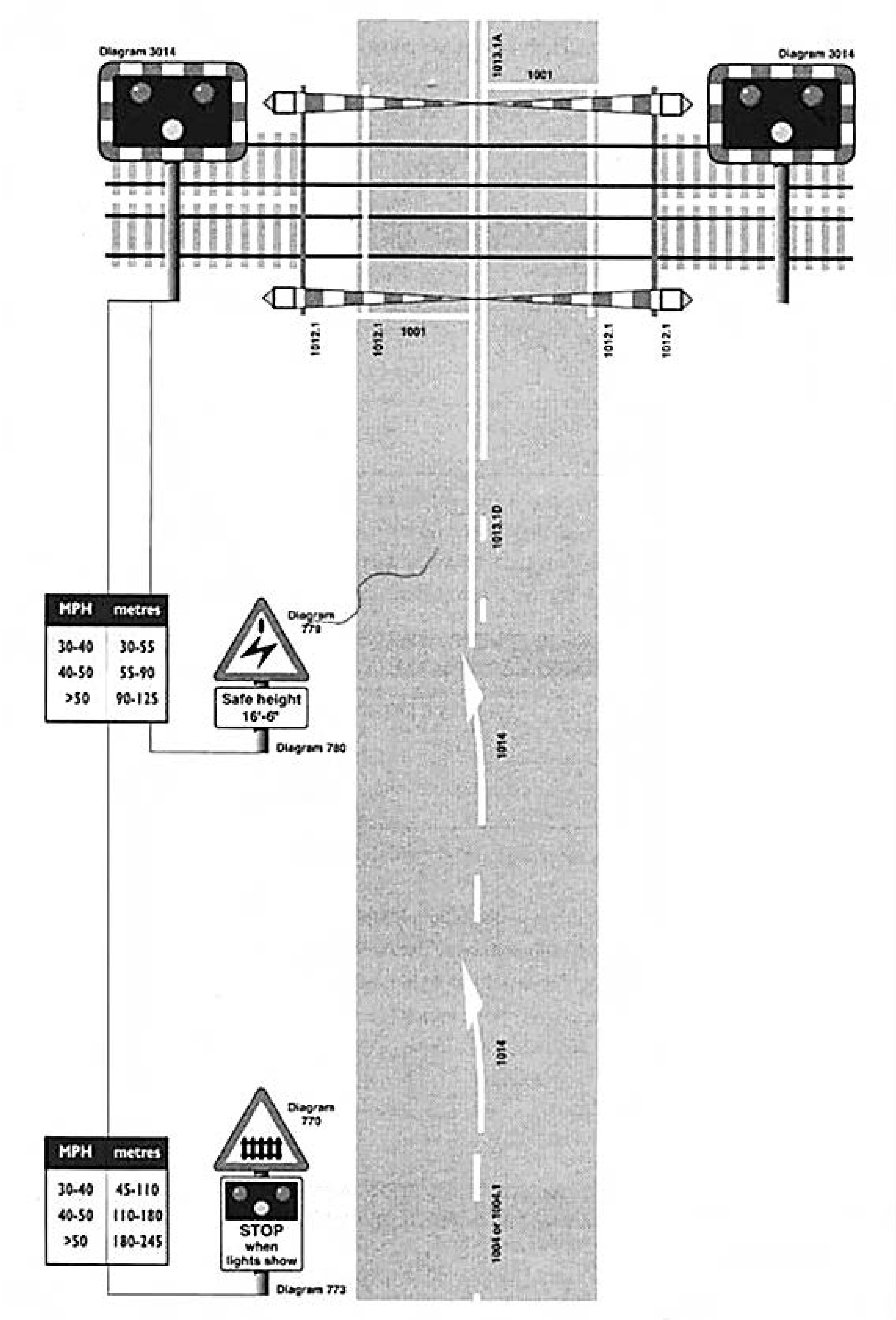


Figure 1 - Manually Controlled Barriers

13. Automatic Half Barrier Crossing and Automatic Half Barrier Crossing Locally Monitored

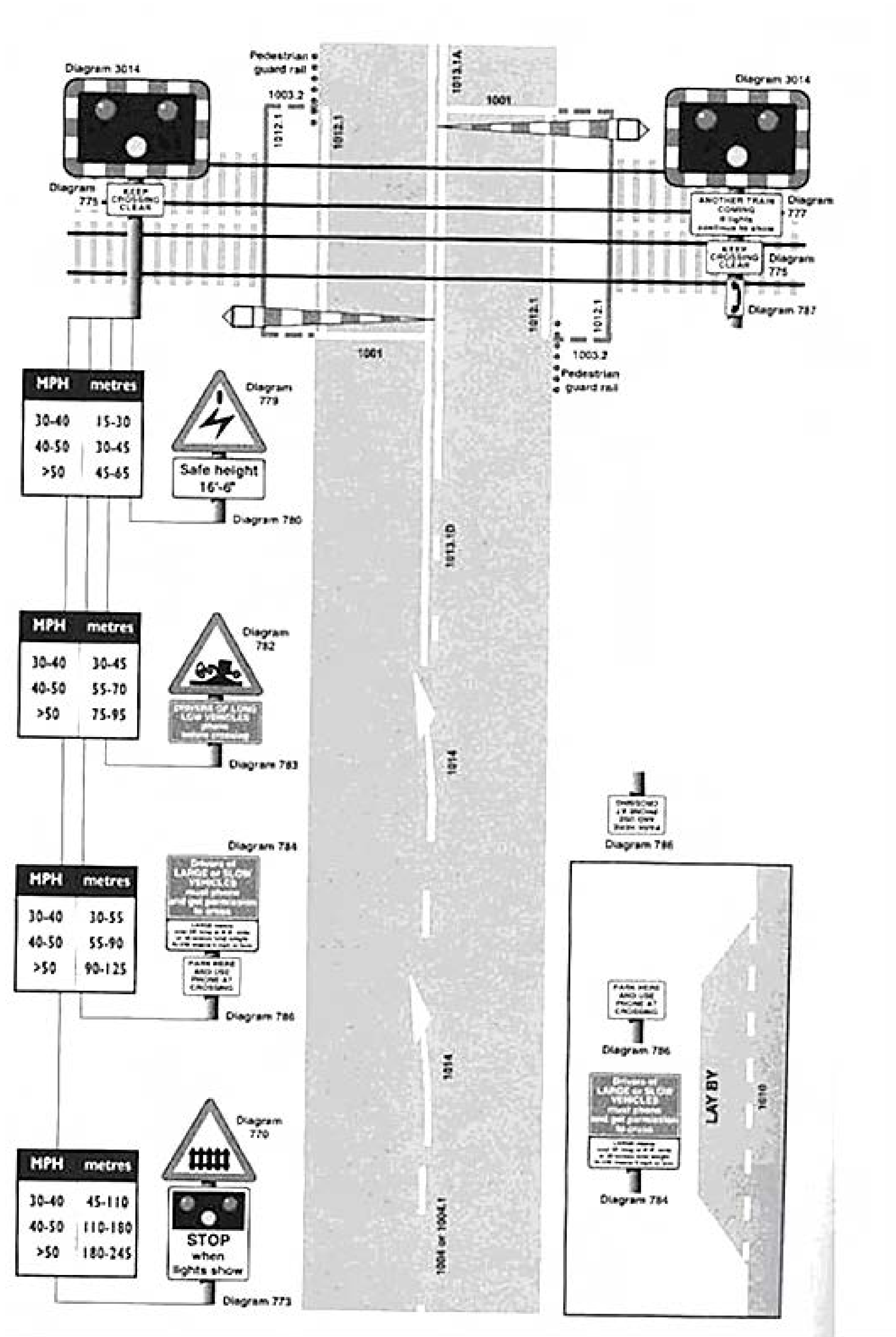


Figure 2 - Automatic Half Barrier Crossing and Automatic Half Barrier Crossing Locally Monitored

At older installations the signs may vary. Check the section order and plans or if in doubt ask your SM(S).

14. Automatic Open Crossing

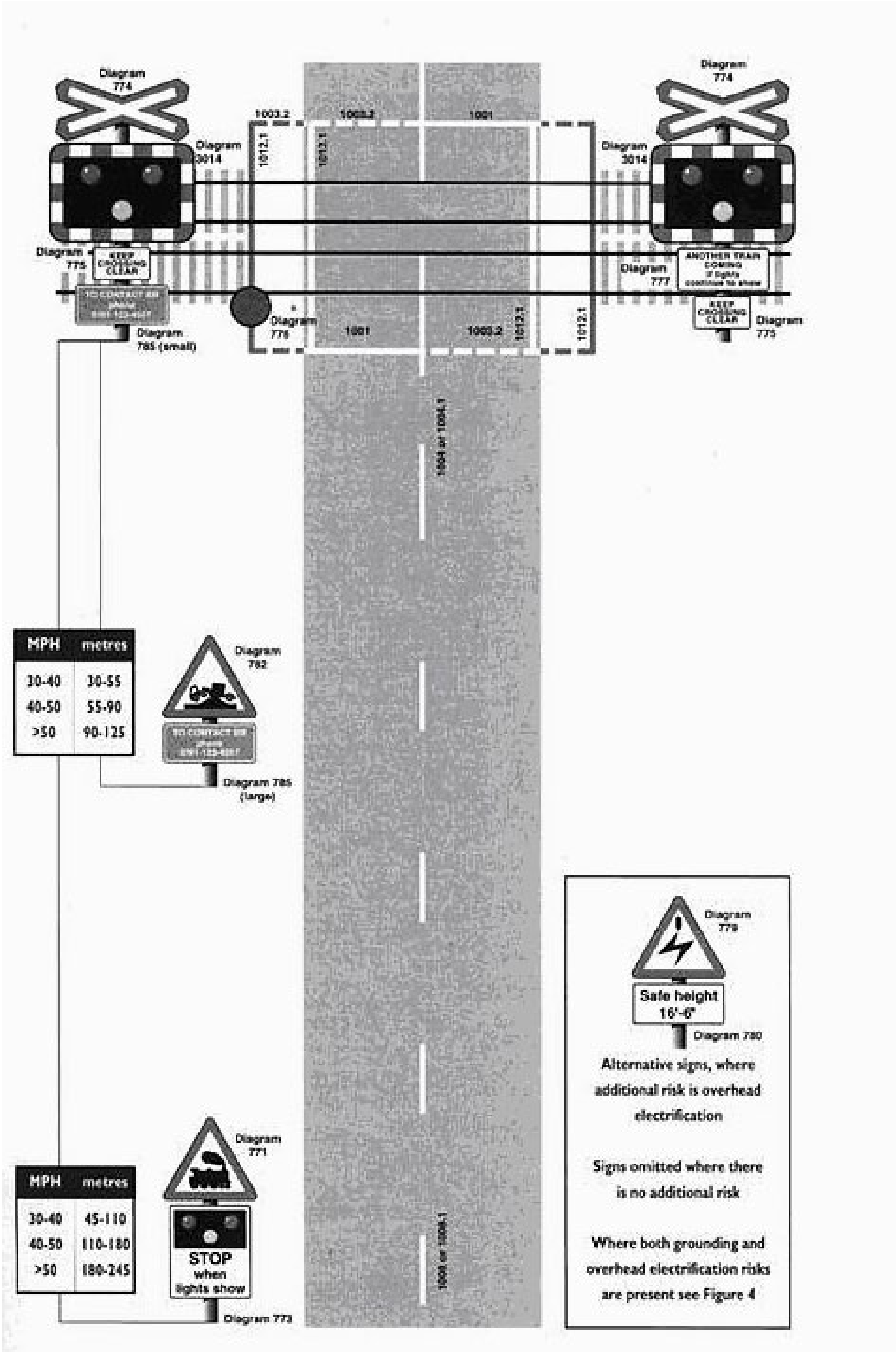


Figure 3 - Automatic Open Crossing

15. Open Crossing

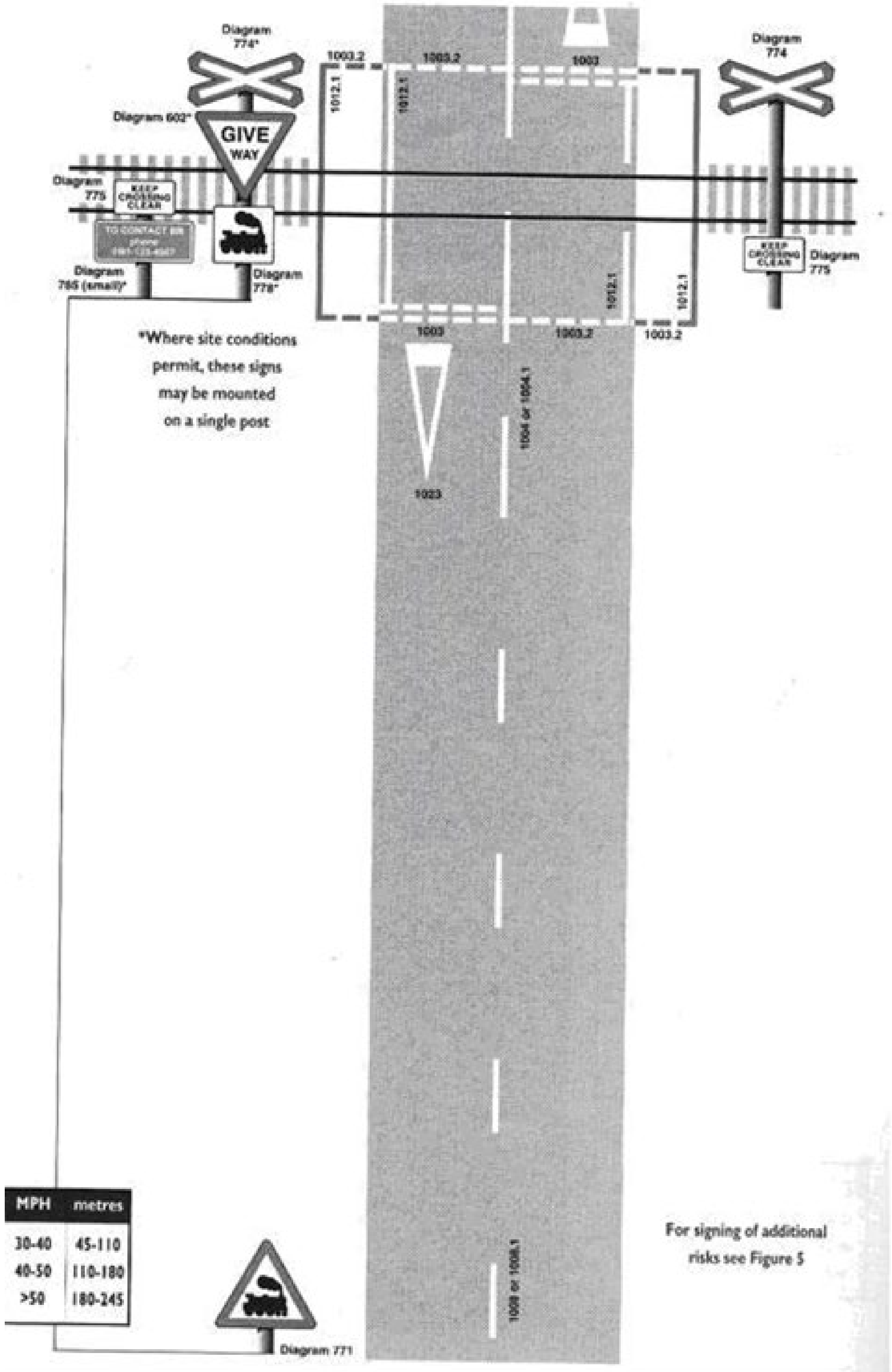


Figure 4 - Open Crossing

16. Miniature Stop Light Crossing with Gates

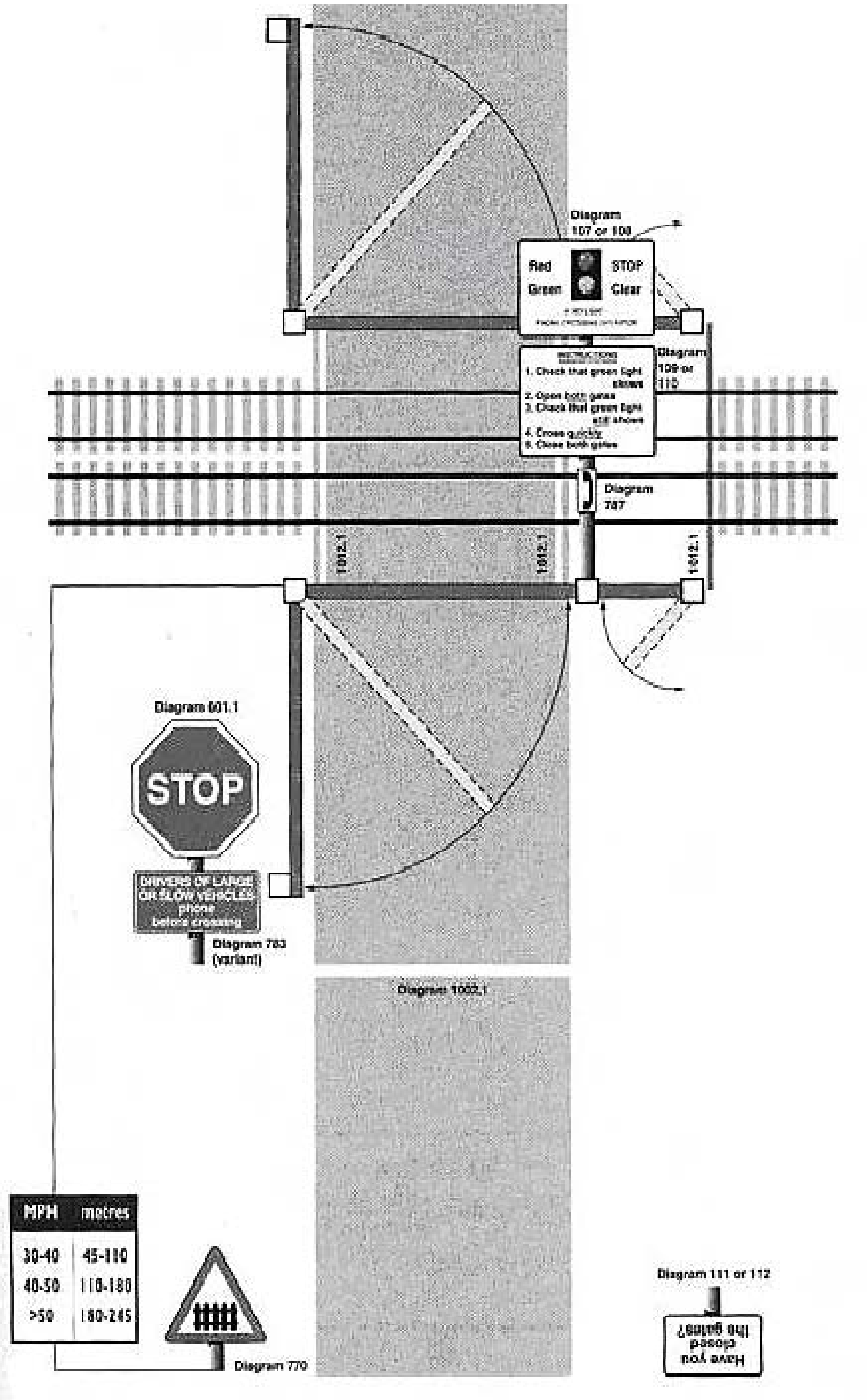


Figure 5 - Miniature Stop Light Crossing with Gates

17. Special Signs for use with MSL Crossings

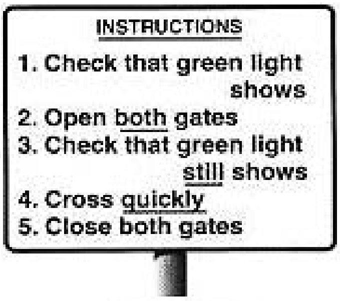


Diagram 109

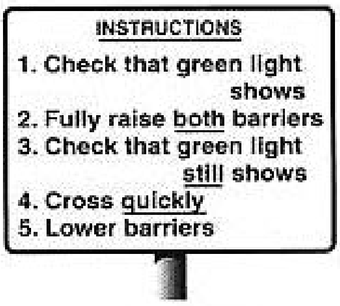


Diagram 110

Diagram 111

Diagram 112

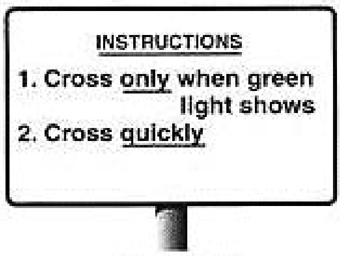


Diagram 114

Figure 6 - Special Signs for use with MSL Crossings

END

Includes:	Level crossings with obstacle detection equipment
Excludes:	All other level crossings

The beam height of LIDARs and RADARs is referenced to the level crossing deck surface.

The number of LIDAR and RADAR provided at a level crossing using obstacle detection will depend on the type of level crossing and the type of obstacle detection equipment.

If the deck height has been changed by works such as tamping or installation of new sleepers, then the impact on the RADAR and LIDAR beam levels needs to be assessed and if necessary, the beam heights of the affected scanners shall be checked, and if beam heights are not within tolerance the beam height shall be setup again.

Some track or surface work will not affect the beam height setting points and so beam heights do not need to be measured after the track works.

Any changes made to the shape of the crossing deck can affect the surveillance Area or Detection Areas of the crossing, e.g. changes to fences or deck panel longitudinal positions.

If a change in shape to the crossing deck has occurred, RADAR and LIDAR surveillance area or detection areas, including the non-detection zones, shall be checked after the track works have been completed. This can be done by a walk test of the Surveillance/Detection Areas using RWMON software and Redscan Manager software.

Details are in the Installation and Set Up Manual.

If the beam height needs to be set up, or if the Surveillance/Detection Areas need to be amended, this shall only be carried by someone competent in the setup of LIDAR or RADAR.

If this cannot be achieved before the crossing is to be handed back to train running, the crossing shall not be operated using the OD equipment.

Where facilities are provided for on-site confirmation of crossing clear e.g. a Crossing Clear Unit (CCU) at an MCB-OD, the crossing can be operated using this. If the crossing has no such facilities, it shall be operated by the LCU.

The tasks in this SMS concern the equipment unique to level crossings provided with obstacle detection equipment.

REGULAR TASK

1. Obstruction clearance

Keeping the crossing clear removes the chance of the crossing detecting vegetation as an obstruction.

1.1 Clear any build-up of dust or soil from the top of the anti-trespass guards.

Either task 2 or 3 shall be undertaken depending on the season in which it is performed.

2. Vegetation growing season

2.1 Check the vegetation growth within the crossing Surveillance Area or Detection Areas.

a) Remove all growth.

b) Keep sight lines to each RADAR Reference Reflector clear of vegetation and other obstructions.

Vegetation should not be allowed to grow above 150mm high within the Detection Area, as this can cause reliability issues with the Low-Level LIDAR scanners.

3. Winter season

3.1 Check for laying snow within the crossing Surveillance Area or Detection Areas.

a) Remove all snow.

b) Keep sight lines to each RADAR Reference Reflector clear of snow and other obstructions.

In winter, snow that has fallen on to the crossing surface can be detected by the Low-Level LIDARs if it builds up to approximately 150mm high or greater.

Winter preparedness plans shall include the pro-active monitoring of snow fall and pro-active clearance of snow from the whole crossing surface before it becomes detected.

The snow piles formed as vehicles traverse the crossing can be detected even though snow fall has been light.

Snow cleared from the crossing shall not be placed in a position where it might obstruct the line of sight of a Reference Reflector or a LIDAR scanner.

The intention of snow clearance is to keep the Detection Area for LIDAR and Surveillance Area for RADAR clear, including the line of sight to each Reference Reflector.

SERVICE B

4. Crossing Inspection

4.1 Check the following:

a) The barrier boom integrity is not strapped out.

b) The barrier down detection is operating correctly.

The barrier down detection is only given when boom is below the minimum angle.

c) The gap between the barrier tips when down is not larger than 65mm.

d) The anti-trespass guards are fitted and complete.

e) The warning labels on barrier machines are present and legible.

These labels are fitted when counterbalance fencing is omitted due to it obscuring the line of sight of the OD system (not to all barrier machines).

These labels warn members of the public to stay away from the machine due to moving parts as there may be no fence provided around counterbalance weights or step protection.

f) Vegetation is clear around each OD scanner and within the crossing area bounded by the barriers and line of sight to each Reference Reflector.

Any actions required shall be undertaken as corrective maintenance.

END

Includes:	AHBC, ABCL, AFBCL, AOCL, AOCL+B, AOCR, MCB, MCB-RB, MCB-OD MSL, MCG, CCTV-MB, MCB-CCTV TMOB, SOB, EBI Gate 200, POGO and Vamos
Excludes:	All other types of level crossing's

Signalling Technical Support staff and/or equipment specialists could perform the level crossing annual test (Service B) separately from maintenance, your SM(S) will advise you.

Access to some or all of the following documents will be required for the annual test:

a) The crossing ground plan.

b) The level crossing order.

c) The crossing control tables.

d) The signalling plan.

If any are not available, inform the SM(S).

If you are in any doubt about any aspect of a level crossing operational sequence, ask your SM(S).

More information on level crossings can be found in NR/L2/SIG/19608 & NR/SMS/Appendix/03 (General Information on Level Crossing Equipment).

SERVICE A

1. Operational Sequences

1.1 If practicable, Observe the operational sequence of the level crossing with the passage of a train.

Check that all the timings are correct for the crossing type and the operation is as described in NR/SMS/PartB/Tests 070 – 084, 159 and 160 (Level Crossing Sequence tests)

If 1.1 is not practicable, perform one normal direction sequence test for as appropriate to the crossing type in NR/SMS/PartB/Tests 070 – 084, 159 and 160 (Level Crossing Sequence tests)

If provided, perform a local control sequence function as appropriate to the crossing type in NR/SMS/PartB/Tests 070 – 084, 159 and 160 (Level Crossing Sequence tests)

This task may be carried out in conjunction with the appropriate tasks/tests of the barrier machine.

2. Adjustment

2.1 Check that on completion of testing and maintenance that all controls are normalised and the correct signal box and/or driver indications are showing.

Check that all hand gates are correctly closed. If possible, on automatic crossings, Observe the passage of a train on an automatic sequence.

Report to your SM(S) any crossing with hand gates that are found open on arrival.

SERVICE B

3. Level Crossing Annual Tests

3.1 Perform the annual test of the level crossing.

3.2 Level crossing annual tests are detailed in NR/SMS/PartD/Index (Level Crossing Annual Tests).

END

Includes:	Flashing Road Light Assemblies (Wig-Wags), Yodalarms, Bells, Pedestrian Lights.
Excludes:	Reflective or externally lit signs Crossing headlight units at AOCL/AOCL+B/ABCL/AFBCL crossings. Permanently lit night-time floodlights at MCB-CCTV

Road light structures do not have a permanent ladder fitted. When using a separate ladder, always follow the ladder drill, if you are unsure ask your SM(S).

The crossing section order and ground plan gives details of the correct alignment of these items. Appendix B gives details of the generic alignment of road light assemblies.

SERVICE A

1. Structures

1.1 Examine posts, fittings, and fixings. Check they are secure and stable.

2. LED Road Lights Assemblies

2.1 Check each road light assembly. The assembly shall be not damaged, properly secured and hoods securely fitted.

2.2 Check the backboard of each assembly, including the chequered border. If the black colour of the backboard is faded, report it as corrective maintenance (See details in Appendix A).

2.3 Check the alignment of the road light LED modules. (See details in Appendix B).

2.4 Report as corrective maintenance any sunlight issues with the sighting of the road lights. (See details in Appendix C).

This can be a problem with low winter sun if the crossing is on an east-west alignment.

Alignment of LED's is not as critical as with filament types as they have a wider spread of light and a restricted amount of adjustment is available on the mounting.

The backboards shall be angled as shown on the ground plan and then the LED modules shall be aligned as near as practical to Appendix B values as the limited adjustment allows.

2.5 Check and wipe the LED module lenses. Cleaning shall be carried out using an approved cleaner. Lenses shall be clean, and free from cracks.

2.6 Examine weather seals and gaskets.

2.7 Check visible tail cables, conduits, cable entries, and glands.

3. LED and Filament Pedestrian Light Assemblies

3.1 Check each road light assembly. The assembly shall be not damaged and properly secured.

3.2 Check each unit is securely fitted and undamaged. Check they are correctly aligned as per the crossing ground plan.

3.3 Check that the hood is securely fitted, and the LED module lens or lamp unit lens is clean and undamaged. Wipe as necessary.

Cleaning shall be carried out using an approved cleaner. Lenses shall be correctly orientated, clean, and free from cracks.

3.4 Where Provided:

Check that the sunscreen is undamaged and securely fitted.

4. Filament Road Light Assemblies

4.1 Check each road light assembly. The assembly shall be not damaged and properly secured.

Where the road lights are attached to Mk1 concrete pedestals, check the brackets are properly secured. These lights tend to lean forward.

4.2 Check the backboard of each assemble. If the black colour of the backboard is faded, report it as corrective maintenance (See details in Appendix A).

4.3 Check the alignment of the road light lamp units. (See details in Appendix B).

4.4 Report as corrective maintenance any sunlight issues with the sighting of the road lights. (See details in Appendix C).

This can be a problem with low winter sun if the crossing is on an east-west alignment.

4.5 Check chequered borders and clips, where provided.

4.6 Check and wipe red and amber lenses. Cleaning shall be carried out using an approved cleaner. Lenses shall be correctly orientated, clean, and free from cracks.

4.7 Examine weather seals and gaskets.

4.8 Check visible tail cables, conduits, cable entries, and glands.

5. Audible Warnings

5.1 Check that the audible warning devices and associated fixtures are secure, undamaged, and correctly aligned with no obstructions in front of the device that might reduce the sound output.

5.2 Check visible cables and glands are undamaged. Yodalarm units can be prone to failure due to water ingress; all seals/glands shall be effective with the cable entry gland being lowermost. Renew as necessary as corrective maintenance.

5.3 Check that the sound output of the audible warning is adequate for the crossing circumstances and (if applicable) is reduced for the night time. Some crossings have had the sound output of yodalarms reduced because of local conditions, check the diagrams.

6. Mechanical Sangamo/Schlumberger Audible Warning Control Unit (AWCU)

Check the time indication displayed and the day/night settings are correct.

If incorrect by more than 30 minutes (taking into account, the bi-annual GMT/BST time alterations) assume that the internal battery or mechanism is defective, and the unit will require replacement as corrective maintenance.

Some time clocks have a day omit dial, the arrows on this shall all be pointing to the centre of the dial.

7. Electronic Audible Warning Control Unit (AWCU)

7.1 Check that the time displayed is correct. If an incorrect time is displayed the unit shall be regarded as defective and shall be replaced as corrective maintenance. If the display is blank press the ‘set’ button to restore the display.

The GMT/BST time alterations are automatic; however, it might take up to 24hrs for the change to occur on the units, this shall be taken into account.

A blank display can occur after a power failure.

NR/SMS/PartB/Test/069 (SELC Digital Timers Set up Procedure), Details how to setup SELC Timer

8. Final Check

8.1 Observe correct operation of all the road lights and audible warnings.

Some Yodalarms have a reduced sound output because of local conditions, Check the section order. This can be undertaken as part of sequence testing in NR/SMS/PartC/LC10 (Level Crossings Operational Sequences).

SERVICE B

9. All Road and Pedestrian Lights

9.1 Examine cable terminations and wiring.

9.2 Examine water seals and gaskets.

9.3 Filament Light Units Only:

a) Check reflectors and inside faces of lenses. Clean as necessary with a lint free cloth.

b) Check lamp holders and alignment of lamps.

c) Lubricate lens assembly retaining screws and hinges to prevent seizing.

d) Carefully re-assemble each unit and check the light units are correctly aligned along the road. (Appendix B).

10. Final Check

10.1 Observe correct operation of the road lights and audible warnings.

10.2 Check that all lights correctly illuminate and flash. This may be undertaken as part of sequence testing in NR/SMS/PartC/LC10 (Level Crossings Operational Sequences).

APPENDIX A - Road Light Assemble Back Boards

Figure 1 – Failed
Example of filament light unit with badly faded with variable grey shading on the back board, requires repainting/replacing urgently. Report immediately as corrective maintenance

Figure 2 – Failing
Example of filament light unit with fading back board (going grey). Acceptable but should be programmed for repainting/replacing. Report as corrective maintenance

Figure 3 - New
Example of a new LED light unit with solid black back board and extended visors. No actions required

APPENDIX B - Flashing Road Light Assemblies Alignment

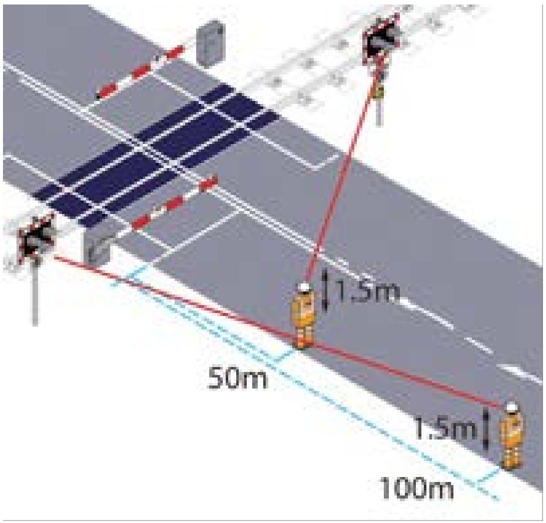


Figure 4 – Road user sighting

The primary Road Traffic Light Signal (wig wag) assembly (near side) should normally be aligned to a point 1.5 metres above the near side edge of the road way or footpath / pavement at 100 metres on the approach side of the stop line.

The duplicate primary Road Traffic Light Signal (wig wag) assembly (off side) should normally be aligned to a point 1.5 metres above the near side edge of the road way or footpath / pavement at 50 metres on the approach side of the stop line or as specified on the Ground Plan or schematic diagram.

If a different alignment is specified on the Ground Plan, then arrange for alignment in accordance with the Ground Plan.

Where alignment to 100m (50m) is not possible (e.g. due to road approach curvature within 50m or the local layout) then the alignment should be to a point 1.5m above ground level on the edge of the footpath at the point where a vehicle driver can first sight the road traffic light (wig wag), to give the motorist the earliest possible view of the flashing lights.

It should be noted that the alignment of the light units on a back-board assembly should all point to the alignment point and that the practice of aligning the red light units, on the same back board, in differing direction (chameleon eye effect) is not allowed.

The reason is that should a red lamp fail then the other might not be seen at the point of alignment. Should a wig wag have its red lights misaligned due to the need for an indication towards another approach this should be reported to the relevant Operational Risk Control Coordinators so that an assessment can be made whether an additional wig wag is required.

APPENDIX C - Sunlight Issues

Technicians and LCIM's shall notify their SM(S) if they become aware of any crossing where sunlight is likely to be an issue.

This 'issue' is deemed to be when visibility of the correct aspect of the RTL's to the road vehicle driver could be affected either by sunlight on the low horizon ahead (Figure 5), or by swamping of the lens from sunlight behind the vehicle (Figure 6).

Figure 5 – Sun flair

Figure 6 - Swamping

If a potential problem is discovered, then your SM(S) should make the necessary arrangements to fit the crossing with extended visors and consider changing the wig-wag units to LED.

END

Includes:	Drivers Plunger Unit, Trainman Operated Barrier Control Pedestal, Local Control Units, Crossing Clear Units, Drivers Release Units, Drivers Pull-Cord Mechanism
Excludes:	All other types of Crossing Plungers, Control Units, and Pull Cords

Contact the Signaller before you open any control unit door that is fitted with a micro-switch.

Before you operate any of the level crossing control buttons make arrangements with the Signaller to protect the line.

SERVICE A

1. Post and Fittings

1.1 Check the following structure items:

a) Posts and foundations.

b) Cable ducts and conduits.

c) Back-boards and lights.

d) Brackets, fittings and fixings.

2. Control Unit

2.1 Check the unit is securely mounted.

2.2 Check the following items:

a) The housing, doors, access plates and seals.

b) Hinges.

c) Latches and locking devices.

Lubricate the hinges, locks, and latches and tighten any loose fixings.

2.3 Check the tail cables. They shall be correctly routed, secure, sealed into the unit, and not damaged.

2.4 Check internal wiring is secure and correctly terminated. Protect terminals as necessary.

2.5 Examine insulation for damage and degradation.

2.6 Open the unit. If the door is fitted with a micro-switch, you shall first contact the Signaller and make arrangements.

2.7 Check and clean the faceplate, engraving and labelling. Check that all the wording is legible.

2.8 Examine plungers, buttons and indications. Check that the correct indications show where they are provided (e.g. train-man operated barriers).

2.9 Examine the door micro-switch, operating mechanism and wiring, where fitted.

2.10 Check the sealed key release is intact and make sure the keys are available (train-man operated barriers).

2.11 Check any door interlock and captive key feature and then close and lock the door.

3. Pull Cord Assembly

3.1 Examine the following on the pull cord assembly:

a) Wire and thimbles.

b) Eyelets.

c) Connection to rotary switch.

Replace the wire if it is damaged or corroded. Examine the following on the rotary switch assembly:

d) Operating arm.

e) Spindle.

f) Switch unit fixings.

g) Connecting lug and pin.

h) Mounting bracket.

i) Cable gland.

3.2 Check that the adjustable stop is tight (two lock nuts).

3.3 Lubricate the micro-switch spindle and lug connection.

SERVICE B

4. Control Unit

4.1 Check Crossing Clear Units (CCU) for correct operation and that the buttons are not stuck in.

4.2 Where a push button type, Local Control Unit (LCU), is provided check the buttons are not stuck in.

END

Includes:	Red/Green Light units at Miniature Stop Light (MSL) & Warning Light (MWL) Units
Excludes:	All Other Crossing Lights

Contact the Signaller before you open any control unit door that is fitted with a micro- switch.

Before you operate any of the level crossing control buttons. Make arrangements with the Signaller to protect the line.

SERVICE A

1. External Inspection

Two Filament Lamp Units:

1.1 Clean and examine light unit lenses. Rectify if missing, damaged or discoloured.

Four Filament Lamp Units:

1.2 Clean and examine front screen and internal glass filter. Rectify if missing, damaged or discoloured.

LED Modules:

1.3 Clean and examine the module fronts. Rectify if damaged do not use abrasive pads or abrasive cleaning agents.

1.4 Check that the post is stable and securely fixed in the ground.

1.5 Check that the lamp unit hoods are correctly aligned, secure, and undamaged.

1.6 Check that the tail cable is correctly routed, the sheath is undamaged and cable entry seal effective.

1.7 Check that the signs and notice boards are legible, correctly worded, and secure. Wipe as necessary to clean.

SERVICE B

2. Internal Inspection

This service is applicable to filament light units only.

2.1 Check the seals around the lenses and access doors.

2.2 Clean and dust the interior.

2.3 Check the wiring and terminations; Protect as necessary. Check that the wiring is routed clear of the lamps and cannot be trapped by the door hinge.

2.4 Check and lubricate doors, hinges and fastenings.

2.5 Examine the lamp holders and fixings.

2.6 Renew the red and green lamps. Check that the replacements are seated correctly and the main filaments illuminate.

Use a clean paper tissue or clean cloth to handle the replacement lamp to avoid contaminating the glass envelope.

Two Lamp Units:

2.7 Check (if provided) that the filament changeover operates correctly.

Four Lamp Units:

2.8 Check that the lamp changeover operates correctly.

2.9 Carry out NR/SMS/PartB/Test/021 – (Signal Filament Lamp Test).

2.10 Lubricate and secure padlock.

SERVICE R1

Includes:	Dorman LED Red / Green light Modules
Excludes:	Non LED Light Modules and MSL/MWL level crossings controlled by Predictors

3. Maintenance

3.1 Check that the tail cable is correctly routed, the sheath is undamaged and cable entry seal effective.

3.2 Clean the module fronts - do not use abrasive pads or abrasive cleaning agents.

3.3 Examine the module fronts. Rectify if damaged.

3.4 Lubricate module hinges and padlock.

3.5 Check door fits securely and has a padlock.

END

Includes:	DCI Signals and Crossing Headlight Units
Excludes:	All other types of crossing signal or light unit

Do not climb up any signal if you are in any doubt of the security of the structure.

Report any serious defects as corrective maintenance.

Some structures do not have a permanent ladder fitted. Always follow the ladder drill. If you are unsure ask your SM(S).

Do not obstruct the sighting of the signal to the driver of an approaching train during any maintenance activity.

General

Drivers Crossing Indicators (DCI) signals with Drivers Red Light/Drivers White Light (DRL/DWL) indications are found at ABCL, AFBCL and newer AOCL crossings.

DCI signals with Drivers White Light (DWL) indications only are found at older AOCL crossings.

Crossing Headlight Units are found at all types and ages of ABCL, AFBCL and AOCL crossings.

At some installations the crossing headlight and DWL are fitted on the same structure.

The crossing section order, ground plan, and signalling plan give details of correct alignments for these items.

SERVICE A

1. Structures (all units)

1.1 Examine posts, fittings and fixings. Check they are secure and stable.

1.2 If a ladder and hoop are fitted, check they are in good condition, secure and stable.

1.3 If anti-vandal measures are fitted, check they are in good condition and effective.

Ladder guards, lens meshes etc.

2. Crossing Headlight Units

2.1 Check that the headlights units are undamaged, have their hoods fitted and are correctly aligned.

2.2 Check that the lens is clean. Wipe as necessary. Carry out cleaning with an appropriate cleaner.

2.3 Check that both headlights illuminate when the flashing red road lights illuminate.

These units usually consist of a sealed beam assemble, if faulty the whole unit will require to be replaced

3. Drivers White Light Units (DWL)

3.1 Check that the DWL units are undamaged, have their hoods fitted, and are correctly aligned.

3.2 Check that the lens is clean, wipe as necessary. Carry out cleaning with an approved cleaner.

3.3 Check that the correct DWL illuminates for the direction of an applied train simulation, check DWLs for other directions do not illuminate.

This task can be carried out as part of a sequence test for the appropriate crossing.

4. Drivers Red/White Light Units (DRL/DWL)

4.1 Check that the DRL is flashing.

4.2 Check that the DRL/DWL units are undamaged, have their hoods fitted, and are correctly aligned.

4.3 Check that the lenses are clean, Wipe as necessary. Cleaning shall be carried out using an appropriate cleaner.

4.4 Open the unit and check the following items:

a) Door seal. Replace if necessary.

b) Cables and wires.

c) Check that the glands are effective.

d) Terminations. Protect as necessary.

4.5 Check there has been no moisture ingress inside the head. Any moisture found should be cleaned away and the source found and sealed.

4.6 Examine the printed circuit board on the DRL for any signs of moisture contamination or damage.

4.7 Check all the LEDs on the DRL unit are flashing. If any are not flashing, replace the whole DRL unit.

As the unit only pivots back a small degree a mirror is required to see the LEDs.

4.8 On completion, check that the door is correctly closed and locked. Lubricate the hinges and padlock.

4.9 Check from the speed restriction board the sighting of the DRL/DWL signal. Check the flashing red light is bright and clearly visible.

4.10 Clear away any obstructing vegetation. If this is not possible arrange via your supervisor for it to be done.

4.11 Check that the correct DWL illuminates for the direction of an applied train simulation.

4.12 Check DWLs for other directions do not illuminate.

This task can be carried out as part of a sequence test for the appropriate crossing.

5. Final

5.1 Check that on completion of maintenance all controls are normalised, and the correct driver indications are showing.

END

Includes:	Single white light units
Excludes:	All other types of Barrow Crossing Light Units.

SERVICE A

1. Light Unit

1.1 Check that the post is stable and securely fixed in the ground.

1.2 Check that the light unit is undamaged, the hood (if provided) is secure, and the unit is correctly aligned.

1.3 Check that the signs and notice boards are legible, correctly worded and secure. Wipe as necessary to clean.

1.4 Examine the tail cable and cable entry gland.

1.5 Examine the internal wiring and terminations. Protect as necessary.

1.6 Check that with no trains approaching the lamp(s) are lit. Replace any defective lamps as corrective maintenance.

1.7 Clean the interior and exterior of the light unit.

1.8 If possible, observe correct operation for the passage of a train.

SERVICE B

2. Voltage Checks

2.1 Carry out NRSMS/PartB/Test/021 (Filament Signal Lamp Tests).

END

Includes:	AHB fitted with BR 843 barrier machines which have met the prerequisites shown in NR/L3/SIG10665
Excludes:	AHB fitted with other types of barrier machines

SERVICE R1

1. Analysis

1.1 Download all data from the level crossing logger for 4 periods over the last 4 weeks.

1.2 For each of the period downloaded check the following data:

a) The time between the start of yellow lamps to train arriving at crossing.

b) The time the barriers took to lower (UP KR down to DN KR up).

c) The time the barriers took to rise (DN KR down to UP KR up).

d) The time taken for the MROT to operate.

e) Look for any irregular operation of any of the RECR relays.

f) Look for any instances of the (DOOR) CR down with LCU(DOOR) CR Up.

SERVICE R2

2. Circuit Controllers (Contact finger type only)

2.1 Examine the case, fixing bolts/screw linkages & pins for signs of seizing or wear, lubricate where required (wipe off any excess).

2.2 Examine the cable & wiring for damage or degradation.

2.3 Examine the termination for risk of short circuit, coming loose or contamination, apply protection where required.

2.4 Examine the contact bands, segments & contact fingers for wear/ damage.

2.5 Clean contact surfaces with lint free cloth moistened with switch cleaner.

2.6 Check the lid for effective gasket.

2.7 Check and lubricate the bearing Bearings (OILITE or nylon should NOT be oiled).

2.8 Lubricate padlock (where fitted).

3. Operational Sequence Test

With the Passage of a Train

3.1 Carry out NR/SMS/PartB/Test070 (AHBC Operational Sequence Test) - Service A.

4. Level Crossing Phones

4.1 Check that each phone can contact the controlling signal box.

4.2 Check that each phone can be called back from the controlling signal box.

SERVICE R3

5. Filament Style - Flashing Road Light Assemblies (Wig-Wags)

5.1 Examine each post and its fittings.

5.2 Check each post for stability.

5.3 Check for damage or fading.

5.4 Check lens orientation (See Appendix A for details).

5.5 Check road light alignment (See Appendix C for details).

5.6 Clean the Yellow and Red lens.

5.7 Clean the pedestrian lights (Where fitted).

5.8 Clean all crossing signs.

6. Barrier Machine

6.1 Check for obstructions and fire risks.

6.2 Check the barrier is secure on the base and there is clearance between counter balance and the ground/base when in raised position.

6.3 Check any gap between base and pedestal is sealed.

6.4 Check the external seals for barrier bearings.

6.5 Check the front and rear door locks.

6.6 Check the boom, boom lamps, reflective strips, brackets and fastenings boom wiring, terminations, plug & sockets for integrity.

6.7 Check motor brushes, replace if less than 7mm in length.

6.8 Tuscan motors: remove screw caps with care as brushes can spring out. Brushes should slide freely in their holders and seat fully on the commutator.

6.9 Check the motor commutator, they should be light coffee colour.

6.10 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

6.11 Lubricate the pedestal door hinges and locks.

6.12 Check Torque Barrier side arm retaining bolt (210Nm) Boom locating pin and 'Vargal' nut (16Nm) (Using torque wrench).

7. Audible Warning Devices

7.1 Check the unit for security of fixings, damage and correct alignment.

7.2 Check the weather seals, visible cables, conduits & glands.

Where Electronic AWCU clocks are fitted

7.3 Check that it is working correctly and displaying the correct time.

For setup details see NR/SMS/PartB/Test/069 (SELC Digital Timer - Set-up Procedure).

SERVICE R4

8. Filament Style - Flashing Road Light Assemblies (Wig-Wags)

8.1 Examine the road light water seals and gaskets.

8.2 Examine the lamp holder and the condition of the internal wiring and terminations.

8.3 Examine and clean internal reflectors.

8.4 Examine and clean the inside of the lens.

8.5 Check the visible cable and conduits.

8.6 Lubricate the lens retaining screws and hinges.

9. Barrier Pedestal Unit

9.1 Wipe each pedestal side arm and counter balance weights.

9.2 Check each pedestal is correctly aligned.

9.3 Check the Auto/Manual valve is set to “AUTO” and split pin and lead seals are fitted.

9.4 Check the Top & Bottom trunnion blocks, mounting & tabs washers are fitted correctly.

9.5 Check the bolts connecting the trunnion to the operating lever are the correct length.

9.6 Check the torque of the trunnion retaining bolts (70Nm).

9.7 Check that the spirol pins are correctly fitted, and that the correct length of bolt is fitted into the correct set of holes.

Bolt Size	**Use**
M12 x 45mm	Used to secure the Top trunnion to the bottom set of holes in the operating arm bracket for boom lengths up to 7.1M
M12 x 70mm	Used to secure the Top trunnion to the TOP set of holes in the operating arm bracket for boom lengths 7.1M and above
M12 x 35mm	Used to secure the Bottom trunnion to its mounting position for ALL boom lengths
The unused Top trunnion holes should be fitted with the RED bolts provided. Tab washers shall be used and turned.	

9.8 Check the hydraulic fluid level and top up as necessary.

The fluid should just be visible in the strainer. If top-up is required then this should be carried out with the barriers in the lowered position.

Figure 1 – Hydraulic Filler Cap

9.9 Check the Earth Bonding.

9.10 Check the effectiveness of door water seals, renew as necessary.

9.11 Check door hinges, locks & door stay.

9.12 Check the Main shaft bearings and its fastenings.

9.13 Check the up & down stops, shock absorbers, fixing brackets & fastenings and replace plastic stop striker pads as necessary.

The shock absorber plunger should not be able to be depressed by more than 3mm by finger pressure.

9.14 Check for excessive play in the keyway on the side arm to main shaft.

9.15 Check the cap head screw on circuit controller lever is secure (see Figure 2).

9.16 Check the position of the circuit controller roller is within the track of the cam.

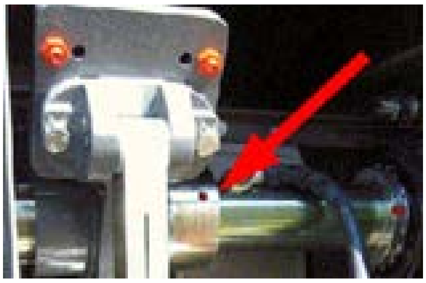


Figure 2 – Cap Head Screw Position

9.17 With the barrier in the lowered position, the roller should be visually flush with the right-hand side face of the operating cam ± 2mm.

9.18 Apply protection to the Pedestal fixing bolts, the main shaft bearing, side arm fixings, vargal nuts and the counter balance fixings.

Figure 3 – Circuit Controller Roller

10. Booms

10.1 Check the height of the boom from the road surface.

Top of boom in the centre of the road should be no less than 0.9m. The maximum height from the underside of the boom to the road surface should not exceed 1m at any point.

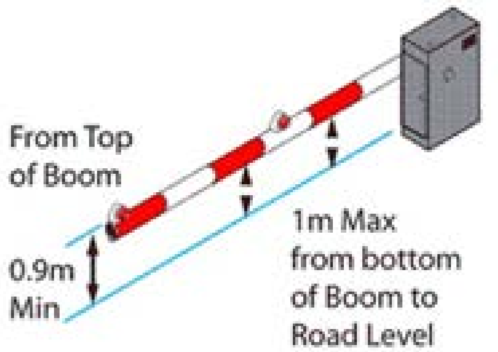


Figure 4 – Barrier Boom Height

10.2 Clean/wipe the Boom including the reflective strips and boom light lenses.

10.3 Check the boom is the correct length.

10.4 Check the booms are not “Hunting” when in the raised position.

Hunting is the term used to describe the action of powering a barrier back to the upright position repeatedly. This action is initiated when barrier falls below 83º due to a hydraulic pack fluid leakage. (And by the force of the wind in windy conditions).

10.5 Measure the gap between the pedestal cabinet and outer face of barrier side arm is 95mm-105mm (report if outside tolerance).

10.6 With boom fully lowered, Measure the distance between the left-hand side of the pedestal to the left-hand side face of the web of the operating lever arm. This distance should be 150mm +/- 2.0mm.

Figure 5 – Operating Lever Arm Measurement

10.7 Check the counter balance weights are secure.

10.8 Check the tip weight of each boom using the following method. Connect the weight measuring device to the tip end of the boom, lift the tip boom until it is approximately 4° to 5° from the horizontal.

Release the weight onto the measure device and record the weight before the lowering the boom to the ground.

11. Local Control Unit

11.1 Examine the Post, fixtures and fittings.

11.2 Check the post stability.

11.3 Check and lubricate door hinges and padlock.

11.4 Check the lock function correctly.

11.5 Check for signs of water ingress.

11.6 Check for signs of internal wire damage or degradation.

11.7 Protect terminations as required.

12. LED Style - Flashing Road Light Assemblies (Wig-Wags)

12.1 Examine each post and its fittings.

12.2 Check each post for stability.

12.3 Check for damage or fading.

12.4 Check lens orientation (See Appendix A for details).

12.5 Check road light alignment (See Appendix C for details).

12.6 Clean the Yellow and Red lens.

12.7 Clean the pedestrian lights (Where fitted).

12.8 Clean all crossing signs.

13. Level Crossing Annual Tests

13.1 Perform the annual test of the level crossing.

13.2 Level crossing annual tests are detailed in NR/SMS/PartD/Index (Level Crossing Annual Tests).

END

Includes:	Barrier Machine BR 843
Excludes:	All other Barrier Machines

When lowering a barrier, take care not to trap limbs between the boom assembly and open pedestal doors or fencing.

More information on these machines and the replacement of booms, A frames, micro-switch assembles etc. can be found in NR/SMS/Appendix/03 (General Information on Level Crossing Equipment).

If practical, take local control prior to starting work.

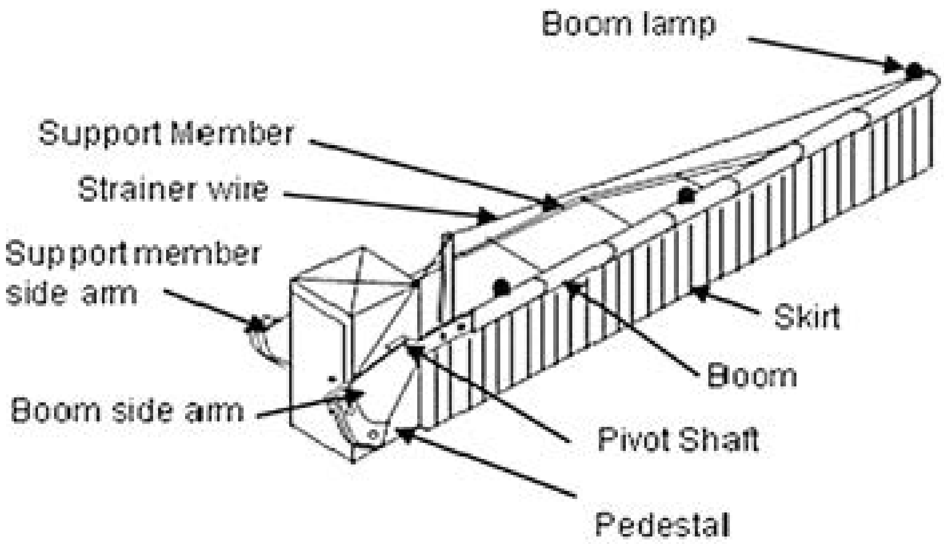


Figure 1 - Typical Boom Layout

SERVICE A

1. External Inspection

1.1 Remove potential obstructions and fire risks.

1.2 Check concrete base, pedestal exterior, side arm assembly, weights and adapter assembly.

1.3 Check that the barrier unit is secure on the base. The gap between the base and the pedestal shall be sealed to prevent rodent access.

1.4 Check external seals for barrier bearing.

NOTE: *Freezing water in bearings can cause barriers to jam.*

1.5 Observe barrier operation with the passage of a train or if this is not practical by local operation check the following:

a) Operation is smooth and not obstructed.

b) There is enough clearance between counter balance and ground / base when raised. The barrier side arm and weights shall not be obstructed by the base or surrounding debris, when raised.

c) The boom comes to rest at a raised angle of 80° – 85° and is damped during the final 10° to 15° when lowering.

d) The pedestal does not foul the operation of the barrier.

e) The boom is approximately horizontal when lowered.

Four Barrier Installations Only

1.6 Check when all 4 barriers are lowered that the distance between the YO-YN and the ZO-ZN barrier tips is no more than 65mm.

1.7 Check front and rear doors. Lubricate hinges and locks.

1.8 Check by means of a approved torque wrench set to 210Nm the security of the barrier side arm retaining bolt.

If side arm retaining bolt is found to be loose, or there is evidence of movement, then this needs to be replaced. Advise your SM(S)

1.9 Check barrier assembly components:

a) Boom, A Frame, welds and fastenings. The key-way shall hold the barrier rigid.

b) Reflective strips.

c) Boom lamps, brackets and fastenings. LED boom lamps shall be visible at 50m in daylight.

d) Skirt assembly link pivot, and fastenings, where fitted.

e) Pogo stick, where fitted.

f) Strainer wire and fastenings, where fitted.

The strainer wire shall hold the barrier in straight alignment. It shall be just taut with the barrier in the raised position, adjust as necessary.

g) Boom lamp wiring, terminations, plug & socket and fixings.

h) Boom proving circuit, terminations, microswitch and fixings, where fitted.

SERVICE B

2. External Inspection

2.1 Wipe all barrier components:

a) Pedestal & Clean the base.

b) Side arms & counter balance weights.

c) Main shaft and side arm.

d) Boom and reflective strips.

e) A frame and reflective strips, where fitted.

f) Boom light lenses and units.

g) Strainer wire, connections and fixings, where fitted.

h) Skirt, pogo stick, connections & fixings, where fitted.

3. External: Barrier Caging (if fitted)

<u>Old BR style caging (pre-2018) Only</u>

3.1 Check the cage is undamaged and securely mounted to the pedestal.

3.2 Verify that boom is unobstructed during its passage between the two sections of the gage and that the gap between the two sections of the cage is even from top to bottom.

3.3 Lubricate the hinges, sliding sections and securing bolts.

<u>Newgate style caging Only</u>

3.4 Check the following:

a) Guard is rigid, secure, true and square to the barrier pedestal.

b) Earth cable connected and un-damaged.

c) Security locks in place and undamaged.

d) Sliding doors operate freely.

e) Retaining plungers working freely

f) Machine guard to pedestal fixings are tight.

- M8 bolts torqued to 29Nm
- M20 bolts torqued to 50Nm

3.5 Check the following dimensions shown in figures 2 to 5 are within spec:

a) A & B 155mm +/- 5mm

b) C is 69mm +/- 5mm

c) D is 18mm +/- 5mm

d) E is no more than 5mm

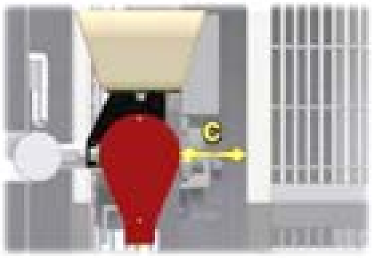


Figure 2

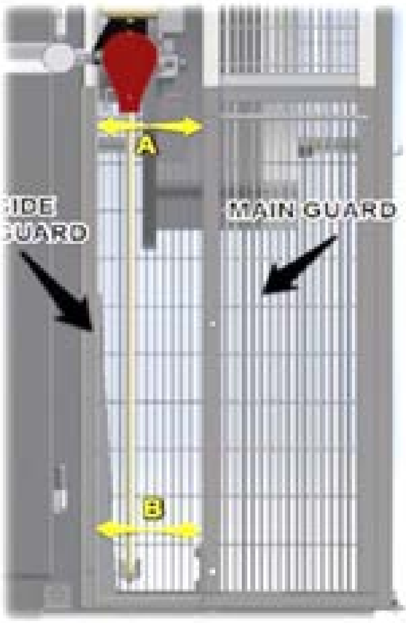


Figure 3

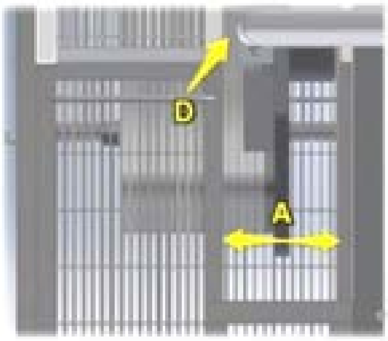


Figure 4

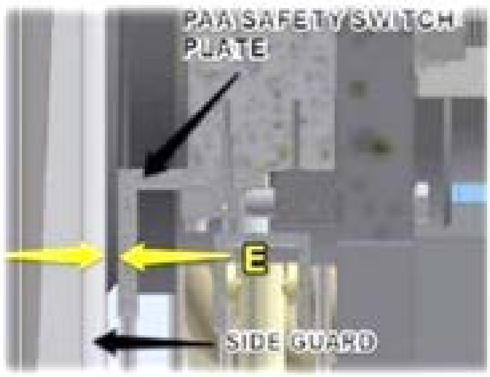


Figure 5

If the cage cannot be adjusted to meet the required specification, then the SM(S) shall be advised.

4. Boom Adapter

4.1 Check that the boom adaptor locating pin assembly is secure and undamaged. The E clip shall be complete, undistorted, and packed with adhesive grease.

If it is found to be broken the complete adaptor locating pin assembly shall be replaced.

5. Hydraulic Power Unit

5.1 Check the following:

a) Auto/Manual valve split pin and lead seal.

b) Power unit lid fastenings.

c) Top and bottom power unit trunnion block mountings and tab washers.

d) Check that the tabs are turned into the bolt head.

e) Bolts through the trunnion to the operating lever are the correct length.

f) The two Spirol pins are fitted.

g) The top and bottom power unit mounting pivots (2) and circlips (4) are not distorted (Bushes shall not be lubricated).

h) Power unit ram adjusting nut and lock washer (This shall not be adjusted).

<u>Manually Controlled Barriers Only</u>

5.2 On manually controlled barriers (MCB, RB, CCTV and TMOB) check that the Auto/Manual valve is in the 'Manual' position and the 'lock down' feature is effective.

Resistance should be felt when the boom is lifted.

<u>Automatic & On Call Barriers Only</u>

5.3 On automatic & on call barriers (AHBC, ABCL, AFBCL and OCB) check that the Auto/Manual valve is in the 'Auto' position and the 'lock down' feature is not effective the boom can be fully raised by hand.

5.4 Check the level of the hydraulic fluid and top up as necessary. The fluid shall be just visible in the strainer. If a top up is required, this shall be done with the barrier in the lowered position.

6. Motor

6.1 Check the following (where access is possible):

a) Motor commutator. It should be a light brown coffee colour.

b) Motor brushes replace as necessary.

c) Both motor brushes shall be replaced when any one reaches a minimum length of 7mm.

Tuscan motors: remove screw caps with care as brushes can spring out. Brushes shall slide freely in their holders and seat fully on the commutator.

7. Interior- General Assembly

7.1 Check the following:

a) Earth bonding assembly, where fitted.

b) Check the security of fixing and continuity between the item and the earth rod or rail.

c) Pedestal, doors and water seals, renew seals as necessary. Dust the unit.

d) Door hinges and locks.

e) Main shaft bearings (2) and fastenings (8).

f) Up & Down stops, shock absorber, fixing brackets & fastenings.

Replace plastic stop striker pads as necessary.

The shock absorber plunger shall not be able to be depressed by more than 3mm by finger pressure.

g) Cable terminations; Clean & protect as necessary.

h) Check that all ‘Klippon’ terminations are tight.

i) Cables and wiring and wire run / fixings.

j) Valve / Motor terminal blocks, connectors and wiring. Check that the blocks and terminations are secure. Loose connections are a common cause of failure.

k) Heaters (if fitted), are working.

7.2 Operate the barrier under power and check:

a) The barrier does not oscillate excessively.

b) When raised, the shock absorber plunger has depressed.

c) This maintains pressure in the hydraulic seal and prevents leakage.

8. Pivot Shaft Alignment

Any discrepancies found with these tasks in this section shall be reported as corrective maintenance immediately.

8.1 Visually Check for the following:

a) Displacement of the pivot shaft sealing washer on the outside face of the pedestal casing.

b) If displaced check for scrape marks on the pivot shaft.

c) Rubbing marks on the inclinometer. This is attached to the outside of the pedestal.

d) Bush particles on top of the hydraulic power pack, directly below the detector cam plate.

e) Wear marks on the detector cam plate.

8.2 Check that the cap head screw on the circuit controlling/operating lever is secure and the arm shows no signs of lateral movement on the pivot shaft keyway.

8.3 Check the dimension between pedestal cabinet and outer face of barrier side arm is 95mm -105mm. Any side wear shall be reported immediately.

8.4 With the boom fully lowered, Measure the distance from the left-hand side of the inside of the pedestal to the left-hand side face of the web of the operating lever arm (see Appendix A).

- 150mm ± 2mm.

  If this measurement is not within the tolerance stated refer the matter to your SM(S) immediately.

8.5 Visually check the position of the circuit controller roller within the track of the cam.

With the barrier in the lowered position, the roller shall be visually flush with the right-hand side face of the operating cam ± 2mm.

9. Circuit Controller

9.1 Refer to NR/SMS/PartC/LV31 (Circuit Controller - Rotary Actuated).

a) For all TY199 circuit controllers, check the length of top studs as described in NR/SMS/Appendix/03 (General Information on level Crossing Equipment).

b) Where pedestal is fitted with F&G type TY 199 group 5 circuit controllers, see NR/SMS/Appendix/03 (General Information on level Crossing Equipment) for any adjustments.

9.2 Check cam, fixing and plastic bush / key-way.

10. Lubrication

10.1 Lubricate with lithium grease the spindle bearings (2 grease points).

10.2 Where fitted lubricate with mineral oil the skirt link pivot and pogo-stick.

10.3 Protect, with adhesive grease.

a) Pedestal fixing bolts (4).

b) Main shaft, side arm fixings and Vargal nuts.

c) Counter balance fixings.

d) Strainer wire adjuster thread, where fitted.

11. Hand Pump Sequence

11.1 Switch the LCU to the lower / hand position and check that all barriers fully lower.

11.2 Open the operator's (rear) door of the cabinet and extend the pump handle.

11.3 Check that the audible alarms are extinguished and the red road lights (wig- wags) are flashing. Pump the barrier to the fully raised position. Check that the barrier does not lower between each pump.

11.4 Repeat 11.2 for the other barrier(s). When the final barrier reaches the fully raised position, check that the red road lights extinguish.

11.5 Check that the operator's door of the cabinets cannot be closed with the pump handle extended.

11.6 Check the operator's door micro switch, wires, and fixings.

11.7 Lift and push in the pump handle on one of the barriers enough to release the valve and check that the barrier starts to lower, and the red road lights start to flash.

a) Extend the handle and check that the barrier movement is arrested.

b) Check that the audible warnings are still extinguished.

c) Push the handle fully home and check that the barrier fully lowers.

11.8 Repeat 11.6 for the other barrier(s).

11.9 Close and lock the operator's door on all cabinets.

11.10 Check that the audible warnings sound only when the final operator's door is closed and locked.

11.11 The door proving micro switch cannot operate until the Yale key is turned fully clockwise, then turn back to normal.

11.12 Switch the LCU to either 'Raise' or Auto' and check that both barriers raise together, and the audible warning and red road lights extinguish when both barriers are fully raised.

12. Final

12.1 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

APPENDIX A - Pivot Shaft Alignment (not to scale)

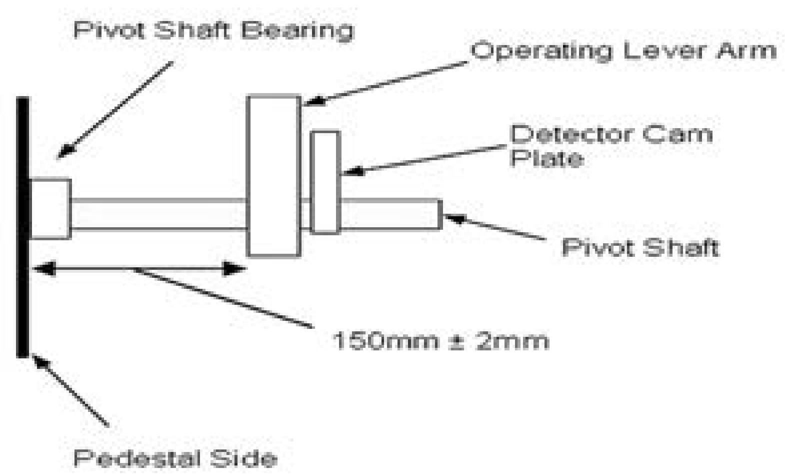


Figure 6 - Pivot Shaft Alignment

END

Includes:	EBI Gate 630 Barrier Machine
Exclude:	All other types of Barrier Machine

Appropriate protection / Possession arrangement shall be taken before commencing work on the Level Crossing System.

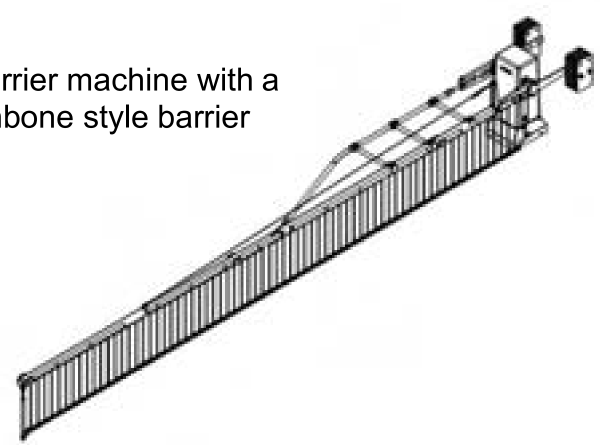
Opening the crank hole flap will release the electromagnetic brake which will cause the barrier boom to fall.

It is essential that the barrier boom is in the horizontal position (lowered) before any work activity is carried out.

When manually operating the barrier machine, if the counter-weights have been removed or the boom has been damaged, the unbalanced boom can cause the crank handle to turn.

For further detail see SMS Appendix 20 – General Information on the EBI Gate 630 / 2000 Level Crossing System.

Figure 1 - EBI Gate 630 Barrier machine with a left handed, ESD-8/01 wishbone style barrier boom.



SERVICE B

1. External Inspection

1.1 Remove potential obstructions and fire risks from around the barrier machine and boom.

1.2 Check concrete base and pedestal exterior for signs of damage.

1.3 Check that the barrier machine is secure on its base and fixing bolts are free from corrosion.

1.4 Check the barrier machine external cover is not damaged.

1.5 Check the counter weights are correct and securely fitted (Torque = 200Nm).

1.6 Check the barrier boom flanges are secure (Torque = 140Nm).

1.7 Check the boom flange plug is present.

1.8 Lubricate the external barrier machine cover lock mechanism and the crank handle cover padlock.

2. Operation of Barrier Machine

2.1 Observe barrier operation with the passage of a train or if this is not practical by local operation, check the following and rectify if necessary

a) Operation is smooth and not obstructed.

b) Sufficient clearance between counter weights and ground / base when raised. The barrier side arm and weights shall not be obstructed by the base or surrounding debris, when raised.

c) The boom comes to rest at a raised angle of 80° – 85° and is damped during the final 10° to 15° when lowering.

d) The boom is horizontal to the road surface when in the lowered position.

e) The boom lights operate correctly.

2.2 Manually operate the barrier machine, check the following and rectify if necessary:

a) Crank handle and locking pin are present.

b) Check the power is cut off after opening the flap over the crank hole.

c) Check the gravitational pawl in the safety ‘break away’ device is working properly in the horizontal position.

d) Manually raise the barrier to the fully vertical position (turn the crank handle clockwise).

e) Operation is smooth and not obstructed.

2.3 Lock the boom in the vertical position with the blocking pin.

2.4 Check the gravitational pawl in the safety ‘break away’ device is working properly in the vertical position.

2.5 Check the self-falling operation of the barrier machine, check the following and rectify if necessary:

a) Remove blocking pin and then the crank handle from the crank hole.

b) The falling time should not exceed 20 seconds (10 seconds for EEG-310125/01).

c) Operation is smooth and not obstructed.

d) The boom is level with the road surface.

3. Inspection of Barrier Boom

3.1 Check the boom components and rectify if necessary:

a) Boom assembly and support frame if fitted.

b) Integrity of welds and fastenings.

c) Safety ‘break-away’ device is secure, greased and free from obstruction and excessive dirt.

d) Skirt assembly and fastenings, where fitted.

e) Pogo stick fastenings and that it touches the road surface but does not cause an upward pressure on the boom, where fitted.

f) Strainer wire, connections and fixings, where fitted.

g) Reflective strips and clean.

h) Lamps are operational and clean.

i) Barrier wiring loom, terminations, plug & socket and fixings.

j) Boom integrity circuit/ wire, terminations and fixings.

k) Boom earth cable is connected to barrier machine.

4. Internal Inspection of Barrier Machine

The internal inspection is to be carried out with the barrier boom in the horizontal (lowered) position.

The crank hole flap shall be opened, the crank handle inserted into the crank hole (this cuts the power to the barrier machine) and the locking pin inserted and locked into place.

4.1 Check the following and rectify if necessary:

a) Build-up of dirt, dust, vegetation or rodent ingress.

b) Evidence of condensation build up or water ingress.

c) Pedestal, cover, water seals and gland are secure and intact.

d) Earth bonds / cables are secure and fault free.

e) Heater is working, if fitted.

f) Signs of any component damage, excessive wear or corrosion.

g) Electrical components and terminations are secure and free from dirt.

h) Signs of any wiring degradation or snagging of wiring or harnesses.

i) Limit switches are free from dirt and are correctly and securely mounted.

5. Motor

5.1 Check the following:

a) Motor commutator. It should be a light brown coffee colour.

b) Both motor brushes shall be replaced when any one reaches a minimum length of 10mm.

c) Brushes shall slide freely in their holders and seat fully on the commutator.

Only brushes the correct type of brushes shall be used.

To access the brushes remove screw caps with care as brushes may spring out.

6. Cog Belt

6.1 Check the cog belt for damage and or wear and replace as required.

6.2 Check the tension on the cog belt

There should be between 5 and 10 mm deflection, adjust as required.

6.3 Grease the following components:

Only “Shell Aero Grease 14” shall be used to grease components of the barrier machine.

a) Guide bars;

- Remove old accumulated grease.
- Apply new grease and distribute evenly across the guide bars.

b) Ball screw;

- Remove old accumulated grease.
- Apply new grease through the grease nipples.

c) Safety ‘break away’ Device; (if the boom has been re-fitted)

- Surfaces are clean and free from dirt

- Apply grease to the surfaces

7. Final Checks

7.1 Measure the voltage on the 24v Busbar

Investigate and rectify if the voltage is 20v below or 32v above

7.2 DYNAMIC EARTH TEST (052)

End

Includes:	GWE Rural Barrier machines and Smiths Industries Rural Barrier machines
Excludes:	All other types of Barrier machines

General

If the barriers are found raised, lower and inform your SM(S).

Smiths rural barrier machines were derived from the BR843 barrier but should not be confused with them. NR/SMS/PartC/LC21 (Barrier Machine BR Spec 843) covers the BR843 machine.

SERVICE A

1. Exterior

1.1 Remove all fire risks and potential obstructions from the pedestal base and the immediate surrounding area.

1.2 Brush the concrete base.

1.3 Check the following items:

a) With the barrier in the fully raised position, there is clearance between the ground and the barrier side arm and weights.

b) Concrete base and pedestal assembly.

c) Safety fencing.

d) Instruction boards.

e) Check they are not obstructed by undergrowth and the legends are correct and legible. Wipe as necessary to clean.

1.4 Examine the following items:

a) Boom side assembly and weights. Report any wear found on bearing shaft/side arm key-way assembly.

b) Seals on the barrier bearing cover. Freezing water in the bearings can cause the barriers to jam.

c) Slave bolts in pedestal lifting eye-holes. Arrange replacement if missing.

d) Boom, reflective bands and strips. Wipe as necessary to clean.

e) Skirt and end steady (pogo stick) if fitted. Wipe as necessary to clean.

f) Pump mechanism and barrier release handle.

2. Interior

2.1 Check the following items:

a) Hydraulic fluid level. Top up if necessary, with the barriers in the lowered position. Clean the filter if necessary. Report as corrective maintenance if an excessive quantity of fluid is required.

b) The barrier-locking pin is in-situ (if applicable).

2.2 Examine the following items:

a) Pedestal, dust as required.

b) Door seals. Replace as necessary.

c) Main bearings.

d) Split pins.

e) Hand pump bracket.

f) Rubber buffer.

g) Hydraulic ram.

h) All hydraulic pipes and connections.

i) Pedestal holding down bolts. Tighten if required.

3. Lubrication

3.1 Lubricate with mineral oil.

a) Door hinges, locks.

b) Pump mechanism linkage and turn pins.

c) Ram upper turn pin.

3.2 Lubricate with lithium based grease.

a) Skirt steady and end steady (pogo stick).

b) Barrier release handle grease nipple.

4. Final Checks

4.1 Check that the barriers are left in the lowered position.

4.2 All doors are secure and locked.

SERVICE B

5. Hand Pump and Barrier Sequence Check

5.1 Observe that both barriers are fully lowered and horizontal.

5.2 Check that approximately 14 full strokes (40 full strokes for Smiths rural barrier units) are required to fully raise both barriers.

5.3 Check there is no air in the system ('spongy' operation).

5.4 Operate the release valve and observe it takes 6 seconds for the barriers to reach the fully lowered position (horizontal).

If the lower time is slow, check that the bleed valve jet on the hand pump is clear. The barrier of the machine on which the release valve has been operated tends to lead the other barrier.

5.5 Repeat items 5.1 to 5.3 for the other barrier unit.

6. Final checks

6.1 Check that the barriers are left in the lowered position.

6.2 All doors are secure and locked.

END

Includes:	Electro-Mechanical and Electro-Hydraulic types
Excludes:	All Other Barrier Machines

SERVICE A

1. Exterior All Machines

1.1 Remove all fire risks and potential obstructions from the pedestal base and the immediate surrounding area.

1.2 Check the following items:

a) With the barrier in the fully raised position there is clearance between the ground and the barrier side arm and weights.

b) Concrete base and pedestal assembly.

c) Safety fence.

d) Tension of straining wire (If applicable). Adjust if necessary.

e) Alignment of boom lamps.

f) LED Boom lamps (if fitted) are visible from 50m.

1.3 Examine the following items:

a) Pedestal fixing bolts.

b) Seals on the barrier bearing cover. Freezing water in the bearings can cause the barriers to jam.

c) Boom, reflective bands and strips. Wipe as necessary to clean.

d) Skirt assembly (if fitted).

e) Support member and reflective bands (if fitted). Wipe as necessary to clean.

f) Boom lamps, lenses, housings, hoods and brackets. Clean lenses and replace any failed or faulty lamps.

g) Boom lamp cables, plug couplers and clamps.

h) Straining wire, stay bracket, clamp and adjuster (if fitted).

i) Skirt fittings and bottom retaining clamp bolts.

j) Skirt support arm pins.

k) Sliding members of end steady units and support posts (if fitted). Check that the spring is intact (if fitted). Clean as necessary.

l) Pneumatic buffers, check that the rubber gaiter is intact (if fitted).

m) Main shaft fixing and balance arm bolts.

1.4 Lubricate with mineral oil:

a) Sliding members of end steady units (if fitted).

b) Sliding members of support posts (if fitted).

c) Skirt support arm pins. Plastic skirt supports should not be oiled.

1.5 Lubricate with lithium-based grease the pneumatic buffers (if fitted).

2. Interior All Machines

2.1 Isolate the motor by opening the manual control door.

2.2 Check the Heaters(s) and check correct operation (if fitted). Check the thermostat is set to 16°C (60°F).

2.3 Examine the heater wire insulation.

2.4 Wipe the limit switches.

2.5 Lubricate with lithium-based grease the limit switches operating plunger.

2.6 Lubricate with mineral oil the limit switches plunger roller pivot.

2.7 Check security, fixings and cabling on all door contacts fitted.

3. Interior Electro-Mechanical Machines

3.1 Examine the motor/gears, base plate, and mounting nuts.

4. Multi-tooth Clutch and Disengaging Mechanism Type

4.1 Examine clutch swivel pin.

5. Electro-magnetic Clutch Mechanism Type

5.1 Examine the following items:

a) The Electro-magnetic clutch teeth. Check that the teeth mesh correctly when the barriers are in the raised position.

b) Wires on rubbing contact and on the gear wheels mountings.

c) Clutch securing bolts and Allen screws on motor operating shaft.
d) Allen screws on clutch disengaging socket and clutch micro-switch screws.

5.2 Lubricate with lithium-based grease the micro-switch cam.

6. Interior Electro-Hydraulic Machine

6.1 Check the following items:

a) Buffers prevent barrier rising above 85°. Adjust if necessary.

b) Hydraulic fluid level. Top up if necessary, with the barriers in the lowered position. Report as corrective maintenance if an excessive quantity of fluid is required.

6.2 Examine the following items:

a) Main bearing bolts and main shaft locating collars.

b) Top and bottom hydraulic pack mounting bolts and lock washers.

c) Top and bottom hydraulic pack mounting ram pins and circlips. **Do not lubricate**.

d) Ram adjusting nut and lock washer.

e) Rubber buffers, brackets and fixing bolts.

f) Hydraulic unit.

6.3 Reconnect the motor by closing the manual control door

7. Final Checks

7.1 Observe the operation of the machine. Check that the damping action is effective.

SERVICE B

8. Exterior All Machines

8.1 Brush the concrete base.

8.2 Examine the following items:

a) Pedestal. Wipe as necessary to clean.

b) Slave bolts in pedestal lifting eye holes. Arrange replacements if missing.

c) Balance weights. Paint marks can be used to check position.

d) Boom clamp bolts and bolt locknuts.

e) Support member clamp bolts and bolt locknuts (if applicable).

f) Straining wire, support bracket, eye bolt and adjuster (if fitted). Wipe as necessary to clean.

g) Skirt assembly (if fitted). Wipe as necessary to clean.

8.3 Lubricate with mineral oil the door hinges and door lock.

8.4 Lubricate with adhesive type grease:

a) Side arm/counter balance weights nut and bolts.

b) Straining wire adjuster thread (if fitted).

9. Boom Adapter

9.1 Run back the lock nut of the boom retaining clamp bolt; unscrew the bolt and Lubricate the exposed thread with lithium-based grease. Tighten the bolt and locknut.

9.2 Repeat 9.1 for all other boom clamp bolts and clamp bolts for retaining support member (if fitted).

10. Interior All Machines

10.1 Check cables and wires are supported clear of moving parts.

10.2 Examine the following items:

a) Pedestal Dust as necessary.

b) Door seals Replace as necessary.

c) Cam retaining Allen screws.

d) Limit switches, retaining screws and mounting plate.

e) Interior of limit switch. Arrange remedial action if water/contamination is found.

f) Terminations.

g) Cables, wires, and clamps.

10.3 On the limit switches make up a 3.5mm gauge from a 2mm and a 1.5mm gauge.

Check that the 3.5mm gauge inserted in gap B figure 1 of Appendix A causes the switch to operate, Contacts D close in figure 1 of Appendix A.

Now remove the 2mm gauge only which should cause the switch to return, Contacts D open and contacts C close in figure 1 of appendix A.

If not carry out Appendix A the re-set the gap and repeat this test.

10.4 Clean the surfaces of the limit switch cams and terminations. Protect terminations as necessary.

10.5 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test)

11. Interior Electro Mechanical Machines

11.1 Check the oil level in the motor gearbox. Top up if necessary, with SAE90 grade oil.

11.2 Check motor brushes replace if less than 7mm in length.

11.3 Examine the following items:

a) Contactors. Dust as necessary.

b) Contacts. Located behind top cover and Bakelite contact cover.

c) Barrier centralising collar and Allen screws.

d) Main bearing.

e) Gear teeth for correct alignment.

11.4 Wipe the spur reduction gear and Lubricate with lithium-based grease.

11.5 Lubricate with mineral oil the cover Allen screws (if applicable).

12. Multi-tooth Clutch and Disengaging Mechanism Type

12.1 Check the clutch disengages/operates correctly. Lubricate the gear rings with lithium-based grease and re-engage clutch.

12.2 Examine the clutch access flap micro switches, fixing brackets and the clutch spring.

12.3 Lubricate with mineral oil the hinge flap, door lock, and operating cam.

12.4 Lubricate with lithium-based grease the clutch swivel pin and main bearing.

12.5 Observe the operation of the machine.

13. Electro-magnetic Clutch Mechanism Type

13.1 Check the following items:

a) Adjuster lock nut at the top of the damper unit.

b) When the barrier lowers with the power off, the damping is effective. Adjust as necessary.

13.2 Examine the following items:

a) The connecting rod turn and split pin.

b) Situated between the damper unit and main operating shaft.

c) Damper Allen screws.

d) Bottom turn and split pin.

13.3 Top up pneumatic damper cylinder if necessary, with 'Shell Tellus23' oil. To top up: remove the small screw in the upper portion of the damper cylinder and use pump type oilcan to add the oil.

13.4 Lubricate with mineral oil the connecting rod and bottom turn pin.

13.5 Observe the operation of the machine.

14. Interior Electro-Hydraulic Machine

14.1 Check the Auto/Manual valve is in the correct position for the crossing type.

The AUTO position is only used for AHB crossings.

The MANUAL position enables the lock down feature for MCB crossings.

14.2 Examine the following items:

a) Split pin and wire seal on the Auto/Manual valve.

b) Hand lower valve.

c) This is operated by fully retracting the handle.

d) Operators door micro-switch.

15. Hand Operation Electro-Hydraulic machine

15.1 Open the operators' door and fully extend the manual pump handle.

15.2 Disconnect the solenoid valve, check the barrier remains raised. Push the manual pump handle fully home to operate the lower valve and allow the barrier to lower.

15.3 Fully extend the pump handle and manually pump the barrier to the fully raised position. Check the barrier does not lower between strokes.

15.4 Reconnect the solenoid valve and push the manual pump handle fully home. Check the barrier remains raised.

15.5 Repeat 15.1 to 15.4 for the other barrier(s).

16. Lock Down Feature Electro-Hydraulic machine

16.1 Check at MANUALLY controlled crossings when lowered the barriers cannot be raised by hand more than approximately 5° from the horizontal.

16.2 Check at AUTOMATIC controlled crossings when lowered the barriers can be fully raised by hand.

APPENDIX A - Limit Switch Identification

Crabtree Microswitch (Adjustable) Honeywell Microswitch (Fixed)

Figure 1 – Types of Microswitch

Limit Switch Adjusting Procedure

1. Check that the roller is not in direct contact with the cam.
2. Remove the cover, insulating shield and gasket.
3. Slacken the screws marked ‘A’.
4. Adjust the internal assembly as necessary to achieve the settings in step 1.28(usually where gap ‘B’ is approximately 1.5mm (1/16’’)
5. Tighten the screws marked ‘A’ and repeat step 1.28
6. Replace the insulating shield, gasket and cover.
7. The operation of the limit switch by the Cam shall be tested after adjustment of the limit switch.

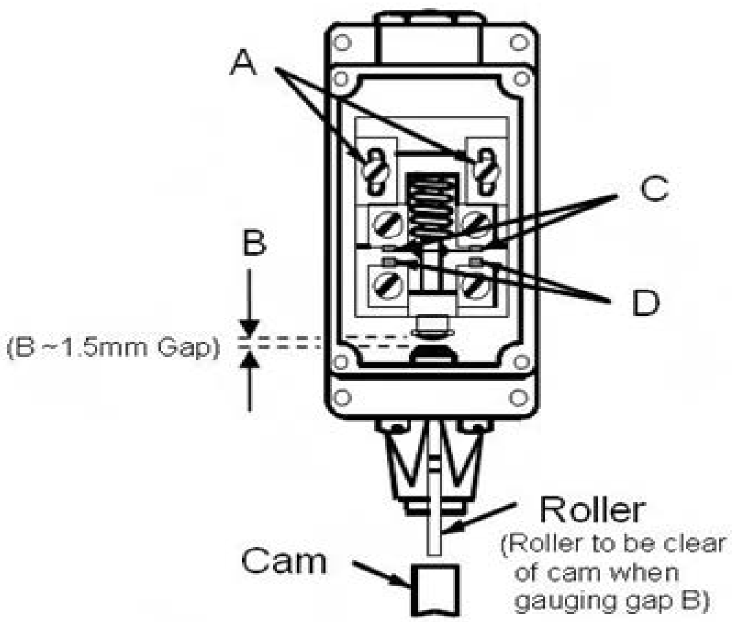


Figure 2 - Limit switch (snap-over switch)

A = Adjustment screw to move switch unit.

B = Gap between switch plunger and roller plunger.

C = Contacts ‘normally closed,

D = Contacts closed when plunger depressed,

END

SERVICE A

1 Exterior All Machines

1.1 Remove all fire risks and potential obstructions from the pedestal base and the immediate surrounding area.

1.2 Check the following items:

a) With the barrier in the fully raised position there is clearance between the ground and the barrier side arm and weights.

b) Concrete base and pedestal assembly.

c) Safety fence.

d) Tension of straining wire (If applicable). Adjust if necessary.

e) Alignment of boom lamps.

f) LED Boom lamps (if fitted) are visible from 50m.

1.3 Examine the following items:

a) Pedestal fixing bolts.

b) Boom, reflective bands and strips. Wipe as necessary to clean.

c) Skirt assembly

d) Boom lamps, lenses, housings, hoods and brackets. Clean lenses and replace any failed or faulty lamps.

e) Boom lamp cable, plug couplers and clamps. Pay particular attention to the cable between the pedestal and boom.

f) Boom retaining bolts, washers and fracture segments (if fitted).

2 Interior

2.1 Examine the following items:

a) Circuit controller, dust as necessary.

b) Motor and gearbox mounting bolts and base plate.

c) Motor adjustment set screws.

d) Emergency hand operation controls.

2.2 Lubricate with mineral oil:

a) The micro-switch push arm.

b) The manual lock toggle.

c) The manual selector shaft.

d) Limit switches plunger roller pivot.

2.3 Lubricate with lithium based grease the limit switches operating plunger.

SERVICE B

3 Exterior

3.1 Brush the concrete base.

3.2 Examine the following items:

a) Pedestal, Wipe as necessary to clean.

b) Slave bolts in pedestal lifting eye holes. Arrange replacements if missing.

c) Balance weights.

d) Boom fixings.

3.3 Lubricate with mineral oil the following items:

a) Door lock and hinges.

b) LCU door lock.

c) Main bearing.

4 Interior

4.1 Check motor brushes, replace if less than 7mm in length.

4.2 Examine the following items:

a) Micro-switches.

b) Power release lock micro-switches.

c) Manual lock release plunger mechanism.

d) Power release lock.

e) Cams and micro-switches.

f) Gear teeth. Report any evidence of incorrect meshing, excessive play between gears or excessive gear wear (e.g. metallic dust or swarf).

g) Terminations, Clean and Protect as necessary.

h) Clutch, Adjust if necessary.

i) Contactor (if fitted). Dust as required.

j) Oil level in the motor gearbox.Top up if necessary with SAE90 gear oil.

k) Remove (if necessary) contact strip.

l) Bands and contacts. Clean as necessary.

4.3 Lubricate with mineral oil the following items:

a) Actuating arms.

b) Manual lock release plunger mechanism.

4.4 Wipe and Lubricate with lithium based grease the motor gear wheel and drive segment. Wipe away surplus grease.

4.5 Dynamic earth test (052).

5 Boom Fixings

5.1 Remove boom main retaining bolts and washers, and Examine key and key way. Arrange for remedial action if worn or damaged.

5.2 Refit and secure boom main retaining bolts and washers.

6 Hand Operation

6.1 Operate the emergency hand control. Check this isolates power to the machine.

6.2 Lower and raise the barrier on emergency hand control. Check the road traffic lights operate when the machine lock is released.

6.3 Return the crossing to normal operation.

7 Final Checks

7.1 Observe the operation of the machine.

End

SERVICE A

1 Exterior All Machines

1.1 Remove all fire risks and potential obstructions from the pedestal base and the immediate surrounding area.

1.2 Check the following items:

a) With the barrier in the fully raised position there is clearance between the ground and the barrier side arm and weights.

b) Concrete base and pedestal assembly.

c) Cage.

d) Alignment of boom lamps.

e) LED Boom lamps (if fitted) are visible from 50m.

f) The barrier engages centrally on the post.

1.3 Examine the following items:

a) Boom, reflective bands, and strips. Wipe as necessary to clean.

b) Skirt assembly.

c) Boom lamps, lenses, housings, hoods and brackets. Clean lenses and replace any failed or faulty lamps. Wipe as necessary to clean.

d) Boom lamp cable, plug couplers and clamps. Pay particular attention to the cable between the pedestal and boom.

e) Clapping post.

f) Balance weights and retaining bolts. Wipe as necessary to clean.

g) Split pins retaining the trimming weight arms and roller.

h) The Allen screws in the barrier fulcrum spacing collars. If any movement is detected check that the fulcrum and barrier are central in relation to the pedestal. Arrange remedial action if necessary.

i) Allen screws securing the barrier.

j) Operating cranks, guides and rollers Clean as required.

1.4 Wipe to clean and then Lubricate with mineral oil:

a) Trimming weight rollers, tracks and pivots Check on replacement that the rollers are engaged on the tracks.

b) Barrier fulcrum bearings.

c) Side cover wing-nuts.

1.5 Wipe and Lubricate with lithium based grease the roller guides and roller grease nipples. Surplus grease shall be wiped away.

2 Interior

2.1 Examine the following items:

a) Operating Cranks and split pins. Check for a tight fit on the operating shaft. If movement is apparent tap the key further into the keyway so as to minimise movement.

b) Rack and pinion adjustable connecting rod and bolts. Wipe as necessary to clean.

c) Micro-switch fixing bolts and terminations.

d) Emergency hand operation controls.

e) Terminations.

f) Guard panel.

2.2 Clean and Protect the micro-switch terminations and other terminations.

2.3 Lubricate with mineral oil the guard panel lock.

2.4 Lubricate with lithium based grease the grease nipples on the following items:

a) The vertical crank shaft and turn pins.

b) The rack guide.

c) The rack guide bottom pin.

3 Barrier Operation and Sequence Check

3.1 Check that the trimming weight rollers are engaged on the tracks.

3.2 Request the signaller to lower the barriers and Observe the following:

a) The boom lights illuminate when the barrier is approximately 80° from the horizontal.

b) The barrier lowers smoothly.

c) The barrier is horizontal and locked when fully lowered.

3.3 Request the signaller to raise the barriers and Observe the following:

a) The barrier rises smoothly.

b) The skirt folds correctly whilst the barrier is rising.

c) The boom lights extinguish when the barrier is fully raised.

d) The barrier is locked when it is in the fully raised position.

End

The barriers shall be prevented from lowering before working within the cage. Utilise the hook and, if necessary, remove the motor fuses.

The machine shall not be operated electrically until any adjustments have been verified by manual operation, to check that the machine is operating without undue strain.

SERVICE A

1. External Inspection: Pedestal

1.1 Remove fire risks and potential obstructions from the barrier base and the immediate surrounding area.

1.2 Examine the concrete base, post and cage for security and signs of corrosion or damage.

1.3 Examine all fitting clamps and foundation bolts, where fitted, for security.
In particular, Examine the bottom clamp, which carries the lower ram pin, as this is prone to movement.

1.4 Examine the rear barrier strut for signs of damage or developing fractures. If any are found a replacement should be fitted as soon as possible.

The strut connects the ram to the barrier; its failure can result in the barrier lowering uncontrolled.

1.5 Check that the rear cage access panel can be removed and correctly replaced by one unaided person.

2. Barrier Boom

2.1 Check that the movement of the boom is free from potential obstruction.

2.2 Examine the boom for security and signs of damage. Look for signs of wear or movement around the barrier fulcrum bearings and brackets.

2.3 Check that all boom securing fixings are tight.

2.4 Examine and Wipe boom, reflective bands and strips.

2.5 Examine skirt assembly, fastenings and end stop. Replace any missing skirt rods as corrective maintenance.

3. Boom Lamps

3.1 Examine housings, hoods & brackets.

3.2 Clean and Examine lamps and lenses for discolouring or damage. Renew any faulty filament lamps as corrective maintenance.

3.3 Check the lamp alignment. Lamps shall be aligned along the road approach. LED boom lamps shall be visible at 50m on a straight approach.

4. Boom Wiring

4.1 Examine boom lamp supply cable, connectors and cable clamps.

4.2 Examine barrier fracture circuit (CCTV crossings only). Report any disconnected circuits as a corrective maintenance requirement.

4.3 On electrified line areas: Check the earth bonding is intact and not fouling moving parts.

5. Internal Inspection

5.1 Check security of the counter-balance weights.

5.2 Examine the following items:

a) Up stops.

b) Barrier retaining hook.

c) Rams, hoses, bearings and fittings, including weatherproof ‘boot’ A maximum of 5mm free play is permitted on either bearing.

5.3 Check the security of the circuit controller driving pin and link rod, including split pin.

Vertical free play in the link rod shall not exceed 2mm in either bearing.

Horizontal free play shall not exceed 5mm. This can be reduced by the insertion of correctly sized, non-ferrous washers.

6. Hydraulic Fittings

6.1 Check hydraulic power unit fluid level and top up as necessary.

The fluid should be at least 15mm above the strainer when the barrier is fully lowered.

If more than 500ml is required, Check all hydraulic components for leakage. If there are no obvious leaks, arrange for the barriers to be operated under power several times and re-check.

Leaks are particularly found at joints and where hoses are in contact with metalwork.

<u>If fitted:</u>

6.2 Test the pump unit door cut out switch for correct operation.

6.3 Check hydraulic power unit lid fits correctly and can be secured.

7. Circuit Controller

7.1 Maintain the circuit controller as per NR/SMS/PartC/LV31 (Circuit Controllers).

8. Lubrication

8.1 Lubricate with lithium grease the following:

- The main barrier bearings (2x grease nipples).
- Ram pivots (grease nipples).

8.2 Lubricate using mineral oil the following:

- Skirt components, including end stop.
- Bearings within the circuit controller linkage.

9. Power Operation

9.1 Check the barrier comes to rest at an angle of between 80° and 85° when raised.

9.2 Check the following when barrier is fully lowered

a) The barrier comes to rest in a horizontal position (0°- 4°).

b) The distance between the road surface and underside of the boom does not exceed 1000mm at any point.

c) The extended ram is 1.02m between centres of top and bottom ram pins.

d) The barrier end stop is not damaging the road surface.

e) The lowered barrier closes the road and is not horizontally misaligned.

9.3 Check the barrier damping is effective during the last 10cm(approx.) of movement when lowering.

9.4 Check the barrier does not bounce excessively at the top of the stroke, when being raised.

9.5 Check the barrier skirts are located in the correct position when barriers are raised.

10. Function Test

10.1 Check all covers and fixings are secure.

10.2 Test the level crossing barrier apparatus functions correctly when operated from the control point.

10.3 Restore to service.

SERVICE B

11. Boom

11.1 As necessary**:** Wipe and clean the barrier skirt and end-stop.

12. External: Barrier Caging (if fitted)

12.1 Check the cage is undamaged and securely mounted to the pedestal.

12.2 Verify that boom is unobstructed during its passage between the two sections of the gage and that the gap between the two sections of the cage is even from top to bottom.

12.3 Lubricate the hinges, sliding sections and securing bolts.

13. Power Unit

13.1 Isolate and clean the power unit interior.

13.2 Examine cables and wires. Look particularly for:

a) Degraded or damaged (chafing) insulation.

b) Trapped wires.

c) Unsupported wires.

d) Risk of short circuit (electrical contact with adjacent terminals, casing or metal parts).

e) Fouling by moving parts.

f) Contamination.

13.3 Examine terminations, Clean and Protect as necessary.

13.4 Examine door micro-switch, wires, brackets and fastenings.

13.5 Remove and Examine the top and bottom ram pins. Renew the pins as corrective maintenance if surface degradation or fatigue cracks are found.

14. Motor

14.1 Examine the commutator. The commutator should be a light brown coffee colour.

14.2 Examine the motor brushes; renew as necessary. They should slide freely in their holders and seat fully on the commutator.

15. Hand Operation Test: Lowering

The barriers are driven up and down and are designed to be counter balanced. If the steps in 14 and 15 show that the barriers are out of balance, the details in Appendix B shall be followed to correct this.

These tasks shall be undertaken for all the barriers in the installation.

15.1 With both hand valves closed, Check the barrier cannot be moved by hand.

15.2 Open the valves and Check the following:

a) The barrier does not fall unaided.

b) One person can pull down the barrier unaided.

15.3 Close the valves and Check the barrier cannot be raised more than 15° by hand.

16. Hand Operation Test: Raising

16.1 With both hand valves open, Check the barrier can be fully raised by one person unaided.

16.2 When raised, check barrier holding hook maintains the barrier in a raised position so as to extinguish the road and boom lights.

16.3 Close the valves, unhook the barrier and lock the power unit door.

17. Final Tests

17.1 Carry out a Dynamic Earth Test - NR/SMS/PartB/Test/052.

17.2 Check all covers and fixings are secure.

17.3 Check that the boom retaining hook is left in the down position.

17.4 Test the level crossing barrier apparatus functions correctly when operated from the control point.

17.5 Restore to service.

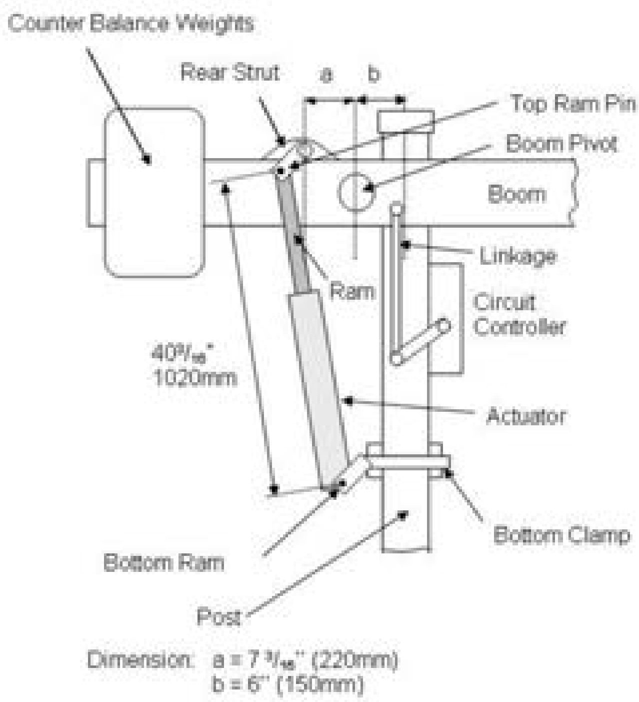


Figure 1 - Barrier Rams and Linkages
(Not to Scale)

APPENDIX A - Boom Re-fitting Instructions

This shall be read in conjunction with appropriate NR/SMTH test plan.

Counter balance weights should be fixed in the raised position before the boom is removed.

It is assumed that all broken or faulty equipment is removed as this procedure is carried out and that replacement parts are to hand.

Boom Replacement

1. Lower the old boom.
2. Disconnect the wiring to boom lights, and earth bonding, where fitted.
3. Support the rear of the operating mechanism near the weights.
4. Undo the bolts holding the boom and rear holding bar onto the skirt.
5. Fit the new boom and refit the rear holding bar onto the skirt, verifying the length is correct.
6. Reconnect the wiring to the boom lights, and earth bonding, where fitted.
7. Test for correct operation, including parts 9,14,15 & 16.

APPENDIX B - Boom Counter Balance Weight Adjustments

These barriers are designed to be counter balanced, failure to correctly set the counter balance weights can result in excessive component wear and failure of the hydraulic rams and power packs.

Weights shall be equal on both sides of the boom.

Due to the components being designed to imperial measurements, these are the only ones quoted.

1. Disconnect the ram from the rear strut and open both valves on the hydraulic pack.
2. Untighten the bolts holding the balance weights and remove the existing weights. Move the back plates until the centre bolt is halfway along the slot.
3. Add one-inch thick weights equally to both sides, then by using decreasing thickness of weights obtain an approximate balance of the barrier over its whole travel.

4. Reconnect the ram to the rear strut and operate the barrier by hand. If required adjust the weights along the channel slots to give a smooth operation throughout the whole barrier travel.

5. If the final position of the weights is at the extremity of the slots then reposition the weights at the centre of the slot and add or remove a quarter inch weight (on both sides) as necessary to enable further site adjustment in the future.

6. Where tie rods and bolts have been historically cut to size to prevent new weights from being added, replace them with one inch diameter threaded bar to enable the correct weight adjustment to be obtained.

Available Counter Balance Weights Sizes

Thickness (inches)	Weight (Pounds)
1	56
1/2	28
1/4	14

Tie Rod Length Required

Barrier Length	Tie Rod Length
15ft to 25ft	32 inches
25ft to 30ft	44 inches

Weights and threaded bar should be obtained through your SM(S).

END

Includes:	Barrier Machine, Boom; Skirt
Excludes:	All other types of barrier machine

When lowering a barrier, do not become trapped between the boom assembly and fencing.

Always obtain the Signallers' permission before operating the barriers on local control or hand operation permission when barriers need to be operated by local control or hand.

If practical, take local control prior to starting work.

Check the site logbook or record card for any entries since your last visit.

Where alterations are being carried out, your SM(S) should have briefed you on the work and the effect on planned maintenance.

If you find evidence of project work that you have not been told about, contact your SM(S).

Before leaving site, check that access points are secured to prevent unauthorised access.

SERVICE A

1. External Inspection

1.1 Report any sign of structural deterioration or forced entry as corrective maintenance.

1.2 Check for potential obstructions and fire risks. Remove or report any possible risks as corrective maintenance.

1.3 Check that security locks and ventilation are in order.

1.4 Check that door safety / warning label is correctly displayed and legible.

1.5 Brush / Wipe any dirt and / or infestation around the unit.

1.6 Check cable entries are sealed to deter rodents.

1.7 Check that the shear bolts intact and secure, replacing as corrective maintenance if there is any visible sign of damage or wear. Shear bolts shall be set to 20Nm by means of a calibrated torque wrench.

1.8 Observe barrier operation with the passage of a train or if this is not practical by local operation. Check the following:

a) Operation is smooth and not obstructed.

b) Lower and raise times are within specification.

c) That there is enough clearance between counter balance and ground / base when raised.

d) The barrier side arm and weights shall not be obstructed by the base or surrounding debris when raised.

e) The boom comes to rest at a raised angle of 85° – 90°.

f) The boom is approximately horizontal when lowered.

<u>4 barrier installations only:</u>

1.9 Check when all 4 barriers are lowered that the distance between the YO-YN and ZO-ZN barrier tips is no more than 65mm.

1.10 Check the following barrier assembly components:

a) Machine mounting bolts and clamps.

b) Boom fastenings.

c) Reflective Strips.

d) Boom lamps, brackets and fastenings. LED boom lamps shall be visible at 50m in daylight.

e) Skirt assembly, retaining bracket and linkage, and fixings where fitted.

f) Strainer wire and fastenings, where fitted. The strainer wire shall hold the barrier in straight alignment. It shall be just taught with the barrier in the raised position, adjust as necessary.

g) Boom lamp wiring, terminations, plug and socket and fixings.

h) Boom proving circuit, terminations, microswitch and fixings where fitted.

2. Internal Inspection

2.1 Check for obvious signs of excessive wear or movement of cams and contacts.

It is normal to see a small amount of dust from the cams collected inside the door.

Brush this out if present.

2.2 Check for presence of internal maintenance covers, labels and drawings inside the door.

2.3 Examine a sample of cables and wires for damage. Report any damage as corrective maintenance. Take immediate action on any exposed conductors.

Rodent damage can occur to wiring in ducting which is not immediately visible.

2.4 Isolate the machine, remove the gearbox cover; lock the barrier in its current position using the lock bar. Lubricate gearbox with lithium grease.

2.5 Remove lock bar, replace the gearbox cover, reconnect the machine, and check barrier operates freely.

SERVICE B

3. General Inspection

3.1 Wipe / Brush the following barrier components:

a) Base and support post.

b) Side arms and counter balance weights.

c) Conversion bracket.

d) Boom and reflective strips.

e) Boom light lenses and units.

f) Strainer wire, connections and fixings where fitted.

g) Skirt, connections and fixings where fitted.

3.2 Remove shear pins by means of torque wrench, check the boom rotates freely and lubricate the king pin with lithium grease.

3.3 Check for free operation of boom detector microswitch and lubricate with spray lubricant.

3.4 Check that the shear bolts intact and secure, replacing as corrective maintenance if there is any visible sign of damage or wear. Shear bolts shall be set to 20Nm by means of a calibrated torque wrench.

3.5 Check by means of a calibrated torque wrench set to 145Nm the security of the king pin.

3.6 Check by means of a torque wrench set to 145Nm the security of the support bracket nuts.

3.7 Check by means of a calibrated torque wrench set to 190Nm the security of the side arm central hub nuts.

3.8 Check by means of a torque wrench set to 75Nm the security of the conversion bracket bolts.

3.9 Check by means of a torque wrench set to 75Nm the security of the boom support bolts.

<u>Manually Controlled Barriers:</u>

3.10 On manually controlled barriers (MCB, RB, CCTV, OD, TMOB) check the ‘lock down’ feature is effective. Resistance should be felt when the boom is lifted.

4. Internal: General Assembly

4.1 Check the following:

a) Base, post, door and water seals, renew seals as necessary, dust the unit.

b) Door hinge and lock.

c) Measure Up and Down buffer clearance from segment gear. Note Auto and Manual barriers are different.

d) Cable terminations; clean and protect as necessary.

e) Cables and wiring and wire run / fixings.

f) Heater is working.

g) Presence of contact and gearbox maintenance covers.

h) Door microswitch, wires and fixings.

i) Isolation switch, wires and fixings.

4.2 Test the barrier under power and check the following:

a) The barrier does not oscillate excessively.

b) No excessive noise from motor, brake or gearbox.

c) The barrier raises and lowers freely.

5. Internal: Motor

5.1 Check the following;

a) Motor Commutator.

b) It should be a light brown coffee colour.

c) Motor brushes, replace as necessary.

d) Both motor brushes shall be replaced when any one reaches the marked minimum length.

e) Remove screw caps with care as brushes might spring out. Brushes shall slide freely in their holders and seat fully on the commutator. Only correct style brushes shall be used.

f) Brake air gap. Should be between 0.015” and 0.020” adjust as necessary.

6. Internal: Cams and Contacts

6.1 Check the following items:

a) Cam fixings and contacts.

b) The position of the contact on the cam (visually). Contacts should be approximately centre of the cam.

c) Cam and contact settings match circuits.

d) Contact gap and tension.

7. Internal: Lubrication

7.1 Isolate the machine, remove the gearbox cover; lock the barrier in its current position using the lock bar.

7.2 Lubricate the gearbox with lithium grease.

7.3 Lubricate the door lock and the door hinges with lithium grease.

7.4 Lubricate door detector with spray lubricant.

7.5 Remove the lock bar and check the barrier operates freely.

8. Hand Wind Sequence

8.1 Switch the LCU to the lower / hand position and observe that all the barriers fully lower.

8.2 Open the door of the machine, switch the isolation switch to the 'Hand' position, and check that the audible alarms are extinguished and the red road lights are working.

8.3 Insert the lock bar in the direction to keep barrier up and attach the winding handle. Wind the barrier up stopping intermittently to check the barrier does not lower.

8.4 Repeat 8.1 and 8.3 for other barrier(s). When the final barrier reaches the fully raised position, check that the red road lights extinguish.

8.5 Check that the door cannot be closed with the lock bar in place.

8.6 Switch the isolation switch to 'Road Lights Override' and check that the red road lights start to flash.

8.7 Remove the lock bar and check the barrier fully lowers.

8.8 Switch the isolation switch to 'Auto', close and lock the door.

8.9 Repeat 8.5 and 8.8 for the other barrier(s).

8.10 Check that the audible warning only sounds when the final door is closed and locked.

8.11 Repeat 8.1 to 8.10 for the other barrier(s).

8.12 Switch the LCU to either 'Raise' or 'Auto' and check that all barriers raise together and the audible warning and red road lights extinguish when all barriers are fully raised.

9. Final

9.1 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

NOTE: *that this could be 12v or 24v.*

9.2 Record details of your maintenance visit and any other work undertaken in the site logbook or NR/SMS record card.

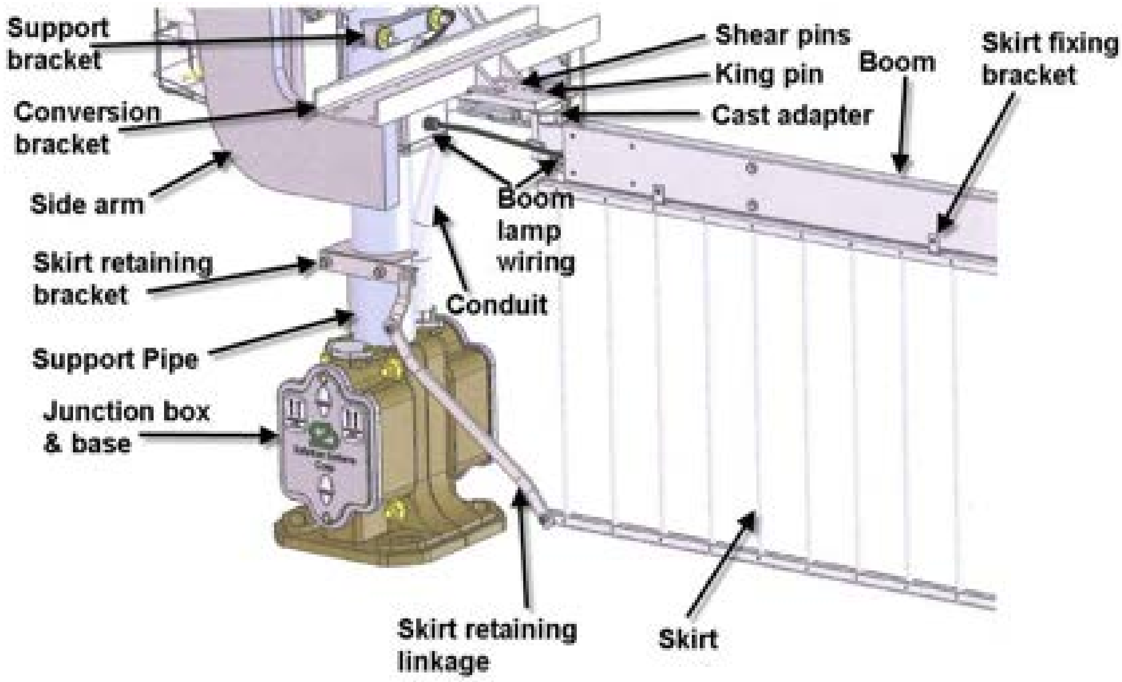


Figure 1 - S60 Barrier Unit Diagram (Not to scale)

END

Includes:	Automatic Half Barrier (AHB) Mk.1 (Penguin)
Excludes:	All other types of Barrier Machine

SERVICE A

1. Pedestal Exterior

1.1 Remove potential obstructions and fire risks.

1.2 Check the concrete base and pedestal. Look particularly for subsidence, movement, cracking, or damage.

A collision by a vehicle might have fractured the concrete, which may be supported by reinforcement rods.

1.3 Check the visible tail cables and route.

1.4 Check the pedestal top and bottom covers, anti-guillotine shields and fixings, and padlocks. Wipe as necessary.

Covers shall be properly fitted and shall not obstruct movement of the barrier. Report damaged covers as corrective maintenance.

The auto/manual valve access doors shall be secure. Pedestal phone covers shall be plated shut where not in use. Grease shall be smeared on anti-guillotine fixing bolts.

2. Pedestal Interior

2.1 Remove the top and bottom covers and examine the hydraulic unit assembly and connections. Wipe as necessary.

Operate the barrier under local control and look for hydraulic fluid leaks. Tighten joints as necessary.

2.2 Check the hydraulic fluid level, top up as necessary.

2.3 Check the Auto/Manual valve assembly. Wipe as necessary.

2.4 Check all cables, wiring and terminations. Pay particular attention to the security of terminations and condition of insulation. Wiring is prone to contamination by hydraulic fluid.

2.5 Clean and examine the following:

a) Motor commutator. It is normally a light brown coffee colour.

b) Motor brushes. Replace as necessary.

NOTE: *Tuscan motors: Remove the screw caps carefully as brushes might spring out.*

c) All brushes shall slide freely in their holders and seat fully on the commutator.

d) Spindle bearings.

e) Ram.

f) Top ram pin and bracket. The top ram pin (as modified) is fitted with a bracket, which shall be securely fixed with a bolt and locknut.

g) Bottom ram pin. The bottom ram pin shall be free to rotate and is fitted with a split pin.

h) Up and down stops and mounts.

2.6 Check and clean the local control push buttons and wiring.

2.7 Check that the door interlocking lever is in place and the local control unit door cannot be closed and locked unless the crossing is on automatic control.

Do not use the interlocking lever to switch the crossing to automatic operation. Using the lever only, does not always fully engage the auto switching. Press the auto button first then operate the interlocking lever.

3. Circuit Controller

3.1 Maintain the circuit controller as per NR/SMS/PartC/LV31 (Circuit Controllers).

4. Barrier Assembly

4.1 Check the barrier boom, cross members, brackets and fixings. Look particularly for rot, damage, and missing parts.

Confirm that the boom is rigid and horizontal when lowered.

4.2 Check the boom reflective strip. Clean as necessary.

4.3 Check boom lamps, lenses, wiring, terminations, plug and socket and fixings.

Confirm that the boom lamps are correctly aligned along the road.

4.4 Where fitted, check that LED boom lights are visible from 50m.

5. Lubrication

NOTE: *The hydraulic ram is self-lubricating.*

5.1 Lubricate with mineral oil the following:

a) Spindle bearings (2).

b) Linkages.

c) Bottom ram pin.

d) Door hinges, locks and fixings.

5.2 Protect the following with adhesive grease:

a) Pedestal fixing bolts.

b) Anti-guillotine shield fixings.

6. Final Checks

6.1 Operate barrier under local control and observe correct operation.

6.2 Replace and secure covers. Confirm that the covers do not foul barrier boom.

6.3 Return the crossing to ‘Auto’, hand back to the Signaller and check the correct indications are received.

SERVICE B

7. Hand Pump Sequence

7.1 In local control, lower the barrier under power.

7.2 Hand pump up the barrier. Check the barrier can reach the fully raised position and does not drop between each pump.

8. Tests and Final Checks

8.1 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests).

8.2 Operate barrier under local control and observe correct operation.

8.3 Return the crossing to 'Auto', hand back to the Signaller and check the correct indications are received.

9. General Arrangement (Not to Scale)

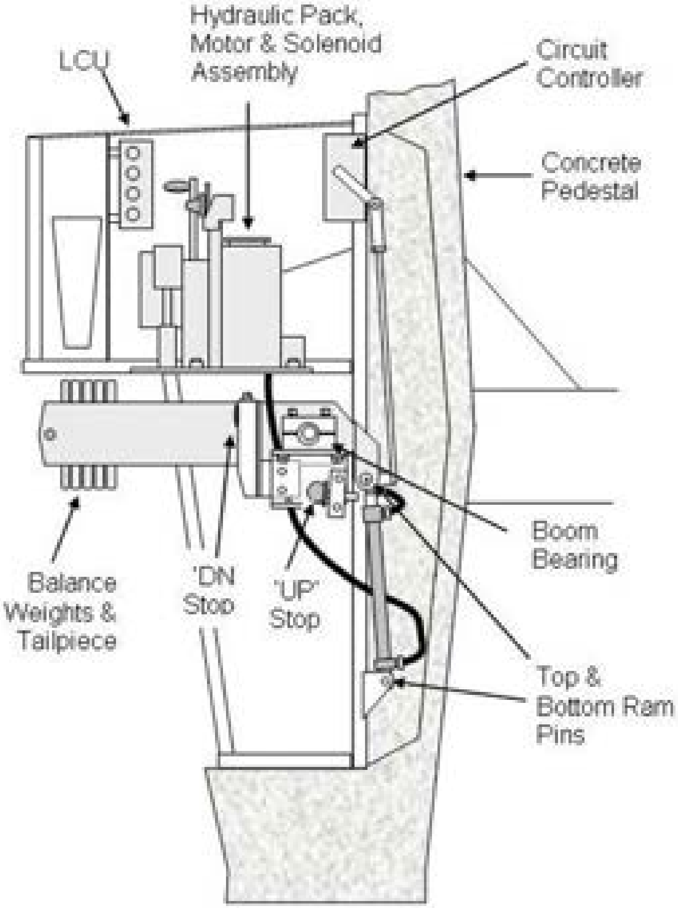


Figure 1 – General Arrangement

END

Includes:	Newgate Barrier NGR18000
Excludes:	All other types of barrier machine

When lowering a barrier, be aware that limbs can be trapped between the boom assembly and fencing.

Liaise with the signaller before operating the barriers on local control or hand operation permission when barriers need to be operated by local control or hand.

If you find evidence of project work that you have not been told about, contact your SM(S).

Equipment Identification Image

Figure 1 - Newgate Barrier Machine - NGR18000

SERVICE B

1. External: General Inspection

1.1 Report any sign of structural deterioration or forced entry.

1.2 Check the following and remove or report any possible risks.

a) Any potential obstructions and fire risks.

b) Sufficient clearance between counter balance and ground / base when raised.

c) That barrier side arm and weights shall not be obstructed by the base or surrounding debris when raised.

1.3 Brush/Wipe away any dirt and/or infestation around the unit.

2. External: Pedestal

2.1 Wipe and clean all components:

a) Pedestal & base.

b) Side arm(s) & counter balance weights.

2.2 Check the following:

a) Cable entries are sealed to deter rodents.

b) Base to under pedestal gap sealed (if required).

c) Barrier machine pedestal for paint damage (ref appendix).

d) Barrier machine pedestal for corrosion (ref appendix).

e) Earth Bonding straps present and undamaged.

f) That door security locks are in order.

g) No rubbing marks on the inclinometer.

h) Side covers are undamaged.

i) External flex conduit from pedestal to boom, terminations, plug & socket, fixings are secured and undamaged.

Rodent damage can occur to wiring in ducting which is not immediately visible.

3. External: Boom & Curtain

3.1 Wipe all components:

a) A frame and reflective strips, where fitted.

b) Boom lamps.

c) Reflective strips.

d) Boom curtain assembly.

3.2 Check the following:

a) LED boom lamps shall be visible at 50m in daylight.

b) Strainer wire and fastenings, where fitted. The strainer wire shall hold the barrier in straight alignment. It shall be just taught with the barrier in the lowered position, adjust as necessary.

c) Skirt assembly, curtain pivot bracket, and fixings where fitted.

d) Boom for visible damage.

e) Boom fastenings.

f) Boom proving circuit, terminations, reed switch and fixings where fitted.

g) Boom lamp fasteners.

4. External: Barrier Caging

4.1 Check the following:

a) Guard is rigid, secure, true and square to the barrier pedestal.

b) Earth cable connected and un-damaged.

c) Security locks in place and undamaged.

d) Sliding doors operate freely.

e) Retaining plungers working freely

f) Machine guard to pedestal fixings are tight.
- M8 bolts torqued to 29Nm
- M20 bolts torqued to 50Nm

4.2 Check the following dimensions shown in figures 2 to 5 are within spec:

a) A & B 155mm +/- 5mm

b) C is 69mm +/- 5mm

c) D is 18mm +/- 5mm

d) E is no more than 5mm

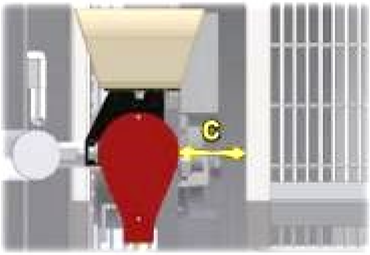


Figure 3

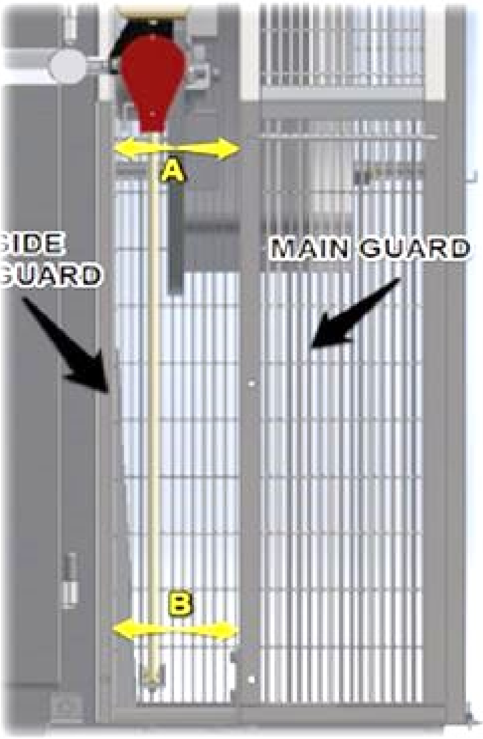


Figure 2

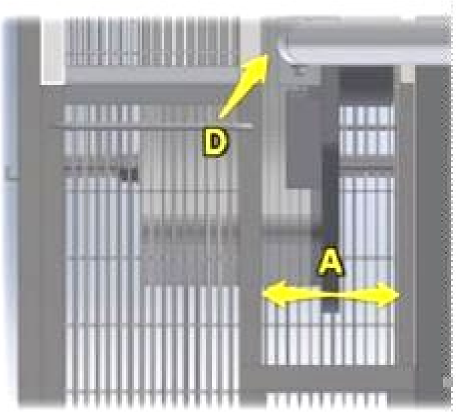


Figure 4

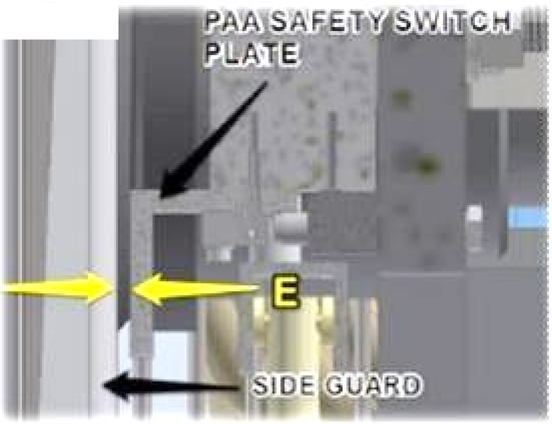


Figure 5

If the cannot be adjusted to meet the required specification, then the SM(S) shall be advised

5. Internal: General Assembly

5.1 Check the following:

a) Base mounting bolts are secure.

b) Door and water seals, renew seals as necessary.

c) Doors hinge and lock.

d) Cable plug couplers are locked and mounting plate secure.

e) Cable terminations are secure.

f) Cables and wires for damage.

g) Earth bonding straps for damage.

h) Heater is working.

i) Doors safety switches and keys are secure.

j) Motor break leaver safety switch & locking pin assembly switch.

k) Isolation switches operates.

l) Wires and fixings for damage & corrosion.

m) Excessive wear or movement.

n) Sealing cap for lock pin opening is in place.

6. Internal: Hydraulic Pump System

6.1 Check the following:

a) Pump handle is intact and stowed correctly.

b) Leaks from cylinder pipes and couplings.

c) Damage to flexible connection pipes.

d) Hydraulic reservoir oil level with the barrier in raised position.

7. Internal: Motor Gearbox

7.1 Check the following:

a) Gearbox oil level.

b) Seals and gaskets for oil leaks.

c) Bottom of the fan cowl clean and free of dirt & debris.

d) Break holding operation at 45 degrees (ref appendix).

8. Internal: Cams & Proximity Switches

8.1 Check the following:

a) Proximity switch mounting plate is secure.

b) Proximity switch should be visually in centre of cam.

c) Tamper proof paint for damage on all proximity switches and cam securing fasteners.

9. Internal: Down Limit Switches

9.1 Check the following items in the barrier down position:

a) Tamper proof paint on fasteners for damage.

9.2 Check the clearance between both limit switches and their cams by inserting a 1.5mm detection gauge, as shown in Figure 6.

Remove the 1.5mm gauge and offer up a 2mm detection gauge, this gauge should not be able to be inserted between the limit switch and its cam, as shown in Figure 7.

Figure 6 - 1.5 mm gauge (Inserted)

Figure 7 - 2 mm gauge (Unable to insert)

10. Lubrication

10.1 Lubricate the door lock and the door hinges.

11. Manual Operation Sequence Test

11.1 Switch the LCU to the hand position.

11.2 Open the door of the machine and release plunger on manual hand pump.

11.3 Release motor break leaver and secure in manual position.

11.4 Toggle direction leaver to the right to lower the boom.

11.5 Insert pump handle in to pump and manually pump to lower the barrier.

a) Check hand pump for ease of operation.

b) Check for leaks around pump pipes and couplings.

11.6 Check that the audible alarms are extinguished and the red road lights are working.

11.7 On manually controlled barriers (MCB, CCTV, OD) check the boom cannot be lifted.

Resistance should be felt when the boom is lifted.

11.8 Toggle direction leaver to the left to raise the boom.

11.9 Pump to raise the barrier.

11.10 When the barrier reaches the fully raised position, check that the red road lights extinguish.

11.11 Release and unlock motor break leaver and secure in normal operating position.

11.12 Push in and turn release plunger in a clockwise direction returning to normal running position.

11.13 Close all doors.

11.14 Repeat 11.2 & 11.13 for other barrier(s).

11.15 Switch the LCU to the 'Local' position and lower barriers. Observe barrier operation and check the following on all barriers:

a) Operation is smooth and not obstructed.

b) The boom comes to rest at a Lowered angle of 0°.

c) The barrier does not oscillate excessively.

d) No excessive noise from pedestal internal mechanism.

e) Lower time is within specification.

f) Audible alarms are extinguished and the red road lights are working.

4 barrier installations only

11.16 Check the distance between the YO-YN and ZO-ZN barrier tips is no more than 65mm.

11.17 With the LCU switch in 'Local Position' start raise sequence. Observe barrier operation and check the following on all barriers:

a) Operation is smooth and not obstructed.

b) The boom comes to rest at a raised angle of 85° – 90°.

c) The barrier does not oscillate excessively.

d) No excessive noise from pedestal internal mechanism.

e) Raise times are within specification.

f) Audible warning and red road lights extinguish when all barriers are fully raised.

11.18 With the LCU switch in 'Local Position' start barrier lower sequence.

11.19 Switch the LCU to the 'Normal' position and hand back to signaller.

12. Final

12.1 Carry out Dynamic Earth Test - NR/SMS/PartB/Test/052.

12.2 If possible, observe the passage of a train in both directions.

PERIODIC TASK

13. Hydraulic Oil

The periodise of the first oil change shall be calculated from the date of manufacture of the pedestal and not the date of installation.

13.1 Drain and replace the hydraulic oil.

END

Includes:	GateCare Power Operated Gate Opener. (POGO)
Excludes:	All other Power Operated Crossing Gates, Mechanically Operated Gates, Wicket Gates, Locked Gates, Hand Operated Gates

Protection arrangements shall be made for both road and rail traffic.

Do not enter the potential entrapment zone whilst the gate is in operation this includes the space between the gate when open and any obstruction such as fences, wall and landscaping.

Figure 1 - Power Operated Gate Opener (POGO)

SERVICE A

1. Gates and Posts

1.1 Remove all rubbish, surface debris, fire risks and vegetation from the vicinity of posts and gates.

1.2 Check the gates are horizontal using a spirit level and adjust as required.

1.3 Check all gates, posts and attachments, particularly for signs of damage or defects.

1.4 Check posts cannot be rotated.

1.5 Check that the rod eye hinge retaining pin and adjustment/securing nuts are in place and that the lock nuts are tight (Figure 1).

1.6 Clean and examine hinges and pivots, then lightly lubricate.

1.7 Check actuators are in line and not binding.

1.8 Check that when the Gate is locked in either the open or closed position, the solenoid sits squarely and in the centre of the jaws through which holds the latch pin.

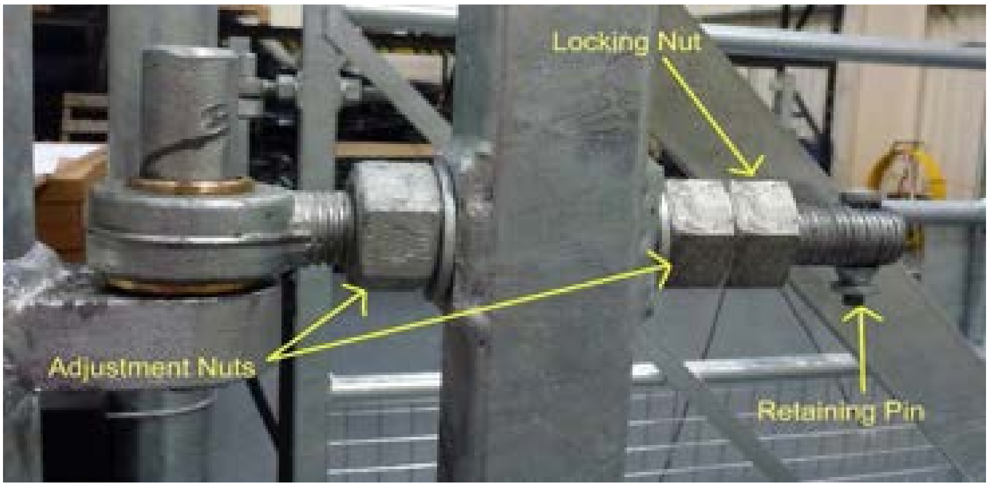


Figure 2 - Hinge and adjustment assembly

1.9 Check the control box and the disconnection boxes are mounted securely.

1.10 Check all operation push buttons are secure.

1.11 Clean and Examine all signage related to the crossing.

1.12 Check the Solar Panel is undamaged. If damaged advise your SM(S).

1.13 Check that there is no obscuration of the solar panel by vegetation etc. If there is or you have concerns this should be reported to your SM(S).

2. Normal Gate Operation Test

2.1 With the gates in the “Closed” position. Depress the green push button. Where linked to an MSL, check a green aspect is displayed on the MSL.

2.2 Check both closed gate solenoid’s release and the gates open smoothly.

2.3 Check both gates complete their travel to the fully open position and the latch pin engages.

2.4 Depress the green push button.

2.5 Check open gate solenoid’s release and the gates release smoothly.

2.6 Check both gates complete their travel to the fully closed position and the latch pin engages.

- If the green push button is depressed while the gates are in motion towards the “closed” position they will immediately stop.
- If the button is pressed again the gates will move back towards the “open”

position.

- If the green button is pressed a third time the gates will again stop.
- And if the button is pressed a fourth time the gate will restart and move to the "closed" position.

If the gate fails to meet any of the above requirements you should refer to NR/SMS/PartB/Test/084 (Power Operated Gate Opener Adjustment / Test).

3. POGO/MSL Link Test [Linked POGO / MSL Sites only]

3.1 With the gates in the "Closed" position, and the MSL displaying a Red aspect. Depress the green push button.

3.2 Check neither of the closed gate solenoids release.

4. Emergency Gate Operation Tests

Test One - Gates Closed

4.1 With the gates in the "Closed" position, depress the red push button on side of the crossing.

4.2 Check both gates immediately open fully and the latch in the open position.

4.3 Repeat 4.1 and 4.2 this time depress the red push button other side of the crossing.

Test Two - Gates Closing

4.4 With the gates in the "Open" position, depress the green button to start the closing sequence.

4.5 During the travel of the gate towards the closed position depress the red emergency button.

4.6 Check both gates immediately stop and reverse direction, opening fully and the latching in the open position.

4.7 Repeat 4.4 and 4.6 this time depress the red push button other gate post.

4.8 Return the gates to the "Closed" position.

5. Obstruction Tests

Test One - Gates moving from the “Closed” to “Open” position

5.1 With the gates in the “Closed” position place an obstruction or stand in the path of one of the gates.

5.2 Depress the green push button.

5.3 Check that when the gate meets the obstruction both gates reverse away and stop.

5.4 Remove the obstruction and depress the green button again.

5.5 Check the gates travels to the “Open” position and latch.

Test Two - Gates moving from the “Open” to “Closed” position

5.6 With the gates in the “Open” position place an obstruction or stand in the path of one of the gates.

5.7 Depress the green push button.

5.8 Check that when the gate meets the obstruction both gates stop and then immediately return to the fully open position and latch.

5.9 Remove the obstruction and depress the green button again.

5.10 Check the gates travel to the “Closed” position and latch.

SERVICE B

6. General

6.1 Check and Lubricate all locks and hinges.

6.2 Check the actuator, and its gate mounting and the manual release pins for signs of damage or wear.

6.3 Check the mounting bolts marked “A” in Figure 3 are secure and torqued to 65lbs/ 77Nm.

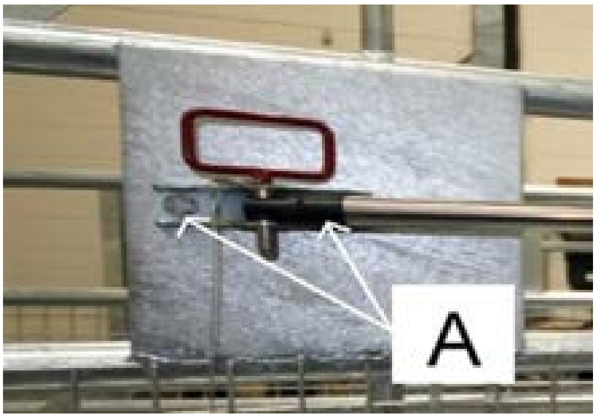


Figure 3 - Actuator pin Gate end

Figure 4 - Actuator pin Post end

6.4 Check the retaining wires on the release pins are serviceable and attached.

6.5 Check the actuator retaining pin at the post end is secured with a padlock. (Figure 4).

6.6 Check the actuator retaining pin for signs of damage or wear.

6.7 Check the following items are secure and adjusted to the correct torque settings:

- The actuator post mounting bracket bolts 48lbs / 66Nm (Figure 5 marked B).
- The actuator mounting extension arm bolt 48lbs / 66Nm (Figure 5 marked C).

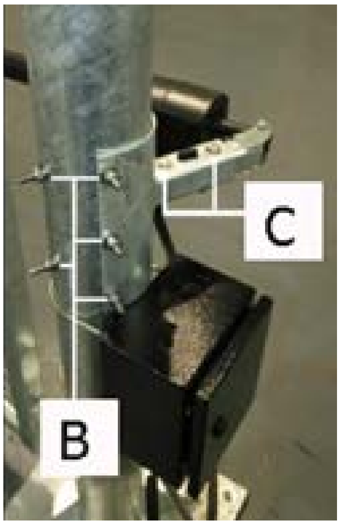


Figure 5 - Actuator mounting bracket

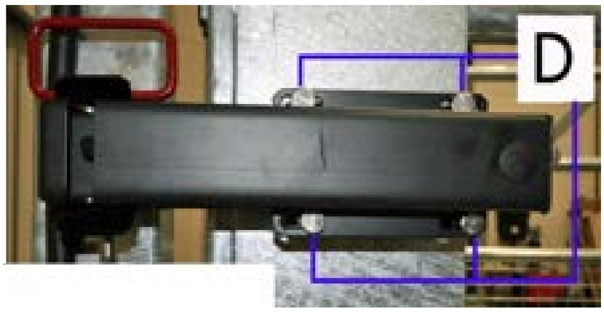


Figure 6 - Solenoid retaining bolts

- The Solenoid Lock bolts 48lbs / 66Nm marked D (Figure 6).

- The two retaining bolts on the reverse side of the gate mounting plate the solenoid is bolted to at 48lbs / 66Nm (Figure 6 marked E).

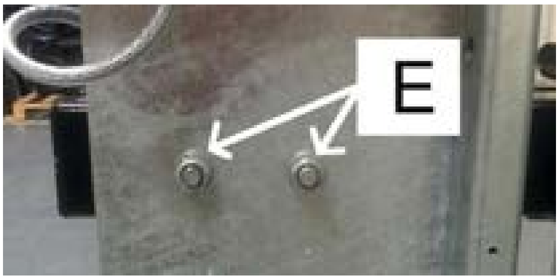


Figure 7 – Reverse side of mounting plate

6.8 Check the condition of all exposed cable.

6.9 Check all exposed cable fittings for tightness.

7. Solar Panel Check

Solar panel and or battery cables shall be insulated when disconnected as the short circuit caused by the cable cores touching will damage or destroy the power generation capabilities of the panel or battery.

7.1 In the cable termination box mounted next to the Crossing Control Box identify the two-core cable from the solar panel and slip the links (Figure 8).

Figure 8 - Solar Panel incoming terminations

7.2 Using a digital voltage meter set on DC check the output from the Solar panel by measuring the voltage across the incoming cable across the incoming terminals.

The expected voltages are related to weather condition and the table below gives the ranges.

Weather conditions	Input voltage range
Bright and sunny	17 to 22 volts
Grey and cloudy	12.7 to 17 volts
Stormy and dark	Less than 12.7

Measure and record the details on the record card. If the reading is lower than 12.7vDC and the weather is not stormy and or dark this should be reported to the SM(S) who should consider replacing the panel.

7.3 Do not reconnect the solar panel at this point.

8. Battery Check

Do not take any readings using the current setting of your meter on this type of battery.

8.1 Check the battery voltage with the solar panel disconnected is above 12.7vDC.

Battery condition	Voltage range
100%	12.7 (or greater)
75%	12.5
50%	12.2
25%	12.0

8.2 Measure and record the details on the record card. Replacement of the battery should be considered if the voltage is lower than 11.5vDC

8.3 Reconnect the solar panel.

END

Includes:	EBI Gate 200 Level Crossing System
Excludes:	All other Types of Level Crossings

Protection / Possession arrangement shall be taken before commencing work on the Level Crossing System.

A general description of the EBI Gate 200 Level Crossing system is given in NR/SMS/Appendix/09.

A record card is available NR/SMS/PartR/AX40-41/RC01, but completion of a card might not be required if the system being maintained has built data recording capabilities.

SERVICE B

1. Mechanical and visual check of wheel sensor RSR123

1.1 Examine the wheel sensor mounting plates and bolts for heavy soiling, security and external damage.

1.2 Check the area around the rail contacts (within 2m) are free of such items as:

a) Visible P/way defects.

b) Metallic debris.

c) New/scrap rails in the four/six foot or cess.

d) Traction bonds.

e) Excessive ballast.

Any problems that cannot be rectified shall be reported to your SM(S).

2. Trackside Connection Box (GAK)

2.1 Check the GAK is secure in the ground, undamaged, and the lid secure.

2.2 Remove the cover and examine the security of cable connections.

2.3 Check cable glands and ties. Unused cable entry points should be sealed.

2.4 Check the cable from the GAK to the wheel sensor is undamaged.

3. Master and Slave Units

3.1 Check the unit is secure in the ground, aligned correctly, undamaged and all doors are secure and padlocked.

3.2 Examine the crossing unit red and green LED’s, clean if required. Rectify if damaged.

3.3 Examine the EBI Gate labelling is legible, clean if required. Rectify if damaged.

3.4 If the crossing is an “On-Demand” type, check the push buttons on each unit are not damaged. Rectify if damaged.

3.5 Check that the Axle Counter Boards (ACB) displays in the master unit are not showing any error messages.

3.6 Check that the Green “DC ok” LED is illuminated on the 24v DC PULS supply unit, If not, this unit shall be replaced (Figure 1).

Figure 1 - 24v DC PULS Unit

Figure 2 - Surge Arrestors

Figure 3 - UPS Controller

3.7 Check that both of the surge arrestors have green indications showing in the status windows as ringed in Figure 2.

3.8 Check that the status LEDs on the UPS Controller has a green indication showing, as ringed in Figure 3.

The EBI Gate 200 incoming supply fuse can be seen in Figure 2 to the left of the two orange surge arrestors.

4. Wheel Sensor Calibration Check (IMC Board)

4.1 Check the “PWR” LEDs on all IMC boards is lit.

4.2 For each IMC Board check the wheel sensor system currents as follows:

a) Plug the multimeter into the 2mm test sockets on the IMC and check if the life-signals for both wheel sensor systems are received.

NOTE: *The voltage should alternate from 0.5 V for 4 seconds to 0.51 V for 2 seconds. If the voltage is constant at 0.5 V no life-signal is present.*

b) Measure the voltage on the IMC for wheel sensor system 1.

c) Measure the voltage on the IMC for wheel sensor system 2.

d) Check that the readings are within the range:

- *System 1: 500mV ± 5% (475mV to 525mV).*
- *System 2: 500mV ± 5% (475mV to 525mV).*

NOTE: *The measured voltage complies with the wheel sensor system current via a 100 Ω shunt (100 mV therefore complies with 1 mA wheel sensor system current).*

e) If the values are not within the stated range check position of the wheel sensor RSR123 as described in NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) - Periodic Task 3, Section 4.

f) If the position of the RSR123 is correct, adjust wheel sensor as described in one of the following:

- For EBIGate 200 NR/SMS/PartB/Test/082 (Frauscher: RSR123 Wheel sensor – associated with IMC & ACB Boards).

g) Recheck if the life-signal and voltages as per steps a) to d).
h) If the life signal is still missing and/or the voltages are out of range, replace the wheel sensor as described in NR/SMTH/Part04/AX40 (Replace a Frauscher wheel sensor RSR123).

5. User Instruction Signs

5.1 Check that user instruction signage is legible and secure. Wipe as necessary to clean.

6. Block Section Test

6.1 Check each ACB axle counting board (Block Section) is counting correctly. NR/SMS/PartB/Test/082 (Frauscher: RSR123 Wheel sensor – associated with IMC & ACB Boards) - Section 3.

7. Operational Sequence Test

7.1 Undertake NR/SMS/PartB/Test/082 (Frauscher: RSR123 Wheel sensor – associated with IMC & ACB Boards) - Section 6.

8. Double Lines Second Train Approaching Sequence Test

8.1 Undertake NR/SMS/PartB/Test/082 (Frauscher: RSR123 Wheel sensor – associated with IMC & ACB Boards) - Section 7.

END

Includes:	Vamos Crossing System
Excludes:	All other Types of Level Crossings

Protection/Possession arrangement shall be taken before commencing work on the Level Crossing System.

A record card is available NR/SMS/PartR/AX40-41/RC01, but completion of a card might not be required if the system being maintained has built data recording capabilities.

SERVICE B

1. Mechanical and visual check of wheel sensor RSR123

1.1 Examine the wheel sensor mounting plates and bolts for heavy soiling, security and external damage.

1.2 Check the area around the rail contacts (within 2m) are free of such items as:

a) Visible P/way defects.

b) Metallic debris.

c) New/scrap rails in the four/six foot or cess.

d) Traction bonds.

e) Excessive ballast.

Any problems that cannot be rectified shall be reported to your SM(S).

2. Trackside Connection Box (GAK)

2.1 Check the GAK is secure in the ground, undamaged, and the lid secure.

2.2 Remove the cover and examine the security of cable connections.

2.3 Check cable glands and ties. Unused cable entry points should be sealed.

2.4 Check the cable from the GAK to the wheel sensor is undamaged.

Figure 1 - GAK

3. Indication Posts

3.1 Check the posts are securely mounted, aligned correctly and undamaged.

3.2 Examine the crossing unit red and green LED's, clean if required. Rectify if damaged.

3.3 Examine the "On demand" unit labelling is legible, clean if required. Rectify if damaged.

4. User Instruction Signs

4.1 Check that user instruction signage is legible and secure. Wipe as necessary to clean.

5. Cabinet

5.1 Check the cabinet is securely mounted, undamaged and locked.

5.2 Check for water ingress and other contaminates.

5.3 Check cables and or plug couplers are undamaged and secure.

5.4 Scroll through the Telemetry Module screens to check there are no failure modes present, if one is noted investigate and correct the issue.

Figure 2 - Telemetry Module

5.5 Check that the Green "DC ok" LED is illuminated on the 24v DC PULS supply unit and the green "Status" light on the Buffer Module are both lit. If not, the failed unit needs to be replaced. Figure 3.

Figure 3 – PULS

5.6 Check that both of the surge arrestors have green indications showing in the status windows. Figure 4.

Figure 4 – Surge Arrestors

6. Wheel Sensor Calibration Check (IMC Board)

6.1 Check the “PWR” LEDs on all IMC boards are lit.

6.2 For each IMC Board check the wheel sensor system currents as follows:

a) Plug the multimeter into the 2mm test sockets on the IMC and check if the life-signals for both wheel sensor systems are received.

NOTE: *The voltage should alternate from 0.5 V for 4 seconds to 0.51 V for 2 seconds. If the voltage is constant at 0.5 V no life-signal is present.*

b) Record the lowest reading, measure the voltage on the IMC for wheel sensor system 1.

c) Record the highest reading, measure the voltage on the IMC for wheel sensor system 2.

d) Check that the readings are within the range:

- *System 1: 500mV ± 5% (475mV to 525mV).*
- *System 2: 500mV ± 5% (475mV to 525mV).*

NOTE: *The measured voltage complies with the wheel sensor system current via a 100 Ω shunt (100 mV therefore complies with 1 mA wheel sensor system current).*

e) If the values are not within the stated range check position of the wheel sensor RSR123 as described in NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) - Periodic Task 3, Section 4

f) If the position of the RSR123 is correct, adjust wheel sensor as described in NR/SMS/PartB/Test/157 (Frauscher: RSR123 Wheel sensor – associated with IMC Boards).

g) Recheck if the life-signal and voltages as per steps a) to d).

h) If the life signal is still missing and/or the voltages are out of range, replace the wheel sensor as described in NR/SMTH/Part04/AX40 (Replace a Frauscher wheel sensor RSR123).

7. Rail Sensor Test (Detection Capability)

7.1 Undertake NR/SMS/PartB/Test157 (Frauscher: RSR123 Wheel sensor – associated with IMC Boards) - Section 3.

8. Operational Sequence Test

8.1 Undertake NR/SMS/PartB/Test159 (Vamos Sequence Test).

END

Includes:	EBI Gate 630 Barrier Machine
Exclude:	All other types of Barrier Machine

Appropriate Protection / Possession arrangement shall be taken before commencing work on the Level Crossing System.

Take necessary precautions when working on or near the vicinity of high voltages (230V AC), only use approved insulated tools.

Take necessary precautions when working on or near the vicinity of the batteries, only use approved insulated tools.

For further detail see SMS Appendix 20 – General Information on the EBI Gate 630 / 2000 Level Crossing System.

SERVICE B

1. External Inspection of Control Hut

1.1 Remove potential obstructions and fire risks from around the Control Hut.

1.2 Check the following and rectify if necessary:

a) The foundations for signs of damage.

b) The hut is secure on its base and fixing bolts are free from corrosion.

c) The hut exterior is not damaged.

d) The external signage is clear and legible.

e) The cable runs / troughing are sealed and undamaged.

f) The cable entry ducts are sealed.

g) The door is locked with both locks and is secure.

1.3 Check the earth connection is securely connected to the hut earthing point:

a) Check its continuity is less than 5 Ohms and that it is free from earth faults

2. Internal Inspection of Control Hut

2.1 Check the following and rectify if necessary:

a) Signs of water ingress.

b) Signs of rodent and insect ingress.

c) General cleanliness and remove any accumulated rubbish.

d) Visually check the condition of the equipment (components, wiring and terminal connections) installed on the racks for any signs of damage or over-heating.

e) Any plug couplers for damage and they are securely fitted.

f) The high voltage protection covers are fitted and secure.

g) The condition of the earthing connections / cables to each module.

h) The condition of overvoltage protection components are fitted and secure (the output terminals on the lower part of the racks).

i) Battery terminals for any corrosion.

j) The operation and thermostat settings of the heaters and fans:

- Fan temperature thermostat setting = 30^{o}C
- Heater temperature thermostat setting = 5^{o}C

3. Internal Equipment

3.1 Battery Condition Check:

a) Turn off fuses ZA, ZB and ZC

b) Check voltage on each battery set is at least 26V DC.

c) Turn on fuses ZA, ZB and ZC

3.2 Check the correct operation of the Local Control Unit (LCU):

a) Operate the LCU to raise the barriers

b) Operate the LCU to lower the barriers

3.3 Check the correct operation of the Remote Control Device (ERP-9):

a) Operate the ERP-9 to raise and lower the barriers

3.4 Check the correct operation of the RCD's:

a) Operate the RCD by pressing the units 'TEST' button

b) A mains power failure should be reported on the local diagnostic panel or ERP-9.

c) Reset the RCD

d) Check the fault has cleared on local diagnostic panel or ERP-9.

3.5 Check the operation of the earth leakage detector modules (Bender Units); MD-A, MD-B and MD-C on both control channels A and B:

a) Observe that the resistance value displayed on the front of each module is greater than 110K Ohms.

b) Connect a 90K Ohm resistor between +UA and PE

c) An acoustic indication (“Click”) should be heard from the module

d) A failure should be reported on the local diagnostic panel

e) Remove the resistor

f) Check that after 3 minutes, no failures are shown on the local diagnostic panel.

g) Connect a 90K Ohm resistor between +UB and PE:

h) An acoustic indication (“Click”) should be heard from the module

i) A failure should be reported on the local diagnostic panel

j) Remove the resistor

k) Check that after 3 minutes, no failures are shown on the local diagnostic panel.

4. Final Check

4.1 If possible observe the passage of a train.

4.2 After inspection the hut door shall be locked using both door locks.

End

Includes:	Flex Crossing System
Excludes:	All other Types of Crossings

GENERAL

Protection/Possession arrangement shall be taken before commencing work on the Crossing System.

A record card is available NR/SMS/PartR/AX40-41/RC01, but completion of a card might not be required if the system being maintained has internal data recording capabilities.

SERVICE B

1. Mechanical and visual check of wheel sensor RSR123

1.1 Examine the wheel sensor mounting plates and bolts for heavy soiling, security and external damage.

1.2 Check the area around the rail contacts (within 2m) are free of such items as:

a) Visible P/way defects.

b) Metallic debris.

c) New/scrap rails in the four/six foot or cess.

d) Traction bonds.

e) Excessive ballast.

Any problems that cannot be rectified shall be reported to your SM(S).

2. Trackside Connection Box (GAK)

2.1 Check the GAK is secure in the ground, undamaged, and the lid secure, see Figure 1.

2.2 Remove the cover and examine the security of cable connections.

2.3 Check cable glands and ties. Unused cable entry points shall be sealed.

2.4 Check the cable from the GAK to the wheel sensor is undamaged and stil secured to sleepers etc.

Figure 1 - GAK

3. Indication Posts

3.1 Check the posts are securely mounted, aligned correctly and undamaged.

3.2 Examine the crossing unit red and green LED’s, clean if required. Rectify if damaged.

4. User Instruction Signs

4.1 Check that user instruction signage is legible and secure. Wipe as necessary to clean.

5. Cabinet

5.1 Check the cabinet is securely mounted, undamaged and locked.

5.2 Check for water ingress and other contaminates.

5.3 Check cables and or plug couplers are undamaged and secure.

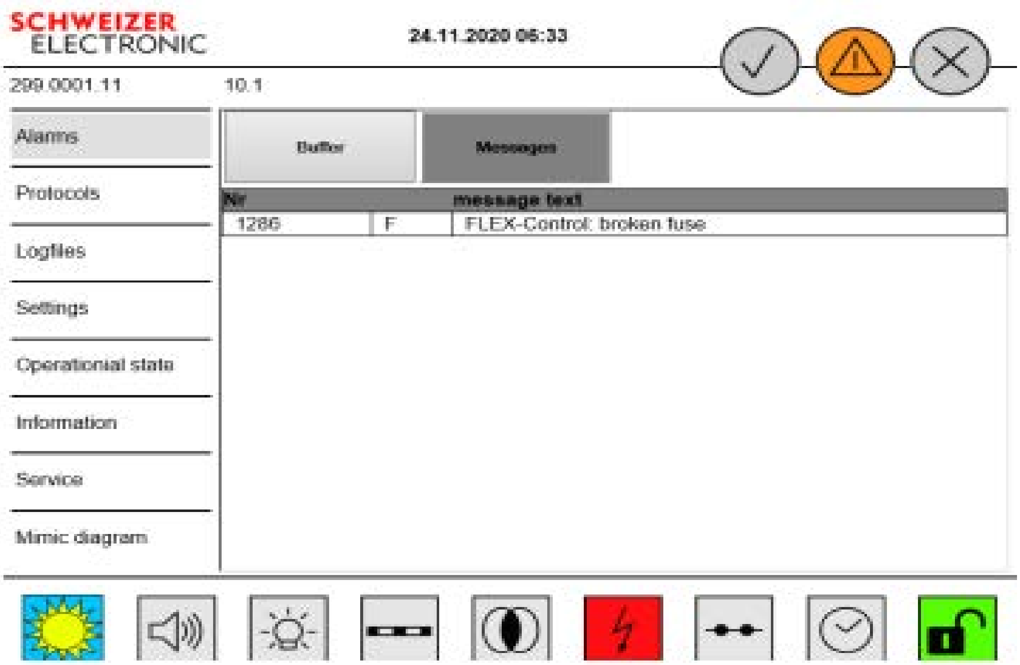


Figure 2 - Flex Life

5.4 Scroll through the Flex Life Log Files to check there are no failures present, if one is noted investigate and correct the issue, see Figure 2.

5.5 Check that the Green “operation” LED is illuminated on the 24v DC Akkutec Battery Charger and the Red “fault” LED isn’t illumiated. If the “fault” LED is illuminated investigate the failure, see Figure 3.

Figure 3 - Akkutec Battery Charger

Figure 4 - Surge Arrestors

5.6 Check that both of the surge arrestors have green indications showing in the status windows, see Figure 4.

6. Wheel Sensor Calibration Check (IMC Board)

6.1 Check the “PWR” LEDs on all IMC boards are lit.

6.2 For each IMC Board check the wheel sensor system currents as follows:

a) Plug the multimeter into the 2mm test sockets on the IMC and check if the life-signals for both wheel sensor systems are received.

NOTE: *The voltage should alternate from 0.5 V for 4 seconds to 0.51 V for 2 seconds. If the voltage is constant at 0.5 V no life-signal is present.*

b) Taking the lowest reading, measure the voltage on the IMC for wheel sensor system 1.

c) Again taking the highest reading, measure the voltage on the IMC for wheel sensor system 2.

d) Check that the readings are within the range:

- *System 1: 500mV ± 5% (475mV to 525mV).*
- *System 2: 500mV ± 5% (475mV to 525mV).*

NOTE: *The measured voltage complies with the wheel sensor system current via a 100 Ω shunt (100 mV therefore complies with 1 mA wheel sensor system current).*

e) If the values are not within the stated range, check position of the wheel sensor RSR123 as described in NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) - Periodic Task 3, Section 3.

f) If the position of the RSR123 is correct, adjust wheel sensor as described in NR/SMS/PartB/Test/157 (Frauscher: RSR123 Wheel sensor Adjustment – associated with IMC Boards).

g) Recheck if the life-signal and voltages as per steps a) to d).

h) If the life signal is still missing and/or the voltages are out of range, replace the wheel sensor as described in NR/SMTH/Part04/AX40 (Replace a Frauscher wheel sensor RSR123).

7. Rail Sensor Test (Detection Capability)

7.1 Undertake NR/SMS/PartB/Test157 (Frauscher: RSR123 Wheel sensor Adjustment – associated with IMC Boards) - Section 3.

8. Operational Sequence Test

8.1 Undertake NR/SMS/PartB/Test161 (Flex – Operational Sequence Test).

END

Includes:	Mechanically Operated Gates, Wicket Gates, Locked Gates, Hand Operated Gates
Excludes:	All other types of gate or barrier

GENERAL

Take special care when working within the area of a level crossing. Protection arrangements shall be made for both road and rail traffic.

Some mechanical gate equipment is located sub-surface (gate stops and wicket gate mechanisms etc) and is only accessible by inspection covers in the road.

Tasks that require the locks, interlocking or protecting signals to be operated, shall be undertaken after liaising with the Signaller or Crossing Keeper.

Not all the tasks in each section will be applicable to all types of gate.

Many mechanical gate components were manufactured in pre-grouping days of the railways (pre 1923). Therefore, new or replacement parts are getting increasingly difficult to obtain/source.

In some cases, spare parts are no longer available at all, therefore great care shall be taken during any maintenance activity to avoid damage or breakage to any components.

SERVICE A

1. External

1.1 Remove all rubbish, surface debris and fire risks from the vicinity of posts, gates, gate locks, stops (road and rail) and rodding drive.

2. Posts and Gates (all types)

2.1 Check all gates, posts and attachments, particularly for signs of rot and damage.

2.2 Check vertical alignment.

2.3 Clean and examine hinges and pivots, then lightly lubricate.

Mechanical gates shall operate smoothly without the need for excessive force. Hand gates shall swing freely.

2.4 Check gate tie-bars and fixings.

2.5 Check the adjustment of each gate.

Adjust gate so that it does not foul the roadway or rails but operates correctly and engages with all the gate stops.

2.6 Check that the gates close the road/footway and cannot be inadvertently pushed open when locked.

2.7 Check any self-closing mechanism fitted to a gate is effective.

2.8 Lubricate the slide bar on locking wicket gates.

3. Gates (mechanically operated and manned)

3.1 Check that the gate is painted white and (if provided) any reflectors/reflective strips are secure and in good order.

Report any gates that require re-painting as corrective maintenance.

3.2 Check that red targets are fitted and are secure. Wash and wipe as necessary. Targets require to be retro-reflective.

3.3 Check that the gate lights are securely fitted, working correctly and correctly aligned for road and rail traffic. Rectify as necessary. Wipe all lenses/glasses.

3.4 On externally electrically powered gate lamps check that all cabling, fixings, junction boxes and glands are secure and effective.

4. Gate Stops

4.1 Before exposing road stops, the correct road protection shall be in place.

Road stops can be seriously affected when the road is salted or gritted.

Extra visits may be required, especially during winter months. The salt is very corrosive, and components must be protected by regular cleaning.

There will be heavy wear on the pins in particular. It is good practice to have a spare set of stops available as immediate replacement.

4.2 Check smooth operation of the stops when worked by the lever or wheel.

4.3 Check that the gates are correctly held in position and no over-riding can occur. The gates shall not be able to be pushed over the stops. Rectify as necessary.

Incorrectly adjusted gate stops can cause the gates to open in front of an approaching train. If not held securely by the stops and adjustment is not possible inform the Signaller immediately and report as corrective maintenance.

4.4 Where auto-raising stops are fitted, check the road stops operate satisfactorily and do not rise too soon.

4.5 Remove dirt and debris from the gate stop assembly. Check that the lid(s) fit securely.

4.6 Examine, clean and lubricate all component parts.

5. Gate Drive and Rodding to Locks

5.1 Examine the drive and rodding from the frame.

5.2 Check benches and foundations for stability, security damage, and deterioration.

Movement of the bench can lead to loss of stroke. Wooden benches can rot internally.

5.3 Scrape, wipe and clean all cranks as necessary. Check for security. Lubricate bearings and cotter pins.

NOTE: *Loose cranks can lead to loss of stroke.*

Items with grease nipples shall have new grease pumped into them to expel the existing grease in the bearing/pin.

Oil lubricated cranks shall have new oil added to flood the bearing/pin.

Check that any bearing covers (e.g. 'Top Hats') are replaced or renewed if missing. Wipe away excess grease and oil.

5.4 Examine ducting and boxing for signs of damage and subsidence.

5.5 Check rollers, pins and split pins. Do not lubricate.

6. Gate Wheels

Many variations exist. Generally, worm drives are of two or three start threads; these are not interchangeable.

The worm and nut should be treated as a unit and if changed, will require 'working in'. Gears come as a pair.

The castings that support the drive are generally unavailable. Care is required with all gate wheel components.

6.1 Clean gate wheels. All old lubrication shall be removed.

6.2 Check security of floor fittings. Look particularly for signs of stress to the floor.

6.3 Check the castings.

6.4 Observe the operation of the wheel and gears or worm drive. Check that no teeth are missing, or the nut is not slipping on the worm.

6.5 Lightly lubricate and wipe away excess.

6.6 Observe smooth operation.

7. Gate Locks (hand operated manned interlocked gates)

Fortress key locks are covered in NR/SMS/PartC/LC86 (Fortress Key Locks).

There are different types of locks for these gates:

a) **Keylocks.** Post mounted lock, operated by a gate bolt and interlocked release key from the frame/panel.

b) **Black's Lock.** Post mounted lock, operated by a gate bolt and rodding from an interlocked lever.

c) **Bottle Lock.** Sub surface lock, operated by a gate bolt and rodding from an interlocked lever.

There are different designs and patterns. Parts are not interchangeable between designs and many are strategic spares.

Many components are right or left -handed and cannot be swapped.

In some cases, springs (e.g. in Keylocks and Black's Locks) are very small and might spring out when the cover is removed extreme care should be taken.

<u>Keylocks (not Fortress style) and Black's Locks</u>

7.1 Observe the operation of the gate lock.

7.2 Check mountings and fixings and then clean the exterior.

7.3 Remove the cover with care and clean the interior.

7.4 Examine the castings, springs, set screws and all interior fittings. Change weak springs.

7.5 Where possible, observe the operation with the cover removed. Take care not to disengage the springs.

7.6 Check the lock operates satisfactorily.

7.7 Replace and secure the lid and check the gate locks operate correctly.

<u>Bottle Locks</u>

7.8 Check the gate locking bolt for security, wear, and damage.

7.9 Remove any debris and scrape dirt from the road plates.

7.10 Remove covers and remove any debris from around the lock assembly. Examine the lock components. Check for cracks in the casting and excessive movement during the passage of road traffic.

7.11 Sparingly lubricate the lock assembly. Excessive lubrication can cause the bottle lock to move with traffic vibration.

7.12 Replace the covers and check the lock operates smoothly and correctly.

8. Gate Locks (hand operated user worked gates)

8.1 Check the gate lock works correctly and securely holds the gate in its closed position.

Gates on bridleways require to have latches that can be operated by mounted riders.

8.2 If provided, check the catches/stops, which hold the gate open, work correctly whilst in use.

SERVICE B

9. Keylocks (not Fortress style)

9.1 Check that the emergency keys are in good condition, painted red, and sealed in a container.

The seal will, in most cases, have to be broken to examine the keys.

9.2 Check it is correctly resealed after this task.

END

Equipment Identification

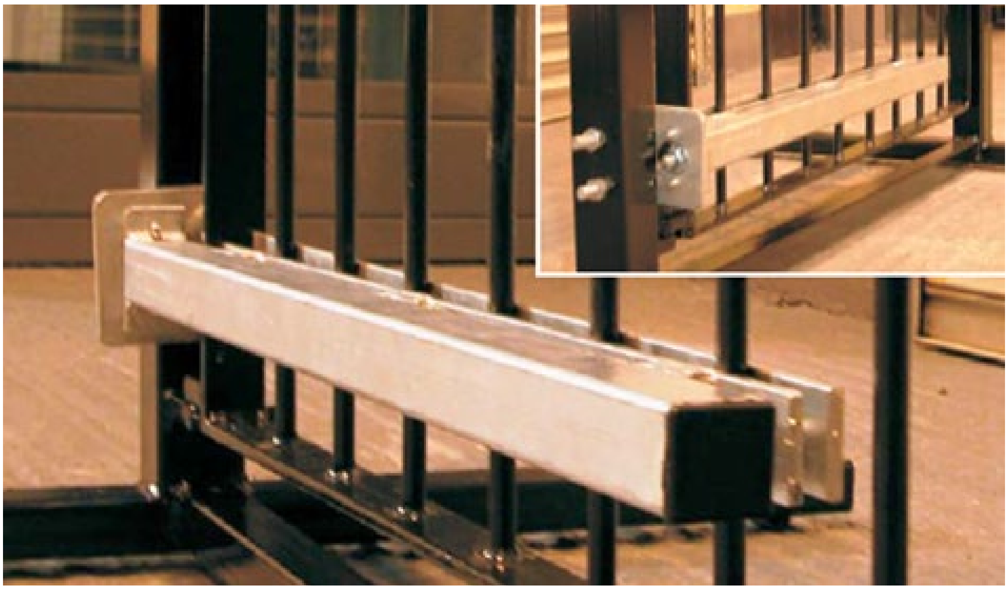


Figure 1 - Automatic Gate Closer

SERVICE A

1. Automatic Gate Closer

1.1 Check mountings and fixings related to the gate closer are secure and undamaged.

1.2 Clean the exteriors

1.3 Check the chassis and clamp plate for wear, damage and contamination (i.e. paint and grease).

1.4 If required, apply lithium grease to the end fixings & joints on both the gatepost & gate surfaces.

1.5 Open and close the gate checking the closer remains in a horizontal position at all times.

1.6 Lubricate the gate hinges.

End

To test the mechanical locking, (NR/SMS/LC81) will require the electromagnetic locks to be temporarily disabled.

Electromagnetic locks can be fitted to wicket gates as an addition to normal mechanical locking, or as the only form of locking the wicket gate.

The electromagnetic lock can be interlocked with signals.

SERVICE A

1 Electromagnetic Lock

1.1 Check mountings and fixings of the locks for security and damage

1.2 Clean the lock equipment.

1.3 Check the strike plate faces and lock bodies for wear, damage and contamination (i.e. paint and grease).

1.4 Clean the strike plate and lock bodies.

1.5 Examine the cables to the locks and cable entry glands.

1.6 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and padlocked and check terminals for security, corrosion, arcing and risk of short circuit/ disconnection.

1.7 Clean the indication panel in the signal box.

1.8 Carry out SMS Test 210 Electromagnetic Lock Test.

End

Includes:	Fortress key lock equipment
Excludes:	Any other type of key lock

General

Tasks that require the locks to be operated with the keys shall be undertaken with the permission of and in liaison with the Signaller or Crossing Keeper.

Any adjustments of the lock and its associated equipment shall be undertaken as corrective maintenance.

The Fortress key locking system is a range of large stainless steel locks and keys together with matching solenoid and switch contacts. These are used to interlock mechanical gates with local signalling. Various combinations of the Fortress range may be used at different sites.

SERVICE A

1. All Outside Equipment

1.1 Clean the exterior equipment and examine the equipment for mounting and security.

1.2 Check for any damage, bending or cracking of the Fortress mountings and brackets.

It should not normally be necessary to lubricate the Fortress fittings, but a light oil can be applied if necessary, cleaning up any surplus afterwards.

1.3 Check that the associated fittings on the post that locate and hold the gate (the Gate Roller and Post Ramp), are secure and holding the gate in the correct position for the lock to engage cleanly.

1.4 Lightly lubricate the roller if required and observe the roller for smooth operation.

1.5 Observe that the roller goes on to the ramp without undue force. Adjust ramp and gate as required to allow this.

1.6 Observe that the bolt is aligned with the lock aperture and travels smoothly into the lock. Adjust ramp and gate as required to allow this

1.7 Operate the bolt and lock to release the key and check for smooth operation.

Check that the key cannot be withdrawn until the bolt is in the unit.

2. Internal Equipment - Mechanical Locks

2.1 Clean the exterior of the fittings if necessary.

2.2 Check mountings and fixings.

2.3 Obtain the key/s. Operate the lock and check for smooth operation with no undue play in the mechanism. Light oil may be applied if necessary, cleaning up any surplus.

3. Internal Equipment - Solenoid Locked Key Unit

3.1 Clean the exterior of the fittings if necessary.

3.2 Obtain the key/s. Operate the lock and check for smooth operation. Light oil may be applied if necessary, cleaning up any surplus.

SERVICE B

4. Internal Equipment - Solenoid locked Key Unit

4.1 Remove the cover of the solenoid lock and examine the mechanism. Clean as necessary.

4.2 Operate the lock and check that the electric lock plunger travels freely and fully locks the lock slide.

4.3 Using a meter across each lock proving contacts. In turn test that they are only made when the electric lock plunger is fully or nearly fully home and break cleanly when the lock is withdrawn.

4.4 Replace the cover.

4.5 Check that the emergency keys are located in a sealed container. Open the container and confirm that they are in good condition.

4.6 Check they correctly operate the locks. Return the emergency keys to the container and re-seal.

END

General

You shall be competent and authorised in accordance with Network Rail standards to maintain, repair, adjust, or test mechanical locking, lever locks, and circuit controllers.

If you find a deficiency or failure that could affect the safe running of trains, or the integrity of the signalling system, you shall report it immediately to the Signaller and your SM(S).

Where signals have to be disconnected during any work on locking, the locking shall be fully tested prior to reconnection and return to service.

All work on locking and signalling equipment shall fully completed and tested before advising the Signaller that the equipment is in working order.

Adjustment, repair, or replacement of locking components shall only be carried out by competent staff who are authorised to work on the equipment.

An incorrect adjustment can result in an electric lock being out of correspondence with the lever position or key and therefore cause a wrong side failure.

If you are not deemed competent and adjustment or repair is necessary, never attempt to work on the equipment yourself. Contact your SM(S) for the necessary arrangements to be made.

The lids of any locking boxes shall not be removed unless you have been certified as competent to do so.

Many frames were manufactured in pre-grouping days of the railways (pre 1923) therefore new or replacement parts are getting increasingly difficult to obtain/source.

In some cases, spare parts are no longer available at all. Every effort shall be taken during any maintenance activity to avoid damage or breakage to frame components.

More information on lever frames can be obtained from NR/L3/SIG/19014.

NR/SMS/PartC/LV99 (Lever Frame Overhaul) describes the scope of work required for a lever frame overhaul.

Overhauls are to be managed in accordance with Network Rail national procedures and/or any local procedures.

1. Frame Types

Wherever possible the NR/SMS specific to the frame type should be used.

Where the frame you are maintaining is not included in this list, NR/SMS/PartC/LV11 (Lever Frames – Non-Specific) shall be used.

There have been many different manufactures of lever frames throughout the era of mechanical signalling.

Many lever frames have been re-used in different signal boxes from which they were originally designed and this process would have resulted in the frame being re-locked.

In some cases, the frames have been re-locked or modified a manufacturing company different from their original designer and this makes identification of a frame type, age and locking difficult.

It is important to correctly identify the frame, manufacturers plates cannot always be relied upon to correctly identify the frame or locking type, if in doubt ask your SM(S).

2. Levers

The colour of the lever denotes its function (a list of these colours can be found in Appendix A).

On most makes of frame, an associated name plate or the pull plate also describes the function.

A lever that operates an electrical item as opposed to a mechanical one has a reduced length handle (e.g. ground frame release or motor operated points).

3. Periodic Testing

Testing of lever frames shall only be carried out by persons who are certified for this task, competent and experienced in the type and complexity of the frame under test.

An up to date testing copy of the locking table is also to be available for recording the test.

The only exception to this, are simple ground frames (e.g. 1 release's 2, 2 reverse locks 1) that can be tested by a competent Technician using either a locking table or the layout diagram/plate legends.

4. Lubrication

Lubrication is to be carried out sparingly and with care. Whenever possible, any excess oil or grease should be wiped away. Oil spilt on insulation causes gradual degradation.

Oil collects dirt and therefore increases wear. An approved oil/lubricant should be used.

Before applying new lubricant, the old is to be removed.

5. Maintenance - General Guidance

Report any excessive dust, rubbish or soiling left by operating staff, to your SM(S).

Do not destroy any re-usable or repairable component.

NOTE: *All lever frame components are considered as strategic spares.*

Slack locking shall be remedied at the earliest opportunity.

6. Pins

Pins shall be examined for wear.

Oversize pins might be needed to take up slack in either the tappet or lever.

Before fitting oversize pins, check this does not compromise other components or affect the locking.

Keep a record of oversize pins fitted, identifying the following overleaf:

a) Original diameter and length.

b) New diameter and length.

c) Date fitted.

When reaming or drilling to fit new pins these shall be marked by lever number and identified by an X if oversize.

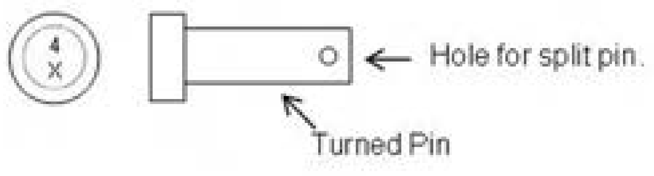


Figure 1 – Turned Pin

7. Split Pins

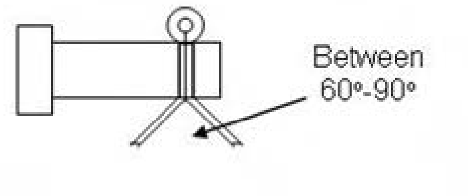


Figure 2 – Fitting of Split Pins

Split pins shall be of the correct type (i.e. not metric in imperial holes).

The length of the split pin should be approximately twice that of the turned pin diameter.

The split pin shall be a "good" fit but still free to move. Each leg shall be opened as shown in Figure 2.

8. Imperial/Metric

Imperial nuts/bolts, pins and split pins shall be used wherever possible, but due to them becoming more difficult to source, metric items might have to be used.

If metric items are used, they shall not be mixed with imperial (i.e. an imperial bolt with a metric nut) as this could result in damage and a failure of the fastening.

Record any metric fastenings used.

9. Records

To monitor the condition of a frame and to identify any signs of serious wear, it is good practice to maintain the following records:

a) Components found out of adjustment.

b) Components found to be slack.

c) Components renewed.

These records should also contain details of how the issue was identified:

a) As a result of above General maintenance.

Or

b) As result of a failure or reported issue

Each component should be recorded by lever number. The record card for each visit should be returned to your SM(S) so that the general condition can be monitored.

Renewal and overhaul can then be programmed.

LEVER LOCKS

General

More information on these items can be obtained from NR/L3/SIG/19025.

10. Force Down Feature

This feature is a mechanical device provided on many locks to force the lock to the locked position immediately before it engages with the locking face of the lock notch.

This operates whether the lock has merely failed to respond to gravity or where the operating coil remains energised as a result of a fault.

Where the force down feature is not provided, locks are restricted to horizontal mounting.

The principle of force down as applied to an SGE Type GF lock is illustrated in Figure 3.

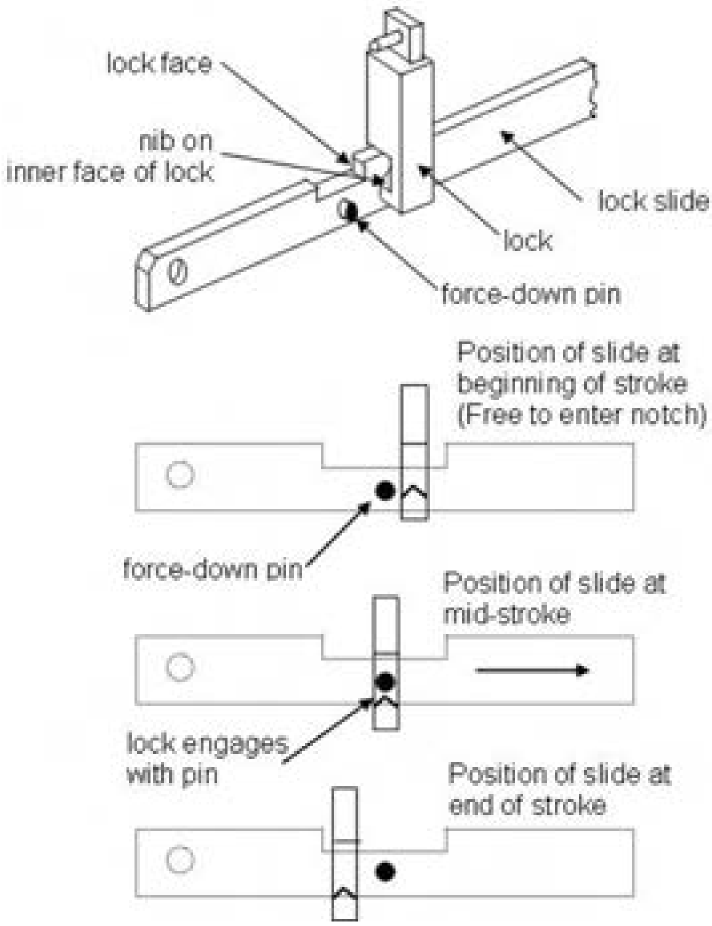


Figure 3 - Force Down Feature (Lock Body Omitted for Clarity)

11. Lock Slide

For locking to be effective, the lock has to fully engage in the correct lock notch.

If the face of the lock notch is worn, the lock might only partially engage and there is a possibility that the lock could ‘creep’ up the lock face and falsely release the lever (See Figure 4).

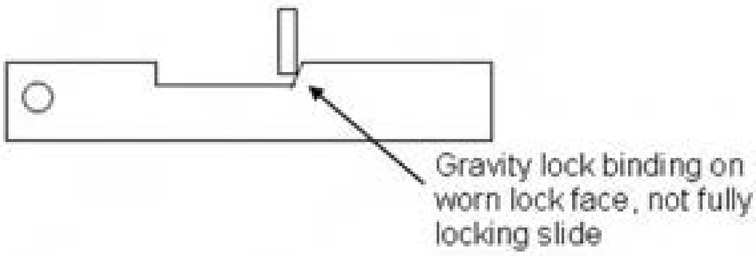


Figure 4 – Worn Lock Face

When cutting a lock, it is essential that the lock face is not chamfered and if anything, the lock face should be slightly undercut (See Figure 5).

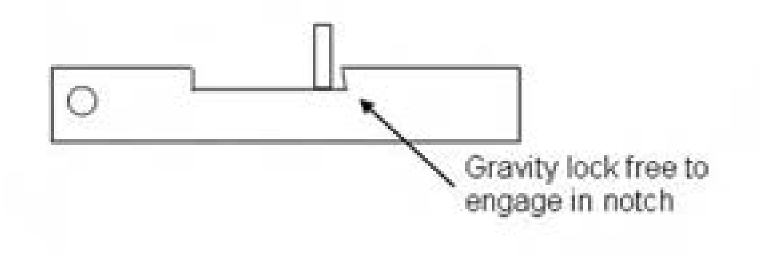


Figure 5 – Unworn Lock Face

12. Economiser Switch

An economiser switch allows the lever lock coil to energised only when operation of the lock is required.

This is a power saving function that reduces the drain on the batteries and prevents overheating of the coil.

It is essential that the switch operates correctly. Different types of lock have various arrangements of economiser switch. Alternatively, separate plungers or foot plungers might be provided.

13. SGE Type GF Lock

A roller on a pivoted lever engages in a small depression on the underside of the lock slide (Figure 6). When engaged, the coil is disconnected and so the depressions are positioned so that the contacts are only made during the stroke.

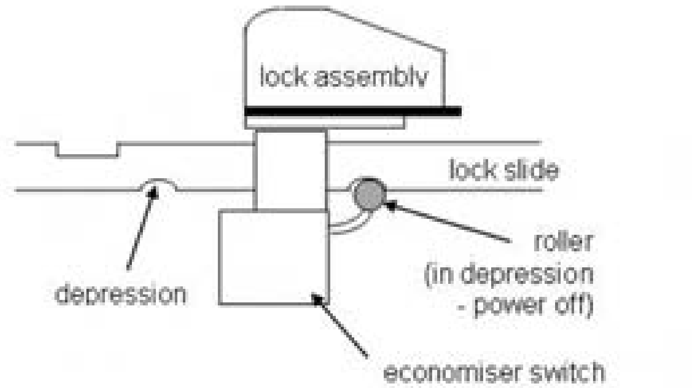


Figure 6 - Economiser

14. SGE Type GA Lock

A similar arrangement is provided on the GA lock, the depressions being located on the side of the lock slide.

Depressions vary in shape and form. To allow correct operation, it is essential that the depressions are kept free from dirt.

15. Western Region 42Ω Lever Locks

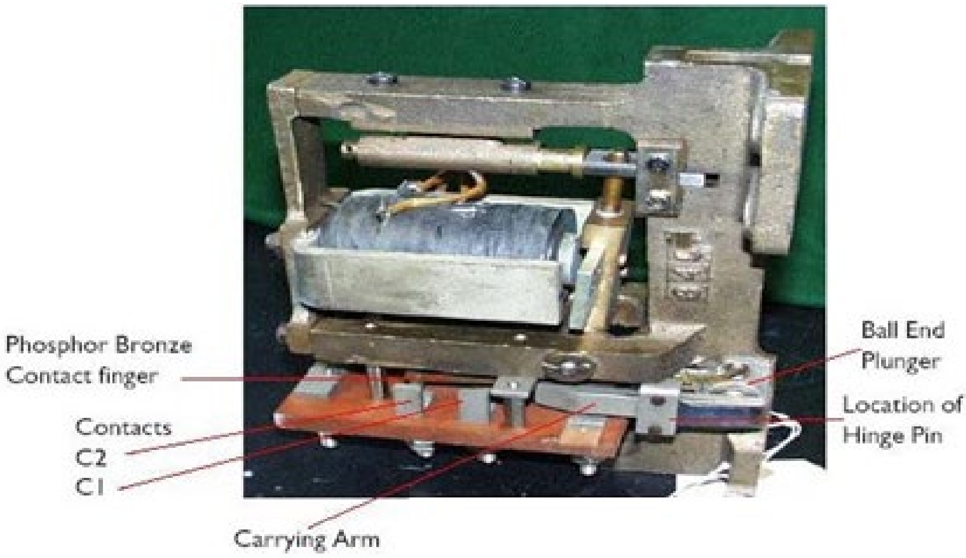


Figure 7 – WR 42Ω Lever Lock

Due to Ex-GWR lever frames having been installed in signal boxes other than the former BR-WR, these lever locks can be found in other areas.

Due to their design there is a possibility of a WSF occurring as wearing of mating surfaces occurs.

Care shall be taken in the gauging of contacts to prevent incorrect operation; any gauging that does not meet the criteria shall be reported to your SM(S) immediately.

Due to the intricate nature of the lock, any repair, adjustments or re-servicing work (other than those considered to be 1st line maintenance, ask your SM(S)) shall be carried out in a workshop environment by specialist staff.

COMBINED LOCK & CIRCUIT CONTROLLER

16. Ex WR Vertical Frames

On this type of frame, a combined lock and circuit controller is fitted directly beneath and is driven directly by the tappet.

There is a risk of oil draining from the locking above into the lever lock assembly.

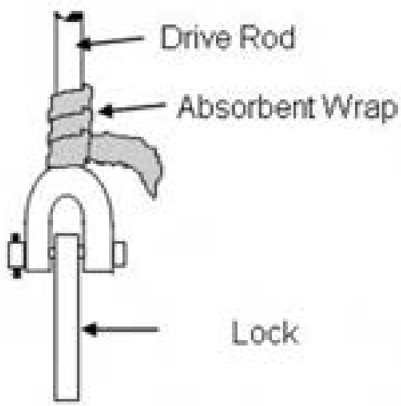


Figure 8 – Wrapping of drive rods

To prevent this, an absorbent wrap shall be tightly wrapped around the drive rod just above the lower fork connection to the lock slide and secured with a cable tie (Figure 8).

Absorbent wraps are made from jute scrim, a sack like material, cut into lengths of 450mm. The wraps should be renewed when they become saturated.

17. SGE Type GA - Slide Travel

If the travel of the lock slide is excessive or incorrectly adjusted, the semi-circular cam gear turns too far and become disengaged from the driving rack. This causes the RE band to remain made when the lever is returned to normal.

An indication of incorrect adjustment can be seen by relating the split pin (block or riveted stud) at each end of the lock slide to the lock body. If either pin is striking the lock body, is bent, or has sheared off, the lock slide is out of adjustment.

Before adjusting or testing the equipment, the Signaller shall be informed, and arrangements made to guarantee the signalling system is not compromised.

The equipment shall be tested before it is returned to service. To check the position of the cam, remove the cover and observe the position of the cam drive gear.

The edge of the cam should be approximately aligned with the edge of the lock slide. Operate the lever, the cam should be approximately aligned with the other side of the lock slide. Figure 9 shows the correct setting and Figure 10 the incorrect setting

Figure 9 – Correct Setting

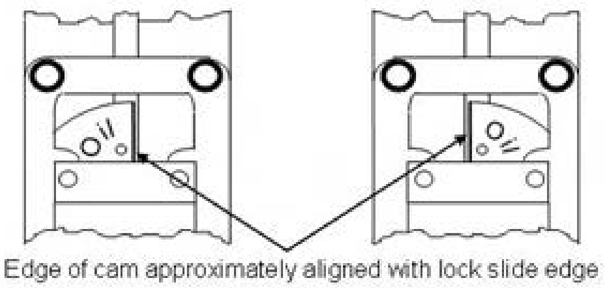
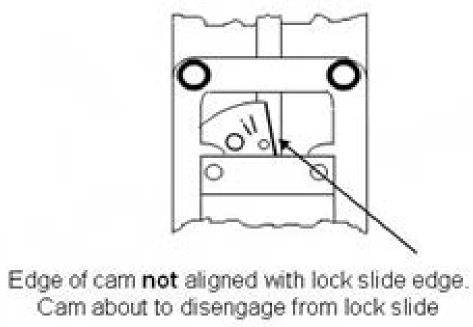


Figure 10 – Incorrect Setting



CIRCUIT CONTROLLERS

18. Field & Grant 4 or 6 way types

Early models use NYLATRON bearings to support the drive shaft of the operating arm. This material proved unsuitable as it tended to swell in damp conditions and shall be replaced.

New bearings with an OILITE sleeve and an improved gasket are identified by a ‘P’ stamped adjacent to the Tyers logo on the lid. A later modification uses an OILITE bearing with a modified hexagonal drive shaft.

The bearing is impregnated with oil during manufacture and is labelled ‘DO NOT OIL’. This modification is identified by an ‘R’ stamped adjacent to the Tyers logo on the lid.

NOTE: *These bearings shall not be oiled as this degrades the bearing material.*

Only type P or R are permitted for use. Unmodified versions shall be reported to your SM(S) and a replacement obtained.

NOTE: *The drive shafts in some R type units have become seized due to drying out. In such cases the unit shall be replaced do not lubricate as this causes premature failure.*

19. Contacts Spring Pressure

The optimum spring pressure for contacts varies between types of contact assembly and is not published.

The spring pressure should be such that a contact is reliably made but does not cause excessive wear or grooving when the contact surfaces are moving.

Damaged, malformed, or wrongly adjusted springs causes wear and grooving and also produce metallic dust (a potential hazard of short circuit).

20. Metallic Dirt/Dust and Short Circuits

Electrical contacts are made by using iron to copper contacts. Copper is a relatively soft metal and wears more quickly than the iron it is in contact with resulting in copper filings.

Due to the design and positioning the filings can fall onto contacts and terminations, if allowed to accumulate they could cause a short circuit that could result in a wrong side failure.

NOTE: *The filings when mixed with oil and grease can look like any other dirt or dust but are still conductive.*

If you find metallic dirt or dust, it shall be immediately carefully removed with great care taken not to spread the contamination. Report the condition to your SM(S).

In cases of severe contamination, report the situation to your SM(S) immediately.

The safety of the line is the prime consideration at all times.

21. Contact Cleaning

Contacts shall be cleaned as necessary using an approved switch cleaner and using a lint free cloth (to prevent contamination by threads and dust).

The wearing action caused by dry, rubbing contacts can be reduced using an approved contact lubricant.

This shall be smeared on the contact surface; any excess being carefully wiped away.

22. Cables and Wires

Cables and wires shall be supported clear of moving parts or live components. Spiral wrapping or approved cable ties can be used. Ties shall not be over tightened and should allow rotation on the insulation.

When replacing lids and cover confirm that cables and wires are not trapped. Crimped connections shall be terminated so that they cannot come into contact with adjacent metallic components.

23. Lubrication

Mineral oil is applied to moving joints (pins, pivots, rollers, bearings etc) to allow smooth operation. Before applying lubrication, first check that all dirt and contamination is removed, and the component is clean.

Always apply lubrication with care, using the minimum necessary and wipe away any excess.

NOTE: *When applying lubrication in the vicinity of or above electrical wiring any oil spilt on insulation shall be wiped clean as it causes gradual insulation degradation, if not removed completely.*

Excessive lubrication might encourage the build-up of dirt and dust, which might find its way into the circuit controller or lever lock and affect the safe operation of the signalling equipment.

24. Oilite/Nylon Bearings

Certain bearings are constructed from nylon or 'OILITE'. These are self-lubricating.

NOTE: *These bearings shall not be oiled as this degrades the bearing material.*

25. Damp Environments.

Where lock slide surfaces are attacked by damp, a thin anti-rust film of oil should be applied with a lint free cloth.

26. Circuit Controllers

The top bearing of the SGE type GA circuit controller is lubricated by applying a drop of oil under the wing nut. A drop of oil should also be applied through either of the two holes in the cam gear wheel.

Other circuit controllers are lubricated via the oil holes provided at the ends of the circuit controller frame assembly. A single drop of oil at each end is enough.

APPENDIX A - Lever Colours

NOTE: *This list is for guidance only; it does not supersede the information in GK/RT0005 Safety Related Colours for Signalling Application*

Colour	Function(s)
Red	Stop Signals
	Ground Signals (inc yellow)
	Route Levers
	Lever Collars
Top Red White Band Bottom Red	Stop Signal that is released from another signal box
Top Red Bottom Yellow	Home and Distant Signals (Worked from the same lever)
Top Red White band, Bottom Yellow	Intermediate Block Signal
Top Red Bottom Brown	Acceptance Lever
Top Red Bottom Black and White Chevrons	Signals working with machine operated detonator placers
Yellow	Distant Signals
Black	Points
	Scotches
	De-railers
Blue	Facing Point Locks
	Clearance Bars
	Detector Levers

Top Blue Bottom Black	Power Operated Points Economical Points
Brown	Wicket Gates
	Gate Stops & Bolts
	Barrier Levers (Directly Worked)
	Bridge Bolts
Top Blue Bottom Brown	Release Lever Barrier Release Lever
	Switch Lever
	Annett's Key Lever
	Bolt Lock
Top Blue White Band Bottom Brown	Direction Lever
White	Spare lever
Green	Asking Levers
Green	Gongs
Black and White Chevrons	Detonators (Point up for up line) (Point down for down line) (Point in both directions for single lines)
Brown and White Stripes	King or Closing Lever

On two colour levers, the top colour indicates the function that operates first. Spare levers (white) have had all mechanical and electrical locking removed.

Levers that are fixed out of use (e.g. bolted in position and/or catch handles removed) but still retain some or all of their previous mechanical/electrical locking retain their former colour(s).

On some areas/routes, they are painted with the top half of the lever white with the bottom of the lever retaining the colour(s) of their former function.

END

Includes:	Any type of lever frame not covered by a frame specific RT/SMS (some sections will not apply to all types of frame)
Excludes:	All frames listed in the 'Includes' section in NR/SMS/LV12 to LV17

The removal of covers of locking box lids or straps may result in the disarrangement of locking. These lids etc. shall not be removed during maintenance unless you have been certified as competent to do so.

Changing of components listed in sections 2, 3, 4, 5 or 6 may affect locking or travel of the lever. Check carefully that neither are affected. Testing of the interlocking may be required.

General

The frame specific NR/SMS shall always be used in preference to this SMS.

The adjustment or renewal of components shall be classed as corrective maintenance.

SERVICE A

1. Frame Structure

1.1 Brush the lever frame, locking boxes and supporting structure.

1.2 Examine all nuts and bolts. Tighten as necessary.

Record slack fittings on the NR/SMS record card. Arrange for the renewal of persistent slack fittings.

1.3 Examine all visible bolt and pin holes. Look particularly for signs of cracking.

2. Catch Handles

2.1 Examine catch handles, turned pins and split pins. Renew worn components.

2.2 Lightly Lubricate using a light mineral oil and wipe away excess.

2.3 Observe smooth operation.

3. Knuckles and Catch Rods.

3.1 Examine components. Adjust and renew components, as necessary.

3.2 Lightly Lubricate using a light mineral oil and wipe away excess.

3.3 Observe smooth operation.

This is particularly important after changing or adjusting catch rods or knuckles.

4. Catch Blocks and Springs.

4.1 Examine blocks for chamfering and wear or breakage.

4.2 Examine springs for breakage and try for weakness. Renew as necessary.

Caution: Changing blocks or springs can affect the locking.

4.3 Lubricate wearing surfaces sparingly using mineral oil and wipe away excess.

4.4 Observe smooth operation.

5. Quadrants

5.1 Examine all bolts and set screws for security.

5.2 Examine visible bolt and pin holes for signs of cracking.

5.3 Check mid-stroke notches and ends of quadrants for signs of chamfering.

In some cases, it may be necessary to disarrange locking and signalling to renew quadrants.

5.4 Observe smooth operation.

6. Levers

6.1 Check each lever is painted correctly and the handle is the correct length.

6.2 Check for signs of breaking.

6.3 Check drives to electric locks, turned and split pins.

6.4 Observe correct operation of the lock in both normal and reverse positions.

6.5 Observe smooth operation without nip or force. External equipment may require adjustment.

7. Contact Boxes

7.1 Examine lever mounted contact boxes for security.

7.2 Check correct operation when the catch handle is operated.

7.3 Check wiring and report any obvious damage.

7.4 Examine "fingers" (operating rear mounted contact boxes) for security.

Check that the lifting catch rod engages box arm correctly.

8. Lever Name and Pull Plates

8.1 Check for damage, security and legibility. Re-order replacements as necessary.

8.2 Examine back-boards and fittings for security.

9. Locking Connections

9.1 Clean and examine drives to locking (to include cranks, cams, pins, threads, tumblers, radial arms, rockers and all connections).

9.2 Record any adjustment made.

9.3 Lightly Lubricate with suitable lubricants and wipe away excess (this could be mineral oil or grease, if outside).

9.4 Observe correct operation.

10. Locking Boxes

10.1 Brush lids.

10.2 Examine set-screws and bolts.

10.3 Examine lids / straps for security.

Do not remove lids or straps as they may hold down locking.

10.4 Examine locking boxes and adjacent fittings for cracks, chipping or other damage.

Particular attention is to be paid to bolt holes and tappet ways, where visible / accessible.

11. Tappets and Locking.

Care and judgement are needed at this stage to avoid interfering with working locking. Lifting tappets shall never be lifted by hand.

11.1 Examine tappet pins, jaws connections and split pins.

11.2 Clean, where accessible and without disturbing locking.

11.3 Renew worn components, where practicable.

Do not affect the integrity of the locking. If the integrity will be affected, then record the worn components for renewal at a later date.

11.4 Lubricate sparingly with a suitable lubricant (could be mineral oil or grease if outside) and wipe away excess.

11.5 Observe correct operation.

12. Electric Locks and Circuit Controllers

See NR/SMS/PartC/LV21 (Electric Locks), NR/SMS/PartC/LV31 (Circuit Controller), NR/SMS/PartC/LV41 (Combined Lock & Circuit Controller).

This also includes their connections to the frame.

END

Includes:	BRB standard ground frame, GCR Tappet, CLC Tappet, Gloucester Wagon Co. (converted to lever locking), GNR tappet, McKenzie & Holland (direct tappet types or converted to direct tappet locking), Railway Signal Company frames (including: LNER standard, GN of I standard), L & Y Types, Saxby Rocker (converted to direct tappet locking), Stevens tappet, Tyers tappet, Westinghouse 17A
Excludes:	All other types of Lever Frame

GENERAL

The removal of covers of locking box lids or straps might result in the disarrangement of locking. These lids (etc.) shall not be removed during maintenance unless you have been certified as competent to do so.

Changing of components listed in sections 2, 3, 4, 5 or 6 might affect locking or travel of the lever. Check carefully that neither are affected. Testing of the interlocking may be required.

SERVICE A

1. Frame Structure

1.1 Brush the lever frame, locking boxes and supporting structure.

1.2 Examine all nuts and bolts. Tighten as necessary.

1.3 Record slack fittings on the record card. Arrange for the renewal of persistent slack fittings.

1.4 Examine all visible bolt and pin holes. Look particularly for signs of cracking.

2. Catch Handles

2.1 Examine catch handles, turned pins and split pins. Renew worn components.

2.2 Lightly lubricate using a light mineral oil and wipe away excess.

2.3 Observe smooth operation.

3. Knuckles and Catch Rods

3.1 Examine components.

Adjust and renew components, as necessary.

3.2 Lightly lubricate using a light mineral oil and wipe away excess.

3.3 Observe smooth operation.

This is particularly important after changing or adjusting catch rods or knuckles.

4. Catch Blocks and Springs

4.1 Examine blocks for chamfering and wear or breakage.

4.2 Examine springs for breakage and try for weakness. Renew as necessary.

Changing blocks or springs can affect the locking.

4.3 Lubricate wearing surfaces sparingly using mineral oil and wipe away excess.

4.4 Observe smooth operation.

5. Quadrants

5.1 Examine all bolts and set screws for security.

5.2 Examine visible bolt and pin holes for signs of cracking.

5.3 Check mid-stroke notches and ends of quadrants for signs of chamfering.

In some cases, it may be necessary to disarrange locking and signalling to renew quadrants.

5.4 Observe smooth operation.

6. Levers

6.1 Check each lever is painted correctly and the handle is the correct length.

6.2 Check for signs of breaking.

6.3 Check drives to electric locks, turned and split pins.

6.4 Observe correct operation of the lock in both normal and reverse positions.

6.5 Observe smooth operation without nip or force. External equipment might require adjustment.

7. Contact Boxes

7.1 Examine lever mounted contact boxes for security.

7.2 Check correct operation when the catch handle is operated.

7.3 Check wiring and report any obvious damage.

7.4 Examine “fingers” (operating rear mounted contact boxes) for security.

Check that the lifting catch rod engages box arm correctly.

8. Lever Name and Pull Plates

8.1 Check for damage, security and legibility. Re-order replacements as necessary.

8.2 Examine back-boards and fittings for security.

9. Locking Boxes.

9.1 Brush lids. Avoid sweeping debris into the locking box or electrical equipment.

9.2 Examine setscrews and bolts.

9.3 Examine lids or straps for security.

Do not remove lids or straps as they might hold down locking.

9.4 Examine lids and locking box for signs of fracture and chipping, or other damage.

Pay particular attention to bolt holes and tappet ways where visible/accessible.

10. Tappets and Locking.

10.1 Examine tappet pins, jaws connections and split pins.

10.2 Clean, where accessible and without disturbing locking.

10.3 Renew worn components. Do not affect the integrity of the locking. If the integrity might be affected, worn components shall be noted for renewal at a later date.

10.4 Remove old oil and grease, lubricate sparingly and wipe away excess (Use mineral oil or grease if outside).

10.5 Where double travelling tappets are used, check the security of the swivel pin.

10.6 Observe correct operation. Only use the operation of the lever to do this. Pay particular attention to swinging and lifting tappets.

Lifting tappets shall never by lifted by hand.

11. Electric Locks and Circuit Controllers

11.1 Electric Locks, Circuit Controllers and Combined Lock and Circuit Controllers shall be observed to confirm that they still operate correctly as they might have been affected by the work undertaken during this SMS.

END

Includes:	Security of contact boxes and electric locks fitted on the lever frame
Excludes:	Excludes all other type of Lever Frame

General

This frame was manufactured between 1870 and 1907. Spare parts ceased to be made in 1930. Special care shall be taken not to damage or break castings and components. There are no new replacement parts.

The cover plates can be removed but shall be stacked carefully and replaced, with care, after maintenance. There are no dust covers. These are catch handle locking frames.

SERVICE A

1. Frame Structure

1.1 Brush the covers of the lever frame quadrants and above floor supporting structure.

The foot-board shall be removed.

1.2 Remove covers and stack carefully.

1.3 Check frame set screws and through bolts both in front of and behind the frame.

1.4 Examine all nuts and bolts. Tighten as necessary. Record slack fittings on the record card. Arrange for the renewal of persistent slack fittings.

1.5 Examine all visible bolt and pin-holes for signs of cracking.

2. Catch Handles

2.1 Examine turned pins and split pins.

2.2 Renew worn components.

NOTE: *Changing a catch rod spring (old pattern) usually requires a disconnection of the locking.*

2.3 Lightly lubricate, using a light mineral oil and wipe away excess.

2.4 Observe smooth operation without nip or force. Outside equipment might require adjustment

Shorter catch handles on the relevant levers should be provided when trigger locking is fitted.

3. Catch Rods

3.1 Examine turned pins and split pins.

3.2 On the old patterned catch rods check security of the spring eye at the foot of the catch rod.

3.3 Check the catch rod has not gouged/become worn against the tumbler.

3.4 Check the catch rod lifts high enough to prevent wear on the rod bottom or quadrant.

3.5 Check the lever tumbler pin for security and observe the amount of wear.

Changing the catch rod or lever tumbler pin can seriously affect the locking on this type of frame and testing shall be required.

3.6 Lightly lubricate the spring box with a light mineral oil and wipe away excess.

3.7 Observe smooth operation.

4. Levers

4.1 Check each lever is painted correctly and the handle is the correct length.

4.2 Check for signs of fracture, especially around the spring box and tumbler pin holes.

4.3 Lightly lubricate the quadrant bearing pin.

4.4 Observe the smooth operation without nip or force. Outside equipment might require adjustment.

Changing of components in sections 3 & 4 affects locking and travel of the lever. Check carefully neither are affected. Testing shall be required.

5. Lever Name and Pull Plates

5.1 Check for damage, legibility and security. Arrange for replacement plates as necessary.

6. Tumblers

These are cast and prone to nib breakage if pins are moved or forced between the nibs. Great care shall be taken to avoid breakage. There are no replacements.

6.1 Check horizontal (backwards and forwards) and vertical movement.

6.2 Examine the tumbler through pin for security. Check rear nut and split pin.

6.3 Examine the tumbler for signs of recent damage. Look particularly for cracking of the casting.

6.4 Check that the lock or release tumblers cannot be operated by hand with the lever in either position.

7. Locking

This is held in position by pins and spacers. There is much more 'slack' in this frame than most others.

7.1 Dust in and around the nibs, packing pieces and bars.

7.2 Examine all "locking pins" and "holding down" pins.

Check that they are correctly in place and are cottered up. These pins shall not be able to move between nibs.

7.3 Check all split pins.

7.4 Examine all packing pieces for security and confirm they are supporting the locking bars. Non-standard pieces of packing should be noted on the maintenance fault list.

7.5 Check the locking is supported correctly and operates without binding or friction.

7.6 Examine lock bars at the swan necks for signs of stress or fracture. Particular care is required with bottom bars and trigger locking bars. A special check is needed from under the frame.

7.7 Examine block locking blocks for damage and check the set screw is secure.

Do not remove the holding setscrew on either top or bottom blocks.

7.8 Check drives to electric locks and circuit controller from the tumblers for security and signs of forcing. Report any damage immediately.

7.9 Very lightly lubricate with a light mineral oil between and around the bars.

A minimum of lubricant is needed. The locking of these frames operates best in a dry environment. The pins and split pins need no lubrication.

7.10 Observe operation of levers with covers removed for signs of stress (bowing of bars).

8. Electric Locks and Circuit Controllers

8.1 Electric Locks, Circuit Controllers and Combined Lock & Circuit Controllers shall be observed to confirm that they still operate correctly, as they might have been affected by the work undertaken during this SMS.

END

Includes:	Midland Railway Tappet, Railway Executive Committee (R.E.C), British Standard (B.S), Pre 43, LMS Standard,1943 Tappet, Saxby & Farmer Rocker, McKenzie & Holland Cam & Tappet, GN Duplex. Security of Frame Fitted Catch Handle Contacts
Excludes:	LNWR Tappet, GWR 5 bar vertical tappet

General

Dust covers can be removed without interfering with locking, but care shall be taken with 1943 pattern dust covers to check that only the dust cover bolts are slackened.

The holding down strap bolts shall be checked.

The holding down pins shall be checked for security.

The cover plates can be removed but shall be stacked carefully and replaced, with care, after maintenance. There are no dust covers.

These are catch handle locking frames.

SERVICE A

1. Lever Frame Structure

1.1 Brush lever frame quadrants, locking boxes and above floor supporting structure.

The footboard shall be removed.

1.2 Examine all nuts and bolts and tighten as necessary, record slack fittings on the record card. Arrange for the renewal of persistent slack fittings.

1.3 Examine all visible bolt and pinholes for signs of cracking.

2. Catch Handle

2.1 Examine turned pins and split pins.

2.2 Check catch handle spring by operating handle. If the spring is weak, arrange for its replacement.

Caution: If changed, the rocker and consequently the locking could be affected.

2.3 Renew worn components.

2.4 Lightly lubricate with a light mineral oil and wipe away excess.

2.5 Observe smooth operation without nip or force.

3. Catch Rods

3.1 Examine turned pin and split pin.

3.2 Check for bowing.

3.3 Examine foot for wear.

3.4 Renew as necessary. Obtain the best fit possible.

3.5 Check security of spring box. If the spring requires changing or is changed, check the operation of the catch handle again.

3.6 Lightly lubricate with a light mineral oil and wipe away excess. Outside ground frames of this pattern might require grease.

3.7 Observe smooth operation.

4. Rockers

4.1 Check rocker bolt and nut. Confirm the nut is correctly tightened (over-tightening causes the locking to seize up).

NOTE: *Some frames have castle head nut and split pin.*

4.2 Renew the rockers if necessary.

NOTE: *Changing rockers might affect locking.*

4.3 On Duplex frames, check the rocker assemblies for correct fit with the spring box. It should not be possible to move the rocker or tappet out of the mid-stroke position with the lever in the half way position.

4.4 Lightly lubricate with mineral oil and wipe away excess.

4.5 Observe smooth operation.

Changing of components in sections 2, 3 & 4 might affect locking and travel of the lever. Confirm that neither are affected. Testing is required.

5. Levers

5.1 Check each lever is painted correctly and the handle is the correct length.

5.2 Check, especially around the spring box for signs of fracture.

5.3 Lightly lubricate the quadrant bearing pin.

5.4 Observe correct operation of the lever, spring and rocker as a unit.

5.5 Check there is no nip or force required to operate the lever. External equipment might require adjustment.

6. Lever Name and Pull Plates

6.1 Check for damage, legibility and security. Arrange for replacements as required.

7. Tappets and Locking

7.1 Examine tappet jaw for security, if riveted type.

7.2 Examine tappet pin and split pin.

7.3 Clean, where accessible, tappets in normal and reverse positions.

7.4 Observe bridges and bridge pieces (conditional sliders). Check rivets are tight.

7.5 Clean accessible locking (Only top bars can usually be cleaned).

7.6 Check, where visible, slack rivets.

7.7 Lightly lubricate with mineral oil, wipe away excess. Confirm no lubricant falls onto or enters any electrical apparatus or wiring.

7.8 Observe correct operation.

Lifting tappets for sequential/rotation locking are fitted on some frames. Under no circumstances shall these tappets be lifted.

8. Locking Boxes

8.1 Examine holding down straps or pins for security. Check that no locking can lift (other than lifting locks/tappets).

8.2 Clean locking boxes, where accessible, without disturbing the locking.

8.3 Check packing on top is operating and holding down correctly.

8.4 Examine locking box/castings for cracks, chipping or other damage. Particular attention is to be paid to bolt holes and tappet ways, where visible.

9. Catch Handle Contacts

9.1 Examine holding bolts and nuts.

9.2 Examine tappet pin and split pin.

9.3 Remove cover of contact box and observe correct operation by the lever.

9.4 Observe visible state of wiring and report any obvious damage/degradation.

9.5 An absolute minimum of lubricant may be required within the contact box. Wipe away any excess.

9.6 Replace lid. Check that all the holding bolts/setscrews are fitted. Do not over-tighten tappet/contact box pin.

10. Electric Locks and Circuit Controllers

10.1 Electric Locks, Circuit Controllers and Combined Lock & Circuit Controllers shall be observed to confirm that they still operate correctly, as they might have been affected by the work undertaken during this SMS.

END

Includes:	London and North Western Railway Tumbler Frame The mechanical fitting of contact boxes on the lever
Excludes:	Any other type of tumbler locking frame

General

The cast bows shall not be slackened off or over tightened. Manufacture of this frame commenced in 1873 and ceased about 1910. Special care shall be taken not to break castings as there are no new replacement parts.

Rockers, cam boxes, quadrants, and levers are changed as one complete unit and shall be kept together. The components are not interchangeable. A disconnection of the locking is required to carry out this work.

SERVICE A

1. Frame Structure

1.1 Brush the lever frame, locking boxes and supporting structure.

1.2 Examine all nuts and bolts. Tighten as necessary.

1.3 Record slack fittings on the record card. Arrange for the renewal of persistent slack fittings.

1.4 Examine all visible bolt and pin holes. Look particularly for signs of cracking.

2. Bow Handles

2.1 Examine the bow handles.

2.2 Check the pins and split pins, renew as necessary.

2.3 Lightly lubricate with a light mineral oil and wipe away excess.

2.4 Observe smooth operation.

3. Catch Rods and Blocks

3.1 Examine the catch rods and blocks.

3.2 Check the pins and split pins.

3.3 Examine block for wear and, in particular, chamfering at the front and back.

3.4 Renew as necessary. Check that the replacement operates correctly.

3.5 Lightly lubricate with a light mineral oil and wipe away excess.

3.6 Observe smooth operation.

4. Quadrants

4.1 Examine for security and signs of fracture.

4.2 Check ends of quadrants for signs of chamfering.

4.3 Observe smooth operation of the lever over the quadrant.

5. Cable Ties

5.1 Check for security.

5.2 Observe wiring is not chafed, damaged or in contact with mechanical equipment.

6. Levers

6.1 Check each lever is painted correctly and the handle is the correct length.

6.2 Check for signs of breaking.

6.3 Check lever mounted contact boxes and fixings.

6.4 Check the correct operation of the catch handle.

6.5 Examine the security of the “fingers” that operate the rear mounted contact boxes. Check that the lifting catch rod engages the box arm correctly.

6.6 Observe smooth operation without nip or force. Adjustment of external equipment might be required.

7. Lever Name and Pull Plates

7.1 Check for damage, legibility and security. Arrange for replacements as required.

7.2 Examine back-board and fittings for security.

8. Lever Shoes and Studs

8.1 Examine lever shoe bolt and hook rack stud. Record any loose bolts.

8.2 Clean and lightly lubricate with mineral oil, wipe away excess.

8.3 Examine stud drive to electric locks. Lightly lubricate with mineral oil, wipe away excess.

9. Rocker/Cam Box

9.1 Clean, where accessible.

9.2 Examine rocker/cam box.

9.3 Examine the hook rack. Attempt to lift hook rack using a small bar, checking for wear on the rocker/cam box.

The maximum allowable wear is one quarter inch (6mm) measured on the bottom rack, if more than this, record the numbers and report it as corrective maintenance.

9.4 On multiple rack locking frames, check for excessive wear in the rocker pins.

9.5 Lightly lubricate with mineral oil and wipe away excess.

9.6 Observe smooth and correct operation with the levers in both positions.

Warning: No attempt shall be made to change these components during maintenance.

10. Hook Rack Adjuster

10.1 Examine and wipe the hook rack adjuster.

10.2 Check for signs of the lever being forced or for signs of a run through (bent adjuster).

10.3 Check the barrel adjuster and lock nuts. This shall be centrally located between top and bottom links and contain enough thread to hold each link securely.

10.4 Tighten and record any slack nuts.

10.5 Lightly lubricate studs and threads with mineral oil. Check threads are clear and wipe away excess.

10.6 Observe smooth operation.

11. Guide Racks/Hook Racks

11.1 Clean, where accessible and examine alignment of the hook rack relative to the guide rack. Adjust, as necessary, to bring into line using the special hook rack adjuster spanner.

11.2 Observe operation of locking when and during adjustment and on completion (both normal and reverse positions).

Locking affected by any adjustment shall be thoroughly tested.

11.3 Lightly lubricate with mineral oil, wiping away excess.

11.4 Observe smooth operation of whole unit.

12. Bars, Locks, Bell Cranks, Weighted Bars, Studs and Fingers

Loose rivets shall not be tightened in the frame. At all times, particularly in cold weather, metal to metal contact (i.e. hammer) shall be kept to a minimum.

12.1 Clean all accessible locking and components.

12.2 Wipe all bar faces and, where possible, tops.

12.3 Examine all bell crank studs and weight studs for wear and security.

12.4 Examine all weights and returning bars for wear and security. Check that weights are correctly located and properly secured. Tighten and record any slack nuts and fingers.

12.5 Examine all rivets, locks and fingers for wear and security.

12.6 Record any slack locking and report to your SM(S).

12.7 Lightly lubricate with mineral oil and wipe away excess.

13. Electric Locks and Circuit Controllers

13.1 Electric Locks, Circuit Controllers and Combined Lock & Circuit Controllers shall be observed to confirm that they still operate correctly, as they might have been affected by the work undertaken during this SMS.

END

Includes:	London and North Western Railway Tappet Frame Mechanical fitting of contact boxes
Excludes:	All other types of tappet locking frame

General

Manufacture of this frame, approximately 1907 to 1925, means spare parts are not generally available. Special care shall be taken not to damage fittings.

The removal of the locking box lids will result in the dis-arrangement of locking. These lids shall not be removed during maintenance.

This is a catch handle locking frame.

SERVICE A

1. Frame Structure

1.1 Brush the lever frame, locking boxes and supporting structure.

1.2 Examine all nuts and bolts. Tighten as necessary. Record slack fittings on the record card. Arrange for the renewal of persistent slack fittings.

1.3 Examine all visible bolt and pin holes. Look particularly for signs of cracking.

2. Bow Handles

2.1 Examine the bow handles.

2.2 Check pins and split pins. Renew as necessary.

2.3 Lightly lubricate with a light mineral oil and wipe away excess.

2.4 Observe smooth operation.

3. Catch Rods and Blocks

3.1 Examine the catch rods and blocks.

3.2 Check pins and split pins.

3.3 Examine block for wear and, in particular, chamfering at the front and back.

3.4 Renew as necessary. Check that the replacement operates correctly.

3.5 Lightly lubricate with a light mineral oil and wipe away excess.

3.6 Observe smooth operation, in particular, the catch handle returns to the normal position. The balance weights may require adjustment.

4. Quadrants

4.1 Examine for security and signs of fracture.

4.2 Check the ends of the quadrants for signs of chamfering.

4.3 Observe smooth operation of lever over the quadrant.

5. Levers

5.1 Check each lever is painted correctly and the handle is the correct length.

5.2 Check for signs of breaking.

5.3 Examine lever mounted contact boxes for security.

5.4 Check correct operation when the catch handle is operated.

5.5 Examine “fingers” operating rear mounted contact boxes for security. Check that the lifting catch rod engages the box arm correctly.

5.6 Observe smooth operation without nip or force. Adjustment of external equipment may be required.

6. Lever Name and Pull Plates

6.1 Check for damage, legibility and security. Arrange for replacements as necessary.

6.2 Examine back board and fittings for security.

7. Lever Shoes and Studs

7.1 Examine shoe bolts. Record the numbers of any loose bolts.

7.2 Clean and lightly lubricate with mineral oil, wipe away excess.

7.3 Examine stud drive to electric locks. Lightly lubricate with mineral oil and wipe away excess.

8. Rocker and Down Rods

The rocker is an integral part of the quadrant.

8.1 Clean, where accessible.

8.2 Examine the rocker and down rods.

8.3 Check rocker is in mid position when lever is halfway.

8.4 Check down rod pins and split pins.

8.5 Examine barrel adjuster for security. This must be centrally located between top and bottom links and contain sufficient thread to hold each link securely. Tighten and record any slack nuts.

Any adjustment of the barrel shall be carried out with great care because it will affect the positions of the connected tappets and hence the locking Adjustment shall only be carried out if the work can be tested afterwards.

8.6 Examine and lightly lubricate the rockers and down rods.

9. Tappets and Locking Boxes

9.1 Brush box lids Do not remove lids since these, hold down the locking within.

9.2 Check security of holding down bolts.

9.3 Clean tappet jaw and pins.

9.4 Examine tappet pin and split pin.

9.5 Lightly lubricate with a light mineral oil and wipe away excess.

9.6 Lightly lubricate, if necessary, the tappet each side of the locking box with the lever in both normal and reverse positions. Wipe away any excess lubricant.

10. Electric Locks and Circuit Controllers

10.1 Electric Locks, Circuit Controllers and Combined Lock & Circuit Controllers shall be observed to confirm that they still operate correctly, as they might have been affected by the work undertaken during this SMS.

END

Includes:	Great Western Railway Five Bar Vertical Tappet Frames and frames converted to five bar vertical tappet locking
Excludes:	All other types of vertical tappet frames

General

The removal or slackening of straps during maintenance might result in dis-arranging the locking and therefore shall not be done.

The cover plates on 3 bar horizontal frames shall not be lifted.

Excess oil shall not be allowed not fall onto or enter in any electrical equipment or wiring.

Examine the jute scrim on the blade to confirm it is not soaked in oil. Replace as necessary.

The Jute Scrim should be fitted at the lower end of the blade between the locking box and the electric lock.

These are lever locking frames.

The principles of this NR/SMS can also be used on other ex GWR type frames (except twistlock).

SERVICE A

1. Frame Structure

1.1 Brush the lever frame, locking boxes and supporting structure.

1.2 Examine all nuts and bolts. Tighten as necessary. Record slack fittings on the record card. Arrange for the renewal of persistent slack fittings.

1.3 Examine all visible bolt and pin holes. Look particularly for signs of cracking.

2. Catch Handles

2.1 Examine turned and split pins.

2.2 Examine the catch handle.

2.3 Renew any worn components.

2.4 Lightly lubricate with a light mineral oil and wipe away excess.

2.5 Observe smooth operation.

3. Back Strap and Spring Box

3.1 Examine the back strap and spring box.

3.2 Examine turned and split pins.

3.3 Check security of spring box. Change springs, when worn.

3.4 Examine foot of back strap for signs of chamfering and wear. Renew as necessary.

3.5 Lightly lubricate with a light mineral oil and wipe away excess.

3.6 Observe smooth operation.

4. Sweeps

4.1 Examine for security and signs of fracture.

4.2 Check mid stroke and end notches for signs of wear and chamfering.

4.3 Observe smooth operation of the lever across the sweep.

5. Levers

5.1 Check each lever is painted correctly and the handle is the correct length.

5.2 Check for signs of breaking.

5.3 Observe smooth operation without nip or force. Adjustment of external equipment might be required.

6. Lever Badges

6.1 Check for damage, legibility and security. Arrange replacements as necessary.

7. Cam Boxes and Drives

7.1 Clean and examine for security and wear. Tighten as necessary. Record slack or worn boxes on the record card. Arrange replacement if necessary.

7.2 Lightly lubricate with oil and wipe away excess.

7.3 Observe smooth operation.

8. Locking

The holding straps shall not be loosened.

8.1 Clean all accessible locking.

8.2 Check all straps and bar set screws for security.

8.3 Examine blade pins and split pins, joints and drive studs to electric locks/controllers.

8.4 Observe correct operation of nibs, interlocks, blocks and sequential springs, during operation of frame.

8.5 Check rivets on drives, where visible, for security. Lightly lubricate, as necessary.

9. Electric Locks and Circuit Controllers

9.1 Electric Locks, Circuit Controllers and Combined Lock & Circuit Controllers shall be observed to confirm that they still operate correctly, as they might have been affected by the work undertaken during this SMS.

END

Includes:	Great Western Railway Five Bar Vertical Tappet Frames and frames converted to five bar vertical tappet locking
Excludes:	All other types of electric lock

If a lever lock is found to be operating incorrectly or is incorrectly adjusted, it shall be treated as faulty and taken out of service immediately.

Adjustments shall only be made by a competent person, who is authorized to adjust and test lever locks.

SERVICE A

1. Exterior

1.1 Examine and dust exterior casing.

1.2 Examine fixing screws and bolts.

2. Internal

2.1 Remove the cover and examine interior of the lock and the interior of the cover.

Look particularly for contamination by metallic dust, dirt, or particles. If any is found, carefully clean and report the condition to your SM(S). More details on this can be found in NR/SMS/PartC/LV00 (Lever Frames, Lever Locks, & Circuit Controllers - General).

2.2 Examine drive, pivots, rollers, pins, split pins, locknuts, and studs.

2.3 Lightly lubricate (wipe away excess), drive, pivots, rollers and pins.

3. Wiring

3.1 Examine cables and wires. Look particularly for:

a) Degraded or damaged (chafing) insulation.

b) Trapped wires.

c) Unsupported wires.

d) Risk of short circuit (electrical contact with adjacent terminals, casing or metal parts).

e) Fouling by moving parts.

f) Contamination.

3.2 Examine terminations. Clean and protect as necessary.

4. Contacts

4.1 Examine contacts. Clean with a lint free cloth moistened with an approved switch cleaner.

5. Final

5.1 Carefully replace cover and secure/lock.

5.2 Check absorbent wrap is effective (where required) and renew as necessary.

5.3 In liaison with the Signaller operate the equipment and observe correct operation of the lock.

SERVICE B

6. Lock and Lock Slide

6.1 Remove the covers and examine the interior as per 2.1.

6.2 Examine lock (where accessible).

6.3 Examine lock slide (blade) notches and force down pins (if fitted).

6.4 Examine notches and depressions in the lock slide, remove any dirt or oil.

6.5 Where necessary (damp conditions), rub a small amount of mineral oil onto the lock slide to provide an anti-rust film.

6.6 Check for correct operation throughout the full movement:

a) Lock dog operates freely.

b) Force down feature (if fitted).

c) Economiser switch (if fitted).

d) Lock proving/checking contacts.

Check that the lock properly engages in the notch. If slackness or mal-adjustment is found, correction and retesting shall be carried out by a person authorised to work on electric locks.

6.7 Check that spring driven contacts fully operate and do not stick when depressed.

7. WR 42-Ohm Lever Lock

If any of the following steps fails the criteria, you shall inform your SM(S). Contact pressure and contact gaps are inter-dependant; any adjustment on one might affect the other.

7.1 Check that the plunger ball and lock slide are not worn.

7.2 Check that the LCC contacts break evenly when the lock pawl has lifted 0.0625" (1.6mm). Check that they open evenly and remain broken until the lock re-engages in the lock slide.

Measure, using an approved gauge, the contact pressure at the point of contact. This should be a minimum of 2oz (60g).

7.3 Check that a gap of between 0.005" and 0.010" (0.13mm and 0.25mm) exists between the sides of the triangular operating plate and the spring rubbing pads when the lock is de-energised.

7.4 Measure, using an approved gauge the contact pressure on C1/C2 contacts; this should be 2oz (60g). Check once the lock slide has moved and the contacts are open there is a contact gap on the two fingers of between 0.060" and 0.075" (1.5mm and 1.9mm).

7.5 Check that the armature assembly operates freely without any trace of binding. Confirm this requirement is met, whatever the rotary position of the armature pivot pin is.

7.6 Check the following when the armature is parallel to the coil assembly when the coil is energised:

a) The residual pin is in contact.

b) The minimum air gap between the armature and the core pole piece is 0.030" (0.75mm).

8. Final

8.1 Carefully replace cover and secure/lock. Lubricate padlock where fitted.

8.2 Check absorbent wrap is effective (where required) and renew as necessary.

8.3 In liaison with the Signaller, operate the equipment and observe correct operation of the lock.

END

Includes:	Contact Finger & Microswitch Types (All makes)
Excludes:	All other types of Circuit Controllers

If a circuit controller is found to be operating incorrectly or is incorrectly adjusted, it shall be treated as faulty and taken out of service immediately.

Adjustments shall only be made by a competent person, who is authorised to adjust and test this equipment.

Allen Bradley microswitch type circuit controllers are usually sealed after installation and therefore require no internal maintenance. However, access to the cams can be gained for adjustment purposes.

Most circuit controllers are rotary actuated. Ex-WR style contact boxes are not, the arm travel on these is linear, not rotary.

SERVICE A

1. Exterior (All Types)

1.1 Examine and dust exterior casing.

1.2 Examine fixing screws and bolts.

1.3 Check the linkage to the circuit controller. Lubricate as necessary.

2. Internal (All Types except Allen Bradley)

2.1 Examine the interior and cover.

Look particularly for contamination by metallic dust, dirt, or particles. If any is found, carefully clean and report the condition to your SM(S).

More details on this can be found in NR/SMS/PartC/LV00 (Lever Frames, Lever Locks, & Circuit Controllers - General).

2.2 Check using a plastic ruler or suitably insulated straight edge, that the circuit controller studs do not protrude and touch the cover. See Figure 1.

Replace the circuit controller if the studs are too long. If the circuit controller cannot be replaced immediately, do not refit the lid. Fit a temporary non-conductive lid until the circuit controller is replaced.

Figure 1 – Stud length check

2.3 Check the lid gasket is undamaged and effective.

2.4 Examine drive, pivots, studs, rollers, pins, split pins and drive lock locknuts. Check they are not seized.

2.5 Lightly lubricate (wipe away excess) pivots and pins.

3. Wiring (All Types except Allen Bradley)

3.1 Examine cables and wires. Look particularly for:

a) Degraded or damaged (chafing) insulation.

b) Trapped wires.

c) Unsupported wires.

d) Risk of short circuit (electrical contact with adjacent terminals, casing or metal parts).

e) Fouling by moving parts.

f) Contamination.

3.2 Examine terminations clean and protect as necessary.

4. Contact Finger Type Circuit Controllers

4.1 Examine contact bands/segments and contact fingers.

If any are worn, damaged, or loose, report as corrective maintenance.

a) Clean with a lint free cloth moistened with switch cleaner.

b) Apply a protection agent as required (except contact faces).

c) Apply an approved contact lubricant to the contact bands/segments.

5. Microswitch Type Circuit Controllers

5.1 Check the Allen nuts that secure the microswitch plate to the body.

5.2 Check the microswitch assembly bolts.

5.3 Clean and examine the tappets and microswitch plungers.

5.4 Carefully check the cam roller Allen nuts.

6. Bearings (All Types except Allen Bradley)

6.1 Check and lubricate bearings.

Bearings made from OILITE or nylon shall not be oiled (see NR/SMS/PartC/LV00 (Lever Frames, Lever Locks, & Circuit Controllers - General).

7. Final

7.1 Check for any slackness or maladjustment and that the equipment operates correctly. If any defects are found, the equipment shall be treated as faulty and the Signaller informed.

7.2 Check and carefully replace cover/gasket and secure/lock. Lubricate padlock where fitted.

7.3 Protect exposed external screw threads with adhesive type grease.

7.4 Operate equipment and observe correct operation.

END

Includes:	Combined Lock & Circuit Controller
Excludes:	Individual Lever Locks and Circuit Controllers

General

If a circuit controller is found to be operating incorrectly or is incorrectly adjusted, it shall be treated as faulty and taken out of service immediately.

Adjustments shall only be made by a competent person, who is authorised to adjust and test lever locks.

SERVICE A

1. Exterior

1.1 Examine and dust exterior casing.

1.2 Examine fixing screws and bolts.

2. Internal

2.1 Remove the cover and examine interior of the lock and the interior of the cover.

Look particularly for contamination by metallic dust, dirt or particles. If any is found, carefully clean and report the condition to your SM(S).

More details on this can be found in NR/SMS/PartC/LV00 (Lever Frames, Lever Locks, & Circuit Controllers - General).

2.2 Examine drive, pivots, rollers, pins, split pins, locknuts and studs.

2.3 Lightly Lubricate (wipe away excess), drive, pivots, rollers and pins.

3. Wiring

3.1 Examine cables and wires. Look particularly for:

a) Degraded or damaged (chafing) insulation.

b) Trapped wires.

c) Unsupported wires.

d) Risk of short circuit (electrical contact with adjacent terminals, casing or metal parts).

e) Fouling by moving parts.

f) Contamination.

3.2 Examine terminations. Clean and protect as necessary.

4. Contacts (Bands, Segments and Fingers)

4.1 Examine contact bands/segments and contact fingers. If any are worn, damaged or loose, report as corrective maintenance.

4.2 Clean with a lint free cloth moistened with switch cleaner.

4.3 Apply a protection agent as required (except contact faces).

4.4 Apply an approved contact lubricant to the contact bands/segments.

5. Bearings

5.1 Check and Lubricate bearings.

Bearings made from OILITE or nylon shall not be oiled (see NR/SMS/PartC/LV00).

6. Final

6.1 Carefully replace cover and secure/lock.

6.2 Check absorbent wrap is effective (where required) and renew as necessary.

6.3 In liaison with the Signaller operate the equipment and observe correct operation of the lock.

SERVICE B

7. Lock and Lock Slide

7.1 Remove the covers.

7.2 Examine lock (where accessible).

7.3 Examine lock slide (blade) notches and force down pins (if fitted).

7.4 Examine notches and depressions in the lock slide, remove any dirt or oil.

7.5 Where necessary (damp conditions), rub a small amount of mineral oil onto the lock slide to provide an anti-rust film.

7.6 Check for correct operation throughout the full movement:

a) Lock dog operates freely.

b) Force down feature (if fitted).

c) Economiser switch (if fitted).

d) Lock proving/checking contacts.

Check that the lock properly engages in the notch. If slackness or maladjustment is found, correction and retesting shall be carried out by a person authorised to work on electric locks.

7.7 Check that spring driven contacts fully operate and do not stick when depressed.

8. Final

8.1 Check for any slackness or maladjustment and that the equipment operates correctly.

If any defects are found, treat the equipment as faulty and inform the Signaller.

8.2 Check and carefully replace cover/gasket and secure/lock. Lubricate padlock where fitted.

8.3 Protect exposed external screw threads with adhesive type grease.

8.4 Check absorbent wrap is effective (where required) and renew as necessary.

8.5 In liaison with the Signaller operate the equipment and observe correct operation of the lock.

END

Includes:	Single Line (Tablet/Token) Instrument, Key Release Instrument, Annett's Key Instrument (including Western region type)
Excludes:	Any token that is not associated with a release instrument and Token instruments configured to WR E10K standard

General

If you find this equipment to be operating incorrectly, tell the Signaller. Take the instrument out of service straight away.

You shall only repair, adjust, or test this equipment if you have been authorised as competent to do so.

SERVICE A

1. Keys & Tokens

1.1 Check all keys or tokens. In particular:

a) Check the engraving for the section or release.

b) Look for signs of damage.

2. External

2.1 Examine fixing screws, setscrews and bolts. It should not be possible to open or tip the instrument.

2.2 Dust and examine the exterior, including key-ways.

2.3 Check external cables and wires. Check that:

a) Insulation is not damaged or degraded.

b) Wires are supported.

3. Internal

3.1 Unlock and carefully remove the cover. Examine the interior and cover.

Look particularly for contamination by metallic dust or particles. If you find any, report it to your SM(S) immediately.

3.2 Examine cables and wires. Look particularly for:

a) Degraded or damaged (chafing) insulation.

b) Trapped wires.

c) Unsupported wires.

d) Risk of short circuit (electrical contact with adjacent terminals, casing or metal parts).

e) Fouling by moving parts.

f) Contamination.

3.3 Examine the terminations. Clean and protect as necessary.

3.4 Dust the interior.

3.5 Examine the contacts/bands/segments. If any are worn, damaged or loose, report as corrective maintenance.

a) Clean with a lint free cloth moistened with switch cleaner.

b) Apply an approved protection agent as required (except contact faces).

c) Apply an approved contact lubricant to the contact faces, as required.

3.6 Examine the lock notch.

a) Remove any dirt and oil.

b) Look for wear.

3.7 Where necessary (damp conditions), rub a small amount of mineral oil onto the lock slide face to provide an anti-rust film.

3.8 Check for correct operation of the lock throughout the full movement.

3.9 Check by operation of the key to the first position, the lock proving/checking contacts correctly operate.

4. Plunger

4.1 Dust the mechanism.

4.2 Examine the mechanism.

4.3 Lightly lubricate hand plunger with machine oil, wipe away excess.

5. Indicator/Galvanometer

5.1 Clean the glass.

5.2 Check the clarity of the labelling.

5.3 Observe the needle operates correctly. Check that it pivots smoothly. If needles/ banners are damaged, inform the Signaller and report as corrective maintenance.

5.4 Examine fixings, check that the indicator unit is secured to the main body.

6. Bell or Gong

6.1 Dust and examine exterior.

6.2 Carefully remove the cover and carefully dust interior.

6.3 Examine interior mechanism, pay particular attention to:

a) Springs and contacts.

b) Trigger mechanism.

c) Terminations and wires.

d) Fixings.

6.4 Check wires cannot be trapped or damaged; carefully replace and secure (lock) cover.

6.5 Ask the Signaller to operate the instrument and observe correct operation.

6.6 Carefully replace the instrument cover making sure that no wires become trapped.

Secure the instrument.

Lubricate the lock as required.

6.7 Observe correct operation of the instrument throughout the operating cycle.

SERVICE B

7. Tokens

7.1 Count the number of tokens in the system. Check that the correct number are in the instruments, they are of the correct configuration, undamaged and any lettering is legible.

The count should be undertaken in liaison with the other Signaller(s) at the other instrument(s) in the system.

Where ‘No Signaller Key token’ systems exist, all instruments in the system should be visited in the same shift.

Allow for any token issued to a train passing through the section.

8. Function test

8.1 Carry out the required NR/SMTH defined test from the following:

a) TOKEN BLOCK CONTROLS TEST.

b) TABLET BLOCK CONTROLS TEST.

c) NO SIGNALLER KEY-TOKEN BLOCK CONTROLS TEST.

Or

d) MECHANICAL LOCKING FUNCTION TEST to check the release function is working as designed.

9. Annett’s Key Instrument (Western Region type)

9.1 Disconnect one wire from the lock proving contacts and make the contact open-circuit.

9.2 Measure the resistance between the terminals of the proving contact assembly using a megger (or similar instrument).

If the resistance is less than 100kΩ#, you shall take the instrument out of service and tell your SM(S) straight away.

9.3 Reconnect the wire and restore the contact.

9.4 Disconnect one wire from a pair of commutator contacts and make the contact open-circuit.

9.5 Measure the resistance between the terminals of the commutator contact using a 1000V insulation tester (e.g. Megger).

If the resistance is less than 100kΩ#, you shall take the instrument out of service and tell your SM(S) straight away.

9.6 Repeat the measurement for each pair of contacts.

9.7 Check that the lock dog drops freely into the notch and that the armature bearings are free from oil.

NOTE: # *If either resistance measurement is less than 1MΩ, you shall tell your SM(S). The SM(S) shall arrange to replace the insulation material.*

END

Includes:	All staffs and tokens for single line use that are not associated with a release instrument
Excludes:	Any tokens from a release instrument

SERVICE A

1. Inspection

1.1 Examine the staff/token and (if provided) the associated holder.

1.2 Check there are no signs of wear or damage to the staff/token and the wording is clear and legible.

1.3 Check (if provided) the associated holder for wear and damage.

1.4 Report any deficiencies found as corrective maintenance.

END

Includes:	Electric token instrument configured to WR E10K standards
Excludes:	All other token instruments

General

Changing of instrument configuration between these types shall only be carried out by authorised servicing agents.

Both manufactures of instrument can work together in the same token system, and can generally be interchanged if necessary, caution is needed when doing this as different terminal numbers might be used, particularly with the section signal release contact mechanisms.

Instruments supplied after the mid 1980's might have 'Klippon' plug coupler connections which have universal terminal numbering irrespective of manufacture.

At some sites which require an intermediate or auxiliary instrument, a terminal instrument with an external 'switching' relay has been provided.

Changing of instrument configuration between these types requires signalling design and may only be carried out when authorised by the infrastructure controller.

Two principal manufactures produced this type of Electric Token Instrument.

GW Type: This instrument was designed and originally produced by the former GWR but was eventually produced by Tyers for the GWR and its successors.

Identifying features include cast 'knob' and flush mortice lock on hinged cover lid, 'brass' plunger and nameplate, an external instrument number, 'butterfly' operated section signal release, and heavy solid appearance.

When manufactured by Tyers, it is known as a No 9 instrument, and will bear Tyers insignia.

Tyers Type: The instrument was designed and produced by Tyers for sale to the British and overseas railways, but also supplied versions to the former BR(WR).

Identifying features include one-piece cover lid with side handles secured by a padlock, non-metallic plunger, 'chrome' nameplate, and lighter alloy casting with a smaller base than GW pattern.

In areas other than GW automatic section status indicators might replace the manual Token In/Out switch. It is known as a No 12 instrument.

Those manufactured for WR use are a style 12A6 terminal instrument and a style 12E8 Intermediate Instrument.

The section signal release arrangements and commutator configurations on both manufactures of instrument are unique to GW areas. The commutator contact settings are set out in the table below. Instruments manufactured or adapted for use elsewhere are unlikely to be compatible with them.

Both manufactures are available as Terminal and Intermediate/Auxiliary types and may also be modified for Remote Operator operation (NSKT/NSTR).

Contacts Settings for Token Instruments used with BR WR E10K Control Circuits

Instrument	**Phase**	**Position**	**Contacts Made**
GW /TYERS Term. (inc Insts mod' with ext'l relay as Int/Aux)	Even	Normal	1-2, 3-4, 6-7- 8
		Withdraw	1-2, 3-4, 5-9
	Odd	Normal	1-4, 2-3, 6-7- 8
		Withdraw	1-4, 2-3, 5-9
GW Int/Aux	Even	Normal	3-4, 5-6.
		Withdraw	1-3, 2-5, 6-7.
	Odd	Normal	3-6, 4-5.
		Withdraw	1-5, 2-3, 6-7.
TYERS Int/Aux	Even	Normal	2-3, 4-5.
		Withdraw	1-2, 5-6, 3-23, 4-24.
	ODD	Normal	2-4, 3-5.
		Withdraw	2-21, 5-26, 3-23, 4-24.

SERVICE A

Liaise with the Signaller before turning or withdrawing tokens, lifting the lock or making/breaking any contacts.

1. External

1.1 Check all tokens for correct colour and engraving. Remove loose pieces of paint.

1.2 Examine instrument fixings (including any balancing magazine attachment or blanking plate) to check the instrument is secure and cannot be tipped.

1.3 Check that illuminated indicator/galvanometer covers are intact.

1.4 Dust and examine exterior including keyways.

1.5 Examine external wires and cables. Check that insulation is not damaged or degraded, and that wires and cables are not 'trapped' and are supported and protected from mechanical damage.

1.6 Examine keyways and aperture for signs of distortion or any damage consistent with an attempt to irregularly withdraw a token.

1.7 Check that the token configuration plate within the aperture is tight by inserting a heavy screwdriver into the key fulcrum guide and gently applying upward pressure against the configuration spigot.

2. Balancing Magazine (If Provided)

If magazine not attached to instrument go to 2.6

2.1 Check that a token can be moved between the instrument and magazine keyways, and that the magazine keyway is not distorted or damaged.

2.2 Check that the back (magazine) locking bolt and neither locking slide can be moved until the front (instrument) locking bolt has been pushed fully down.

2.3 Detach magazine from the instrument, and check that locking bolts on both magazine and instrument are locked down and fully closing keyway.

2.4 Check that configuration pins are secure and not damaged. If an adjacent instrument for an adjoining token section is provided, confirm that the magazine cannot be attached to that instrument.

2.5 Attach magazine to correct instrument and padlock instrument locking bolt in the raised position. Go to section 3.

2.6 Check that the locking bolt is fully closing the keyway, and that the configuration pins are secure and not damaged.

3. Internal

3.1 Carefully unlock and withdraw the instrument cover.

GW Instrument covers are susceptible to damage and distortion if the hinge lid is not opened carefully, making it difficult to re-secure the cover. If the lock is stiff apply a small amount of an approved lubricant wiping away any excess.

3.2 Examine the internal surfaces of the instrument, cover, and sides for flaking paint or metallic dust and particles. If you find any, attempt to ascertain to the source and inform your supervisor.

3.3 Examine internal wires and cables. Check that insulation is not damaged or degraded, and that wires and cables are not ‘trapped’ and are supported and protected from mechanical damage.

3.4 Check that heater (if fitted) is working, and that all wiring is clear of it.

3.5 Examine all cast parts for signs of cracking or misalignment; if you find any report it to your SM(S).

3.6 Dust the interior of instrument.

3.7 Examine all springs, fixing bolts and springs for security.

3.8 Examine the commutator, ensuring that all contact fingers, segments and insulated bridge strips are secure and intact.

Tyers Instruments only:

3.9 Check that the section signal release ‘flipper’ contact (11 on terminal instruments and 27 (where fitted) on intermediate/auxiliary instruments) has the underside insulant intact and is approximately horizontal.

3.10 Test that when deflected up and down slightly it is returned by the leaf spring to the horizontal.

3.11 Check that the insulant is present on the roller contact, and that it is free from metallic dust.

GW Instruments only:

3.12 Check that the ‘butterfly’ at the back of the commutator is secure, and that the faces which operate the section signal release mechanism are square and not grooved.

3.13 Check that the mechanism push rod is free from oil and corrosion and is held against the bottom strip by the coil spring.

3.14 Check that the section signal release contacts (right-hand pair) are not made.

All Instruments

3.15 Replace cover, ensuring that locating spigots are correctly seated, and not trapping any wiring. Re- lock the instrument.

3.16 Test operation of instrument, checking that illuminated indictors/galvanometers operate correctly, and that a token can be withdrawn. Replace token into the instrument.

SERVICE B

The angular references below are in an anti-clockwise direction with the 0° referenced when a token is first raised within the instrument and pushed fully into the commutator aperture.

With all the steps listed below it will be necessary to hold the token firmly throughout, only releasing it when stated. It is particularly important not to allow the token to turn in the opposite direction to that required in the sequence of steps.

If this is inadvertently done it will be necessary to return the token to the 0º position, and to start the sequence of steps again.

To carry out this service you will need to take a short possession of the token system.

Refer to the table in the general section to ascertain the contact numbers for the commutator positions for each type of instrument.

4. Tyers Instruments (No 12) only

4.1 Carefully unlock and withdraw the instrument cover.

GW Instrument covers are susceptible to damage and distortion if the hinge lid is not opened carefully, making it difficult to re-secure the cover. If the lock is stiff apply a small amount of an approved lubricant wiping away any excess.

4.2 Slowly depress the plunger, checking that there is enough, but not excessive pressure, on the contact arms and springs.

4.3 Clean pitted or dirty contacts if necessary. Check that plunger ‘normal’ contacts break well before the ‘depressed’ contacts are made. When the plunger is released, confirm that it springs fully back to its normal position.

Maladjusted plunger contacts can lead to a Signaller being able to irregularly release his own token.

4.4 With no token in the aperture check that the lock armature cannot be raised fully to the pole pieces.

4.5 Check from within the instrument that the commutator cannot be manually turned more than 1/8th of a turn, this equates to 10 to 15mm of movement. If the movement exceeds this you should advise your SM(S).

4.6 Raise a token into the aperture and turn slowly anti- clockwise to the lock position.

4.7 Check that the token remains in the lock position when grip is released. If the token does not stay in that position, check the registration plunger/disc for wear, and inform your SM(S).

4.8 Check that whilst the token remains in the lock position, the lock dog is not binding. (A clearance of about 1mm between the face of the lock dog and the face of the locking disc exists for this purpose).

4.9 Check that the token cannot be turned past the lock position.

4.10 Check that the flipper contact (where fitted) is approximately horizontal, and about 2-3mm clear of the commutator segment.

4.11 Manually lift the lock and turn the token approximately 10º anti-clockwise.

4.12 With the lock armature fully raised to the pole pieces, check that there is a small clearance of around 1mm between the lock dog and the top surface of the locking disc.

4.13 Turn the token a further 10º anti-clockwise.

4.14 Check that the flipper top face is making contact with the commutator segment, and that the roller contact metallic face is making with the end segment.

4.15 Turn the token a further 10º anti-clockwise.

4.16 Check that the lock dog has dropped away from the pole pieces.

4.17 Turn the token a further 40º anti-clockwise.

4.18 Check that the flipper is no longer in contact with the segment band and has returned to the horizontal position.

4.19 Turn the token anti-clockwise to a point about 10º before the face of the token is standing vertical. Whilst turning the token check that the pole change contacts break and remake in the opposite phase.

4.20 Check that the lock dog force down is effective by attempting to manually lift it, and that the token cannot be withdrawn from the aperture.

4.21 Turn the commutator further anti-clockwise, and Check that the token cannot be turned past the point where the token face is vertical.

4.22 Withdraw the token from the aperture, and place to one side.

4.23 Repeat steps 4.1 to 4.22 for the opposite phase by using a second token.

4.24 Place one of the withdrawn tokens back into the aperture.

4.25 Turn the token a 30º clockwise.

4.26 Check that the flipper contact bottom insulated face is making contact with the commutator segment, and that the roller contact has turned so that the insulated face is making with the end segment.

4.27 Turn the token a further 80º clockwise.

4.28 Check that the flipper has been released by the commutator segment and sprung back to the horizontal position.

4.29 Check that the lock dog falls cleanly into the port.

4.30 Turn the token further clockwise until face is vertical.

4.31 Check that the token cannot be turned any further clockwise.

4.32 Withdraw the token from the aperture and lower into a storage slot.

4.33 Repeat steps 4.23 to 4.31 for the opposite phase with the remaining token that was withdrawn from the instrument.

4.34 Lubricate the locating plunger with a small quantity of light machine oil, wiping away any excess.

Under no circumstances shall lubricant to be applied to any part of the commutator lock mechanism.

5. GW Instruments only (No 9)

5.1 Carefully unlock and withdraw the instrument cover and side plates.

5.2 Slowly depress the plunger, checking that there is enough, but not excessive pressure, on the contact arms and springs. Clean pitted or dirty contacts if necessary.

5.3 Check that plunger ‘normal’ contacts break well before the ‘depressed’ contacts are made. When the plunger is released, confirm that it springs fully back to its normal position.

5.4 Maladjusted plunger contacts can lead to a Signaller being able to irregularly release his own token.

There is a tendency for the brass handled plungers on the GW instruments to ‘stick’ in due the presence of metal polish on the shaft. Such deposits shall be removed with an approved cleaner.

5.5 With no token in the aperture check that the lock armature cannot be raised fully to the pole pieces.

5.6 Check that the commutator cannot be manually turned without a token in the aperture.

5.7 Raise a token into the aperture and turn slowly anti- clockwise to the lock position.

5.8 Check that the token remains in the lock position when grip is released. If the token does not stay in that position, check the registration bars/spring/disc for wear, and inform your SM(S).

5.9 Check that whilst the token remains in the lock position, it is not binding against the lock dog. (A clearance of about 1mm between the face of the lock dog and the face of the locking disc exists for this purpose).

5.10 Check that the ‘butterfly’ at the back of the commutator is NOT contacting with the bottom face of the cam on the section signal release assembly.

5.11 Manually lift the lock and turn the token approximately 10º - 15º anti-clockwise.

5.12 Check that the butterfly has now raised the cam on the section signal release mechanism far enough to cause the section signal release contacts (right-hand pair) to make.

5.13 Check that the cam face is fully in contact with the face of the butterfly.

5.14 Turn the token a further 25º anti-clockwise.

5.15 Check that the section signal release contacts are still made.

5.16 Turn the token anti-clockwise to a point about 10º before the face of the token is standing vertical. Whilst turning the token check that the pole change contacts remake in the opposite phase.

5.17 Check that the lock dog force down is effective by attempting to manually lift it, and that the token cannot be withdrawn from the aperture.

5.18 Check that the butterfly is clear of the cam on the section signal release assembly, that the push rod has fully returned to the bottom stop, and the section signal release contact has broken by at least 2mm.

5.19 Turn the commutator further anti-clockwise and check that the token cannot be turned past the point where the token face is vertical.

5.20 Withdraw the token from the aperture, and place to one side.

5.21 Repeat steps 5.1 to 5.20 for the opposite phase by using a second token.

5.22 Place one of the withdrawn tokens back into the aperture.

5.23 Turn the token 40ºclockwise.

5.24 Check that the butterfly has pushed the cam fully in on the section signal release assembly, and the section signal release ‘hold up’ contacts (left-hand pair) are broken by at least 2mm.

5.25 Turn the token 50º clockwise to the lock position.

5.26 Check that the lock dog falls cleanly into the port, and that the cam on the section signal release assembly remains fully pushed in.

5.27 Turn the token 30º clockwise.

5.28 Check that the section signal release assembly cam has been released and the section signal release ‘hold up’ contacts (left-hand pair) re-made.

5.29 Turn the token further clockwise until face is vertical.

5.30 Check that the token cannot be turned any further clockwise.

5.31 Withdraw the token from the aperture and lower into a storage slot.

5.32 Repeat steps 5.22 to 5.31 for the opposite phase with the remaining token that was withdrawn from the instrument.

6. Instruments not fitted with an internal heater which are situated in an unheated environment and have voltages higher than 24volts (nom) present

6.1 Insulation test with a 500v tester between each adjacent unconnected contact finger and between each adjacent segment, and from each one to the instrument housing. If any values of less than 1MΩ are found, attempt to ascertain to the reason and inform your SM(S).

To carry out this step it will be necessary to turn the commutator with a token to various positions to check that the segments/contact fingers under test are not in contact with each other; and to also isolate the fingers.

If such isolation requires removal of wires the provisions of the Signalling Maintenance Testing Handbook (NR/SMTH) shall be used.

6.2 Check that the lubricating holes at each end of the commutator are clear and place a small amount of light machine oil into each, wiping away any excess.

6.3 Smear a small amount of lithium-based grease on the corners of the commutator registration disc where contact is made with the registration bars.

6.4 Clean contacts and segments, if necessary, using a cleaner.

6.5 Check that all contacts have enough, but not excessive tension.

6.6 Move the Token Section Switch (where provided) to each position, check that the contacts make and break correctly, and that the switch does not spring away from any position.

6.7 Where a neon spark quench is connected across the lock coils, check that is effective by arranging for a token to be electrically released from the instrument and observing the neon to flash when the lock de-energises.

6.8 Replace the instrument top and sides, checking that wiring cannot become trapped. RE-LOCK the instrument.

6.9 Test operation of the instrument, both for sending and receiving a release. Check that illuminated indicators and galvanometers operate correctly without sticking in one position. Replace token once the test is complete.

7. System Test

Carry out NR/SMS/PartB/Test/301 (WR E10K Token System Test).

END

Includes:	All types of lever frames
Excludes:	

Competent, qualified, locking staff familiar with the type of frame shall only carry out this work.

This work requires a method statement. Testing of lever frames shall only be carried out by persons who are certified for this task, competent and experienced in the type and complexity of the frame under test.

Simple ground frames (e.g. 1 releases 2, 2 reverse locks 1) that can be tested by a competent technician using either a locking table or the layout diagram/plate legends.

The terminology used refers to tappet frame components. The principles apply to all types of cam, tumbler / twist rocker and soldier locking.

Overhaul Requirements

Typical overhaul frequencies can be found in appendix A

1.1 All levers shall have paint removed

- All trigger pins and holes to be examined for excessive wear and replaced as necessary.
- All back rods and springs to be examined for excessive wear and replaced as necessary.
- All Quadrants shall be examined for excessive wear and over stroke plates where necessary. (Function and locking test of affected lever required).

1.2 All Bearings and spindles shall be examined for excessive wear and replace as necessary.

1.3 Locking drive devices shall be examined for excessive wear and replaced as necessary (locking test of affected lever required).

1.4 Lever Tails shall be examined for excessive wear and replaced as necessary (function test of affected equipment required).

1.5 All levers shall be painted in accordance with NR/SMS/LV00.

1.6 Pull plates shall be examined for damage and wear. Replace as necessary.

2 Removal of Locking

2.1 Disconnect the following:

- The locking.
- Points and signals that are connected to the lever frame.
- Electric locks .

Lock Blade

2.2 Remove Lock Slide from base casting.

2.3 Clean and examine lock slide check throw down studs are not loose or worn, check there is no damage to the controller drive slot or gear. (replace or File as necessary).

2.4 Clean and Examine drive rod and pins for any wear (Replace as necessary).

2.5 Clean and examine base for any cracks or damage.

2.6 Check that the base is securely fitted to the controller table.

2.7 Lightly oil lock blade and re fit. (Check the blade runs freely and that over-stroke pins or blocks are not fowling at either end of the travel).

2.8 Check new split pins are fitted to drive pins and opened to 45 degrees.

2.9 Remove lids / straps holding locking.

2.10 Check stamping of all components.

2.11 Remove and correlate to the diagrams:

- All locking bars.
- Packing pieces.
- Locks and spacers.
- Tappets.

Lock Assembly

2.12 Remove clean and examine lock dog ramp for wear burr’s, File off rough edges, renew dogs where necessary

2.13 Check lock adjusting screw and lock pivoting pins for wear or distortion.

2.14 Check that dowel pins are fitted to either the lock or the base (Mostly Westinghouse D and L type Models)

2.15 Check that armature piece is securely fixed to armature arm

2.16 Check pivot pins and bearing holes of the armature and laminations for any excessive play

2.17 Check nylon roller at lock end of armature arm (L Type Only)

2.18 Lock proving contacts should be clean and undamaged and provide good tension to check a good contact, spring pressures are based on experience.

2.19 On completion of the lock checks before the lock is rewired, an insulation resistance test should be carried out between all terminals and base frame work not less than 5 Megohms.

2.20 When lock proving is provided each lock proving contact should be tested to the frame with the lock in the de energised position.

2.1 Test coils for resistance:

Westinghouse : D4/D6 (DE Coils)		Westinghouse : D4/D6 (coil)		Westinghouse : L type	
Volts	Ohms	Volts	Ohms	Volts	Ohms
10	10	110 50hz	2.8	1/17/6 12v dc	10
20-24	50	110 75hz	1.8	1/1 24v dc 7/8	55
50	109	110 50hz old pattern	6	1/17/9 50v dc	270
xxxxxxxx	xxxxxxxx	110 50hz old pattern	3	2/9/2 110v ac 2/9/12 12v dc	4

3 Economiser

3.1 Carefully clean and examine all individual parts for wear ., particular attention being given to all insulations including the spring depression roller on GA Type.

3.2 Replace burnt or damaged contacts, file contact nibs where possible.

4 Controller

4.1 Clean and examine contact segments for wear, burns. Renew where necessary, check segments for correct position.

4.2 Clean and examine contact springs, keepers for wear, distortion.

4.3 Polish contact nibs, (File and shape surfaces were necessary) or renew contact spring complete and check for sufficient spring pressure.

4.4 Check controller operating spindle and bearings for damage or excessive wear.

4.5 Clean and examine actuating drive gear or roller (check free operation).

4.6 Renew any worn or badly pitted bands (try to clean burnt bands with fine emery cloth where possible).

4.7 Light mineral oil to be used on bearings and drive gear.

5 Component Overhaul

5.1 Clean all components.

5.2 Check security of all rivets and studs (fastenings).

5.3 Thoroughly scrape, Wash and clean the locking boxes.

5.4 Examine all castings for fractures or breakages.

5.5 Check the security of attachment of the locking boxes/guide racks.

5.6 Examine boxes for damage around tappet ways, especially front and back.

5.7 Examine tappets for worn / oversize notches and wear on bevels. Check for conflicting notches.

5.8 Examine locking bars for damage and slack locks.

5.9 Check loose lock stamping.

6 Covers

6.1 Lock and controller covers should be cleaned and inspected for any damage or loose pins and re painted where necessary.

7 Re-instatement of Locking

7.1 Correlate all locking to diagram before returning to the frame.

7.2 Check the stamping.

7.3 Check that no redundant locking is returned to the frame.

7.4 Check packing pieces and packing bars are correctly stamped.

7.5 Check each bar has been returned and test on installation.

7.6 All locks will “fit” their notches and there shall be no excess slack. The amount of slack or slog on lever locking frames varies.

7.7 Only experience can tell if it is correct. Slack is there to reduce wear on direct lever locking frames. The notch size is usually cut larger than the lock.

7.8 Check each lock travels correctly.

7.9 Conditional locking cannot lose stroke / travel across the slides. (tappet or bridge).

7.10 Check locks do not foul tappets when operating slides.

7.11 As locking is installed, Check for conflicting notches on the tappets.

7.12 Check the following on tappet locking frames:

- All locks can fit in all ports of a tappet simultaneously.
- Multiple locks on the same bar impart the same travel to all opposing locks on the same bar.
- Any conditional locks are correctly set with equal shoulders and no loss of travel occurs especially when conditions occur in series.
- Conditional locks are correctly lipped so that the bar travel is not impeded by the lip hitting the tappet face.

7.13 Check the following on pre 43 and MR tappet frames:

- Any locks in adjacent channels have upside down lip locks fitted so that the sliding bridge does not collide with a lock in the next channel.

7.14 Check the following on LNWR tumbler frames:

- All locks are set at the correct clearance from the hook rack.
- The conditional ‘dart’ type locks do not permit a half release of a function when the conditional lever is in mid position.
- All locks enter the racks without forcing the rack vertically.

7.15 Check that any spring loaded or weighted locks operate correctly.

8 Sequential / Rotation Locking

8.1 Check noses of locks and notches in tappets for rounding / wear.

8.2 Check notches are correct shape and the locking becomes effective correctly to correspond with the lever position.

9 Final Checks

9.1 Check that all shockproof washers, circlips, and lock plates are fitted, and that all split pins are in and opened to 45 degrees, nuts and set screws are secure.

9.2 Check that all moving parts operate freely.

9.3 Carry out a full correlation of the lever bands and check there are no overlapping bands.

9.4 Check that you have the correct lock position and that the lock operates correctly.

9.5 Check that the economiser is open at the end of each travel.

9.6 Check that any force down features work correctly.

9.7 Check that all SMTH testing has been carried out, and that all records have been completed.

10 Testing

10.1 Carry out a full frame test

After re-assembly, when each bar has been individually tested, a full test is required after replacement of all packing pieces, packing bars and holding down strap / lids has occurred.

On some frames it is possible to work on one locking box at a time. The locking for each box can be separately coloured on the locking sheet or separate sheets produced for each box.

Appendix A – Expected Overhaul Maintenance Tasks Frequencies

Frame type	Frequency (years)				Remarks
	4	3	2	1	
All Frames over 100 years old				X	Irrespective of type
Dutton 1893 pattern			X		
			X X		

END

Includes:	TEML41 PMUX systems at Aston. Interface equipment and associated cubicles contained in equipment or relay rooms
Excludes:	All other Panel Multiplexers, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

The SSI panel multiplexer forms the interface between the Signaller's controls and a solid-state interlocking.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Power Supplies

7.1 For systems A and B Measure the DC output voltages from all the power supply units.

The measurements should be taken at the 2BA terminals on the rear of the sub-racks.

For duplicated supplies, switch off the other supply before taking measurements.

If the voltages are out of tolerance, the relevant unit shall be adjusted or replaced.

Supply	Volts	Limits	Ripple	Test Point
Logic A (LHS)	+5V	5.1V to 5.25V	<50mV	5V1 & 0V1
Logic B (RHS)	+5V	4.75V to5.25V	<50mV	5V2 & 0V2
Comms A	+5V	5.1V to 5.25V	<50mV	5CB1 & 0V1
Comms B	+5V	5.1V to 5.25V	<50mV	5CB2 & 0V2
Alarm A	+24V	23.4V to 24.6V	<50mV	Alarm Common Terms
Alarm B	+24V	23.4V to 24.6V	<50mV	Alarm Common Terms

Supply	Volts	Limits	Ripple	Test Point
Output A	+12V	11.4V to 12.6V	<100mV	Output Common Terms
Output B	+12V	11.4V to 12.6V	<100mV	Output Common Terms
Input A	+24V	24V to 26V	<100mV	Input Common Terms
Input B	+24V	24V to 26V	<100mV	Input Common Terms

Table 1 - DC Voltages

8. Final

8.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

8.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

9. Equipment Cubicles

9.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

10. Control and Interface Equipment

10.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

10.2 If provided, disconnect and clean all keyboards as necessary.

10.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

10.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

10.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

10.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

11. System Change Over

The following tests shall be conducted under a system possession or during a quiet traffic period in liaison with the Signaller.

11.1 Check which of the duplicated systems is on line (A or B). This shall be indicated on the status card. Observe all indications are as shown in Table 4.

11.2 Using the key switch on the status card change control to the hot standby system.

11.3 Observe that the changeover has successfully taken place (status card) and that the indications as shown in Table 4 and on the signalling panel Table 3 are correct.

11.4 Check that the system is operational by selecting some routes on the Signaller's panel and observing the responses.

11.5 Check the Technicians terminal print out for any on-going panel multiplexer alarms.

12. Line Protection and Route Selection

12.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

12.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

13. Spares

13.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

13.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

14. Final

14.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

14.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications

LED	State
SPA Fail	Extinguished
SPB Fail	Extinguished
TEML41 Fault	Extinguished

Table 2 - System Status Panel

LED	State
Critical Alarm	Extinguished
Non-Critical Alarm	Extinguished
Normal Working Failed	Extinguished
Indications Failed	Extinguished

Table 3 - Signalling Panel

Card	Function	Indication
System Processor	TD1 (4Tx channel monitor) RD1 (4Rx channel monitor)	Normally Off. TD3 & RD3 will flash when message is sent to fault terminal
System Processor	PGM (Program running)	Illuminated (Slight Flicker)
General Processor	TD1 (4Tx channel monitor) RD1 (4Rx channel monitor)	Flashing when data is being exchanged between SSI & TEML41
General Processor	PGM (Program running)	Illuminated (Slight Flicker)
Universal Input	32 LED's indicating I/P status	Input Made: extinguished Input Open: Illuminated
Universal Output	32 LED's indicating O/P status	Output On: Illuminated Output Off: Extinguished
Status	1 to 24 O/P Register Bits	Refer to Manual
Status	Loc PSU	Extinguished
Status	Clock	Flashing (1 second)
Status	Master/Slave A/B	A will show Master & B Slave or vice-versa
Status	Power	Illuminated (Green)

Table 4 - System Status

END

Includes:	WBS Type S2, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	WBS Type S2 (TDM) and all other Panel Multiplexers, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

The SSI panel multiplexer forms the interface between the Signaller's controls and a solid state interlocking.

This system was developed in the late 1970's. It is an asynchronous system using simplex or duplex as a transmission mode. The system is based on microprocessor technology.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

System Tests

On duplicated systems invasive tests shall be conducted on the off-line system.

To test the current on-line system, a change-over shall be forced to change the on-line systems over.

On non-duplicated systems the tests shall be conducted under a system occupation.

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Power Supplies

7.1 Measure the DC voltages of the power supplies associated with the system. Measure using a Digital voltmeter or an oscilloscope the AC ripple on the DC output. Check they are within the limits as shown in Table 1.

Power Unit	Supply Voltage	Limits	Ripple
12v PSU1&2	+12V	11.5V to 12.8V	<50mV
24v PSU1&2	+24V	23.5V to 24.5V	<100mV

Table 1 - DC Power

The PSU's cannot be adjusted. If any of the voltages or ripples are outside the limits, the relevant power unit shall be replaced and re-tested.

8. Final

8.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

8.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

9. Equipment Cubicles

9.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth

10. Control and Interface Equipment

10.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

10.2 If provided, disconnect and clean all keyboards as necessary.

10.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

10.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

10.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

10.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

11. Duplicated Power Supply Units (PSU) Associated with S2 Housings

The following tests shall be conducted under a system occupation or during a quiet traffic period in liaison with the Signaller.

11.1 Disconnect the 110V AC feeds to one of the PSUs.

11.2 Check that the S2 system continues to operate correctly.

11.3 Measure the DC output and using a digital voltmeter or an oscilloscope the AC ripple voltage of the remaining PSU.

11.4 Check that the ripple voltage does not exceed 50mV.

11.5 If this voltage is exceeded, change the PSU.

11.6 Observe that the DC output indicator lamp(s) of the un-powered PSU are extinguished. If any remain illuminated, the PSU shall be replaced.

11.7 Repeat 11.1 to 11.6 for each PSU.

12. Change Over Alarms

This system normally operates on system 1, switching to system 2 only in the event of a failure of system 1.

12.1 Disconnect the link between the SSI PPM1 and S2 system 1 or power down PPM1.

a) Observe that the 'Non-Critical' alarm operates, and the correct fault messages appear on the Technician's terminal.

b) Observe that the panel controls and indications continue to operate correctly.

c) Re-connect the link.

12.2 Disconnect the link between the SSI PPM2 and S2 system 2 or power down PPM2.

a) Observe that the 'Non-Critical' alarm operates, and the correct fault messages appear on the Technician's terminal.

a) Observe that the panel controls and indications continue to operate correctly.

b) Re-connect the link.

12.3 Remove the cleared faults from the SSI Technician's terminal memory.

13. Line Levels (Systems with Modems Only)

13.1 If modems are fitted (if the SSI interlocking is remote from the panel multiplexer).

<u>Non- Manchester systems only</u>

13.2 Using the adaptor plug (Appendix B) set the office modem A to continually transmitting. Measure using a meter the modems transmit level at a convenient point, they should be between 11.4dBm and –16dBm.

At the field(s) locations, measure using a meter the received level at a convenient point they should be no lower than –40dBm.

13.3 Remove the adaptor plug from modem A and repeat 13.2 and 13.3 for modem B.

Where Line Matching Units (LMU) is fitted the signal shall be measured on the modem side of the LMU.

13.4 Disable the office modems and set one of the fields modems to transmit (Appendix B).

Measure using a meter, the transmitted level at a convenient point, they should be between -11.4dBm and –16dBm.

At the office locations, measure using a meter the received level at a convenient point they should be no lower than –40dBm.

13.5 Repeat 13.4 for each of the field modems.

Where Line Matching Units (LMU) is fitted the signal shall be measured on the modem side of the LMU.

13.6 Set all the modems back to normal operation and confirm using the office alarm panel that the system is operating correctly.

<u>Manchester Systems Only</u>

The following tests shall be conducted under a system possession.

13.7 The modem line levels shall be measured with a constantly transmitting data signal. Use either the adaptor plug shown in Appendix B, modem test set, or the modems own test facilities (check the modem manual).

13.8 Set the office modem A to continually transmitting data. Measure using a meter (VF meter) the modems transmit level at a convenient point; they should be between –11.4dBm and –16dBm.

At the field locations, measure using a meter the received level at a convenient point, they should be no lower than –40dBm.

13.9 Check that the alarm fault indication panel for the processor housing is showing the relevant alarm, e.g. 'link failure'.

Check the audible/visual LED indication alarms on Signallers desk and also on corresponding processor alarm panel (also ref section 6- System Changeover).

Not all processors are duplicated, check on drawings.

13.10 Set the field modem A to transmit data. Measure using a meter the modems transmit level at a convenient point; they should be between –11.4dBm and –16dBm.

At the office locations, measure using a meter the received level at a convenient point, they should be no lower than –40dBm.

13.11 Repeat 13.8 & 13.9. for modem B.

Where Line Matching Units are fitted the signal shall be measured on the modem side of the LMU.

13.12 Set all the modems back to normal operation and confirm using the office alarm panel that the system is operating correctly.

14. Line Protection and Route Selection

14.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

14.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

15. Spares

15.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

15.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

16. Final

16.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

16.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications

System	Indication	Status
Critical alarm	Red	Extinguished
Non-Critical Alarm		
Normal Working Failed		
Indications Failed		

Table 2 - Signaller's Panel

LED Position and Colour	Indicating	State
Top Red	Highway OK	Regular Flashing
Lower Red	Program OK	Illuminated
Top Yellow (x2)	Data Tx Data Rx	Continuous Flickering
Lower Yellow (x2)	Data Tx Data Rx	Extinguished #
DIP Card Top Red	Highway A	Regular Flashing
DIP Card Lower Red	Highway C	
DOP Card Top Red	Highway A	
DOP Card Lower Red	Highway C	

Table 3 - Scanner Cards in S2 Housing

Not used on this system

LED	Indicating	State
On Line Scanner	A or C system on line	One illuminated only (A or C)
PSU1&2 (12v)	110v (White)	Illuminated
	12v (Green)	
PSU3&4 (24v)	110v (White)	Illuminated
	24v (Green)	

Table 4 - Fuse/Status Panel

LED	Indicating	State
PWR	Power	Illuminated
DTE	Data Terminal Equipment	
RXD	Receive Data	Flashing
TXD	Transmit Data	

Table 5 - Modems (if provided)

APPENDIX B - Modem Connections for Continuous Transmission

The configuration of the modem 9-way 'D' connector is as follows:

Pin	Signal	Pin	Signal
2	Tx Ready	5	CTS (Clear to Send)
3	Rx Data	6	DTR (Data Terminal Ready)
4	RTS (Ready to Send)	7	Ground (0V)

Table 6 - Modem configuration

A line pair can be tested by disconnecting the 'DTE' D-type connector at the rear of the 'end of the line' modem (this can be the office modem or the furthest away field modem) and replacing it with a D-type male plug with the internal connections configured Pin 4 connected to Pin 6.

This can set the modem to continually transmitting at 1300Hz (mark).

The modem launch level and receive levels along the line can now be measured at a convenient point in the S2 cabinet (refer to the site diagrams).

If there is a miniature switch fitted to the D-type plug (this is between Pin 2 and Pin 6) the modem can be set to transmit either 'mark' (1300Hz) or 'space' (2100Hz) to check the frequency attenuation of the line.

END

Includes:	Vaughan Harmon, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Panel Multiplexers, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

The SSI panel multiplexer forms the interface between the Signaller's controls/indications and a solid-state interlocking.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

System Tests

On duplicated systems invasive tests shall be conducted on the off-line system.

To test the current on-line system, a change-over shall be forced to change the on-line systems over.

On non-duplicated systems the tests shall be conducted under a system occupation.

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Power Supplies

7.1 Measure using a meter on both the 'A' and 'B' processors the following voltages. Check they are within the stated limits (See Table 1):

Source	Voltage / Ripple	Limits
Logic	+5V DC / <1%	+4.9V to +5.5V DC
Logic	+7V DC / <1%	+6.3V to +7.7V DC
I/F	-12V DC / <1%	-10.8V to -13.2V DC
External	+12V DC / <1%	+10.8V to +13.2V DC
Auxiliary	+48V DC / <1%	+45.2V to +52.8V DC
Incoming Mains	110V AC @ 50Hz	99v to 121V AC @ 47Hz to 64Hz

Table 1 – Power Supply Voltages

8. Final

8.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

8.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

9. Equipment Cubicles

9.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

10. Control and Interface Equipment

10.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

10.2 If provided, disconnect and clean all keyboards as necessary.

10.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

10.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

10.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

10.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

11. System Change Over and Alarms

11.1 Check that the processor indications are as listed in Appendix A.

a) With the co-operation of the Signaller force a changeover of the system and observe the processor indications remain as listed in Appendix A (on line & off line shall now be reversed).

b) Return the changeover switch to its original position and observe the processor indications remain as listed in Appendix A.

11.2 Disconnect the links as listed in Table 2 below, in turn.

a) Observe that the ‘Non-Critical’ alarm operates, and the correct fault messages appear on the Technician’s terminal.

b) Observe that the panel controls and indications continue to operate correctly.

Re-connect the link before proceeding with the next link, checking that indications remain constant:

Alarm Message
Data + PPM1 to Panel Multiplexer Port ‘C’
Data - PPM1 to Panel Multiplexer Port ‘C’
Data + Panel Multiplexer Port ‘C’ to PPM1
Data - Panel Multiplexer Port ‘C’ to PPM1

Table 2 – Message Content

11.3 Repeat 11.2 using PPM2 & Panel Multiplexer Port ‘D’.

11.4 Clear the fault memory on the Technician’s terminal and check no faults are left on the system.

12. Serial Test

12.1 This test shall only be carried out on the standby system as it could evoke a system change over.

12.2 Perform a ‘Back to Back’ serial test to coincide with the changeover test so both channels can be checked.

12.3 Clear the fault memory on the Technician’s terminal and check no faults are left on the system.

13. Line Protection and Route Selection

13.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

13.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

14. Spares

14.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

14.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S) Test the operation of the cards/units in the test rack.

15. Final

15.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

15.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications

LED	State
Watchdog	Illuminated
Select	Illuminated
Available	Illuminated
Power	Illuminated
Fault	Extinguished
Halt	Extinguished
C Port	Flashing Red/Green
D Port	Flashing Red/Green

Table 3 - On Line Processor

LED	State
Watchdog	Illuminated
Select	Extinguished
Available	Illuminated
Power	Illuminated
Fault	Extinguished
Halt	Extinguished
C Port	Illuminated Red
D Port	Illuminated Red

Table 4 - Off Line Processor

LED	State
I/F (A&B Processors)	Illuminated Yellow
Logic Status	Illuminated Yellow
‘IN’ Control Processor Scan	Flashing Red
‘STANDBY’ Processor Scan	Extinguished

Table 5 - Digital Output Modules

LED	State
I/F (A&B Processors)	Illuminated Yellow
Logic Status	Illuminated Yellow
'IN' Control Processor Scan	Illuminated Red
'STANDBY' Processor Scan	Illuminated Red

Table 6 - Digital Input Modules

LED	State
External Power Supply	Illuminated Green
Auxiliary Power Supply	Illuminated Yellow

Table 7 - External and Auxiliary Power Supplies

END

Includes:	GEC Type RM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Panel Multiplexers, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

GEC Type RM equipment can also be referred to locally as SDT and SIGNET.

The SSI panel multiplexer forms the interface between the Signaller's controls and a solid-state interlocking.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

Some of the following tests do not require a possession of the system but it is recommended they are performed within a system possession unless the duration of occupation is limited, and the Signaller is in agreement.

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. General Checks

7.1 Observe the system status LEDs on the Signaller's panel, check they are as show in Table 1:

System	Indication	Status
Critical Alarm	Red	Extinguished
Non-Critical Alarm		
Normal Working Failed (Delayed)		
Indications Failed		

Table 1 – Signallers LED Status

7.2 Ask the Signaller if they are aware of any faults present on the system(s).

7.3 Check that the audible SSI alarm is silent.

7.4 Check there are no current panel multiplexer faults recorded by using the SSI Technician’s terminal.

7.5 Observe the LED Indications on each card in the PMUX rack for alarm conditions, check that they are as shown in Table 1

Card	Indication/Function	State
Alarm Unit	Sys OK Indication	Illuminated
	All other indications	Extinguished
Microcomputer JM25XX	LED’s 1-8	Extinguished
Memory Extension	N/A	N/A
Highway Buffer Unit	LED’s A0-A10 [1] *	Pulsing
	LED’s D0-D7	
	RD LED	
	WR LED	
	RESET LED	Extinguished
	COMPARE LED	Illuminated
Input Buffer Units (Single)	LED 1	Pulsing
Input Buffer Units (Double)	LED 1	Pulsing
	LED 2	
Transistor Output Buffer Units	LED 1	Pulsing
Single PSU (JD1076)	+5v LED	Illuminated
Triple PSU (JD1077)	+12v LED	Illuminated
	+5v LED	
	-12v LED	
Battery Backed Triple PSU (JD1077)	+5v LED	Illuminated
	+12v LED	
	-12v LED	
	Batt OK LED	

Card	Indication/Function	State
Output Changeover Unit (Dual Systems Only)	LED 1	Pulsing
	LED 2	Illuminated (Online unit only)
	LEDs 7,8,3,4 (not used)	Extinguished
	LEDs 5, 6	Illuminated

Table 2 – LED Indications

1✱ ***NOTE:*** *LED's A7-A10 might be extinguished for smaller systems of less than 4 subracks.*

8. Power Supplies

8.1 In the order as listed in Table 3 below, using a meter and/or oscilloscope, measure the microcomputer power supply and sub rack PSU DC output voltages and the AC ripple voltages. Compare the readings with the previously recorded results.

Card/Test	Terminals		DC Voltage Limits	AC Ripple
	+Ve	-Ve		
Microcomputer JM25XX +5V Supply Check	TP4	TP1or TP6	+4.95V to+5.25V	<50mV
Single PSU +5v Output Check	TP2	TP1	+5.15V to+5.25V	
Triple PSU +5V Output Check	TP2	TP1	+5.15 to+5.45V	
Triple PSU +/- 12V Output Check	TP4 2✱ TP3 2✱	TP1 2✱ TP1 2✱	+10V to+14 V-10V to-14 V	

Table 3 – Voltages

If any of the voltages are found to be outside the limits, adjust or change the relevant power unit and re-test all units.

2✱ ***NOTE:*** *TP located on back of PSU on some systems.*

9. Final

9.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

9.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

10. Equipment Cubicles

10.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

11. Control and Interface Equipment

11.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

11.2 If provided, disconnect and clean all keyboards as necessary.

11.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

11.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

11.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

11.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

12. Power Supplies

12.1 Measure the AC supply voltage to all the power supply units and confirm it is between 105V to 120V.

13. System Changeover (Dual Systems Only)

The following test shall be conducted under a system possession or during a quiet traffic period in liaison with the Signaller.

13.1 Check that the processor indications are as listed in 7.1 and 7.5.

13.2 Check that SW1 on both Output Change-Over Unit cards are set at AUTO.

a) Identify which Output Change-Over Unit card is in ONLINE by observing which one has LED 2 lit (Com Line Output indication).

b) Push SW1 on this card over to the OFF position.

c) Observe that within 3 seconds control passes over to the OFFLINE Output Change-Over Unit card.

NOTE: *This should be confirmed by LED2 illuminating on the card newly in control and extinguishing on the card previously in control.*

d) Return SW1 on the OFFLINE card back to the AUTO position.

13.3 Observe the processor indications remain as listed in 7.1 and 7.5.

14. Monitor Card

14.1 Test the operation of the Monitor card by checking a convenient signalling function whilst it is being operated.

15. Line Protection and Route Selection

15.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

15.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

16. Spares

16.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

16.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S) Test the operation of the cards/units in the test rack.

17. Final

17.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

17.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

Includes:	GE Panel Multiplexer, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Panel Multiplexers, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

The GE Panel Multiplexer, PMux, is used to interface a panel to a Solid-State Interlocking (SSI).

It consists of a Delphin1024 enclosure that is connected via a dual serial links to the SSI.

The PMux database maps the serial data to the relevant digital inputs and outputs and this is used to generate the digital outputs (indications) displayed on the Signaller's panel.

Similarly controls set by the Signaller are read by the PMux digital inputs and sent serially to the SSI.

Each enclosure is fitted with dual power supplies and processor modules operating in a control/standby configuration accessing common input and output modules.

The control/standby status of the office and field end processor modules is controlled by the changeover and alarm module, CCO.

The module provides for both an automatic and manual changeover facility.

The CCO module can also provide digital outputs and inputs to drive the half system and total system failure alarms on the Signaller's panel.

The input and output modules, CMI-x and CMO-x, are common to both processor modules and are scanned sequentially.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Visual Checks

7.1 Check that the interface and logic indication LEDs on the CPW power are lit.

7.2 Check that the power indication LEDs are lit on the following modules:

a) CMP-P2.

b) CCO.

c) CSC.

d) CMI.

e) CMO.

7.3 Check that the Watchdog (WD) LED is flashing and Available (Av) LED is lit on both CMP-P2 modules. One of these modules is selected as being in control and this is indicated by the ‘Sel’ LED being lit on the selected module.

7.4 Check that both the scan LEDs are lit on all configured input modules.

7.5 Check that the scan LED representing the CMP-P2 selected as being in control is either on or flashing on the configured CMO modules. Note: either state is acceptable, both scan LEDs off is not.

7.6 Check that the power LEDs are lit for any other external power supplies where these have been supplied.

7.7 Where fitted, check status of surge protector units and take action as follows:

a) Green lit only – Full protection – No action.

b) Green and Red lit – Reduced protection – Replace unit within one week.

c) Red lit only – No protection – Replace unit immediately.

8. Changeover

NOTE: *Inform Signaller before proceeding.*

8.1 Check for faults by observing the fault light on either processor is not lit and clear before proceeding.

8.2 Force a changeover to the standby CMP-P2 module using the switch on the front panel of the CCO module.

8.3 Check that the standby CMP-P2 module is now in control by observing that the 'Sel' LED is lit.

The CMP-P2 module that was previously in control should now be in standby mode and this can be checked by observing that the 'Sel' LED is no longer lit and the 'WD' LED is still flashing.

8.4 Check that the scan "LEDs" on the CMO modules now represent the newly selected processor module.

8.5 Check that the changeover switch is returned to the auto position and that any alarms that can have been raised have been cleared by using the Alarm / Ack switch on the CCO module.

8.6 Confirm that no faults have been introduced onto the system by checking the EFA LED is out.

8.7 Check for system faults by looking at the fault LED.

8.8 Record the details on the record card.

9. Final

9.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

9.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

10. Equipment Cubicles

10.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

11. Control and Interface Equipment

11.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

11.2 If provided, disconnect and clean all keyboards as necessary.

11.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

11.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

11.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

11.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

12. Testing

12.1 Measure the voltages on the test points at the front of both of the CPW power supplies. The values obtained shall be:

a) between 6.5Vdc and 7.5Vdc for the 7VL logic test points.

b) between 11.5Vdc and 12.5Vdc for the 12VIF interface test points (on CPW-A).

c) between 23Vdc and 25Vdc for the 24VIF interface test points (on CPW-D).

Record the voltages measured on the record card, if outside the specified range change the CPW-A.

12.2 Where fitted, measure the voltages on external power supplies. The values obtained shall be:

a) between 10.5Vdc and 13.5Vdc for an external 12V supply.

b) between 21.5Vdc and 26.5Vdc for an external 24V supply.

c) between 44Vdc and 63Vdc for an external 48V supply.

Record the voltages measured on the records card, if outside the specified range change the power supply.

13. Line Protection and Route Selection

13.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

13.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

14. Spares

14.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

14.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

15. Final

15.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary, locked.

15.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

Includes:	Honeywell Radar scanner equipment
Excludes:	Lidar scanner (See NR/SMS/OD02) other crossing equipment

SERVICE B

1. Honeywell Radar Scanner

1.1 Check the RADAR is firmly mounted. Observe that it does not move when lightly pushed.

1.2 Check each RADAR Reference Reflector is firmly mounted. Observe that the post does not move when lightly pushed.

DO NOT push the Reference Relfector itself as they are easily bent and once bent will need replacing.

1.3 Check the RADAR scanner and Reference Reflectors for signs of external damage.

1.4 Check barrier machine deflector plates are present. Oil spring loaded hinges.

1.5 Check for noise and vibrations when scanning. If RADAR is very noisy when operating report this.

1.6 Check the Surveillance Area and line of sight to each Reference Reflector are clear of obstacles,

For example vegetation, building materials, ballast build up.

a) Remove these obstacles from the Surveillance Area and Buffer Zone.

1.7 Check the internal temperature.

This requires running RWMON software, which shall only be done if competent (using RWMON will cause the RADAR to ignore commands from the crossing)

1.8 Measure and record the return voltage of each Reference Reflector and compare to previous readings.

a) If the voltage has changed by more than 0.2V, set up Reference Reflector to achieve a voltage as close to 1.9V as possible.

1.9 Check any Deflector plates are present as required by RADAR set up record (e.g. Rear Deflector plate, “cheese wedge” deflectors, any bespoke defelctor plates).

1.10 Walk test the Surveillance Area using RWMON software.

Details are in the Installation and Set Up Manual.

1.11 Exit Test Mode **DO NOT** leave RWMON running on DVR and Diagnostic Unit.

SERVICE C

2. Battery Replacements

2.1 Save protocol and error logs before any attempt to power down and replace batteries.

2.2 Replace the two CR2430 batteries for the internal clock and protocol storage within the Control Module.

2.3 Set up time and date.

2.4 Record battery change.

End

Includes:	LIDAR scanners used at level crossings e.g. RLS3060 and RLS3060SH
Excludes:	All other types of obstacle detection equipment

SERVICE B

1. LIDAR Scanner

1.1 Check the shutters open and close and leave open for the rest of the tests if possible, or close if a train is to pass over the crossing.

They should take approximately 2 seconds to open and 2 seconds to close.

1.2 Clean the lens with a baby wipe, then dry with a clean tissue, then spray a clean dry tissue with BEESWAX based furniture polish and wipe over the lens, do not leave streaks of wax on the lens.

DO NOT use a silicone (general purpose) based polish, only use a beeswax-based furniture polish.

1.3 Check the LIDAR post does not move when lightly pushed.

1.4 Check the scanner lens and housing for signs of external damage.

1.5 Check that the follower relay (or equivalent) for the scanner de-energises to indicate occupied when an object (person or Test Target) is placed in the scanners Detection Area.

1.6 Check the follower relay (or equivalent) for the scanner energises to indicate the crossing is clear when the scanners Detection Area becomes clear after being occupied.

1.7 Check the follower relay diodes (where shown on circuit diagrams) visually for signs of damage.

1.8 Carry out NR/SMS/PartB/Test/053 (Earth Leakage Detector (ELD): Testing and Calibration) – use the Functional Test relevant to the type of ELD or carry out NR/SMS/PartB/Test/051 (Busbar Earth Tests) on the B24 bus bar.

1.9 Monitor busbar voltage as the barrier rise, checking that the voltage does not drop below 18V dc.

When using a Fluke TPWS meter set to DC volts, select '*Fast Min/Max*' function.

NOTE: *On other meter types or styles the selection of fast sampling mode might be different.*

Inform (SM)S and investigate to find the cause if below 18V dc.

NOTE: *If Min voltage is greater than 14V but less than 18V, even after any obvious defect is repaired and the test performed again, then the battery and charger should be changed within 13 weeks.*

If Min voltage is less than 14V, there is a risk of a LIDAR becoming unresponsive, and additional checks should be made immediately to identify and fix the reason e.g. loose or high resistance connections, failed cell, group of cells or charger, or incorrectly set up charger, if no obvious cause can be found then replace the battery and charger within 4 weeks.

If no Low Level LIDAR is provided, the risk of a High Level LIDAR becoming unresponsive is mitigated by the Honeywell RADAR. If two LIDAR scanner detection areas overlap significantly (e.g. two High Level or two Low LEVEL LIDARs) the risk is also mitigated by the presence of the other LIDAR scanner at the same height i.e. Low or High. The worst case is a crossing with Low Level LIDAR where the Low-Level LIDAR detection area overlaps only cover a small proportion of the combined Low Level Detection Area.

1.10 Check the beam height at the beam height setting up points as shown on the Detection Area Diagram. Compare the beam heights to the previously recorded heights on the Detection Area Diagram.

If adjustment is required, this shall only be carried out by staff with LIDAR Set Up competency.

Any variation of up to ± 50mm is not uncommon and requires no further action.

1.11 Using Redscan Manager, check the Ethernet connection to the scanner is communicating with the scanner.

1.12 Check the Redscan Manager view is as expected, e.g., no spurious false detections (vegetation), no dirt on lens, no SO or AM error code with shutters open.

1.13 Check the LIDAR Detection Area (i.e. combined Detection Area of all LIDAR scanners) by Internal Walk Test with barriers down.

This requires Redscan Manager and changing to different scanners where overlaps have been created whilst a person walks the perimeter of the crossing surface with the barriers down.

1.14 Check whilst observing Redscan Manager that there are no false detections when the boom and skirt are pushed inwards and held for 1 second minimum at the tips of each barrier and every 2m along each barrier.

If any false detections occur, adjust the Detection Area as necessary.

Any remedial adjustments require the LIDAR setup completing.

1.15 Close shutters.

1.16 Check trespass guard is in place.

END

ALL POINT SYSTEMS

Any deficiency or failure, which could affect the safe running of trains or the integrity of the signalling system, shall be reported to the signaller immediately.

More information on point equipment can be found in NR/L3/SIG/19047.

DEFECTS

Any defects found or repairs and/or adjustment made to correct defects shall be reported as corrective maintenance.

STRUCTURE OF THE POINT SMS SUITE

The SMS suite is structured into the various components that form a point installation. The includes/excludes section lists what each SMS applies to. Your work order can tell you what SMSs and which service to carry out on the point installation.

SWITCH OPENING

The nominal standard switch opening between the switch and stock rail at the toe is detailed in NR/SMS/Part/Z02.

The dimension can vary between sites but shall not normally exceed the specified range. Corrective maintenance action shall be arranged where switch opening is found to be out of tolerance.

TEMPORARY PACKING

The provision of extra (temporary) packing is permitted as an interim measure until the gauge can be restored.

The maximum permitted thickness of temporary packing is 3.5mm. On conventional point machine layouts, packing shall be fitted between the switch extension piece and the switch rail.

For UIC54 / RT60 switches and switch diamond layouts, refer to the applicable mechanical layout drawing (BRS-SM****).

POINT NUMBERS

The point number is fixed to the sleeper at each point end close to the toe of the normally closed point switch.

Where this is not physically possible (e.g. double slip layout), an arrow is fixed between the number and the normally closed point switch, pointing to it. If you are in any doubt which is the normally closed switch, ask your SM(S).

The numbers are orientated to that they can be read when looking at them in the same direction as though you were about to pass over the points in a facing direction.

Point numbers can also be displayed on each point machine and power pack. Care shall be taken to replace the correct covers following removal.

If the lie or identification of points is not clear on site, report this to your SM(S). The official signalling record diagram shall be used to clarify the actual layout.

HYDRO-PNEUMATIC POINTS

These are often referred to as Train Operated Points and are trailable self-restoring points.

The lie of the points is indicated to the driver of a train by a Points Detected Normal Indicator, which can be an elevated position light signal or a single white or yellow light.

SECURITY OF FASTENINGS

Nuts and bolts that that are used to secure fixed, adjustable or lock stretcher bars to the rail, or to bolt the various components that make up a stretcher bar assembly shall have their security checked by the application of a calibrated torque wrench set as detailed in NR/SMS/PF01.

The primary and secondary locking devices on tubular stretcher bar assemblies do need to be checked for security.

The security of other fastenings not associated with these items (e.g. point machine fixings to bearers and adjustable nuts on detector rods) can be checked by the application of a short handled spanner (a nut that is tight cannot move with a minimal application of pressure from the handle of the spanner).

A short handled spanner is defined as one having a handle between 16 & 17 inches (400mm & 450mm) in length.

If you are in any doubt about how to check the security of any fastenings on point systems or you have any doubt about any fastenings on a point system you shall ask your SM(S). If the safe running of trains is affected you shall report it to the signaller immediately.

MECHANICAL POINTS

GENERAL

The maintenance of any set of points shall require the whole route to be examined from the lever tail to the points. At times, especially if detectors are being maintained, both point and signal NR/SMS can be involved.

A clear understanding shall be reached with the Signaller before any maintenance commences. It is good practice to make an entry in the Block / Occurrence Book on arrival at the signal box. Check at all times the signaller is aware of your presence.

No point lever shall be moved without the permission of the Signaller.

It can help with maintenance if the points are operated by the S&T technician, with the Signaller's permission, before maintenance commences; and then operated again, by the same Technician, at the completion of maintenance.

The Signaller shall also operate the points.

Rodding

Rodding shall be laid out in the straightest manner available. There shall be a minimum of changes of direction.

Any suggested improvements to the rodding run shall be made via your SM(S).

Rodding can be either channel or round type, or a mix of both.

The rodding run shall at all times be clear of debris and vegetation, which shall be cut back and killed. Anticipate growth, particularly in spring and summer.

Adjacent objects (rail ballast etc.) can interfere with the operation of the rodding and shall be removed.

Check that in track circuited that the correct insulations are fitted.

Third and fourth rails in electric traction areas need special care. Under no circumstances shall the rodding come into contact with the rail.

Rodding stools shall generally be no more than 9 feet (2.75m) apart.

The rodding run shall be parallel to the line and is usually approximately 6 inches (150mm) below rail level. Local circumstances and conditions can vary this figure.

Orange piping was not designed for rodding and shall not be used for this purpose when crossing the line. Plastic rail clips can be used as a temporary solution to prevent short circuits.

At level crossings, ducting is required for rodding, driving points or gates.

All ducting shall be kept clear of debris and rubbish.

STROKE

At no point in the rodding run shall stroke be gained.

The lever frame always provides sufficient stroke to operate points at any distance.

Loose fittings or slack pins can cause stroke to be lost.

Stroke shall be lost at the end of the rodding run. The final drive crank, (12" x 15") shall be adjusted to achieve this.

COMPENSATION

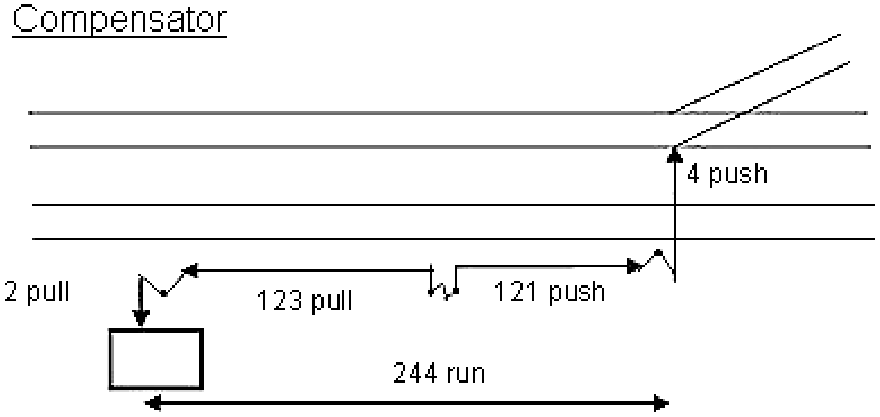
Compensation is required for all rodding runs over 10 yards (9.14m) in length. The simple rule for compensation is the amount of pull equals the amount of push.

Compensation is required because variations in temperature cause the rodding to expand or contract. If "fixed" at the lever, the maximum length of rodding (350 yards / 320m) could move more than 6 inches (150mm) this would easily open a set of points.

The rodding within the signal box can generally be ignored from any compensation calculations. The amount is small and the temperature stable.

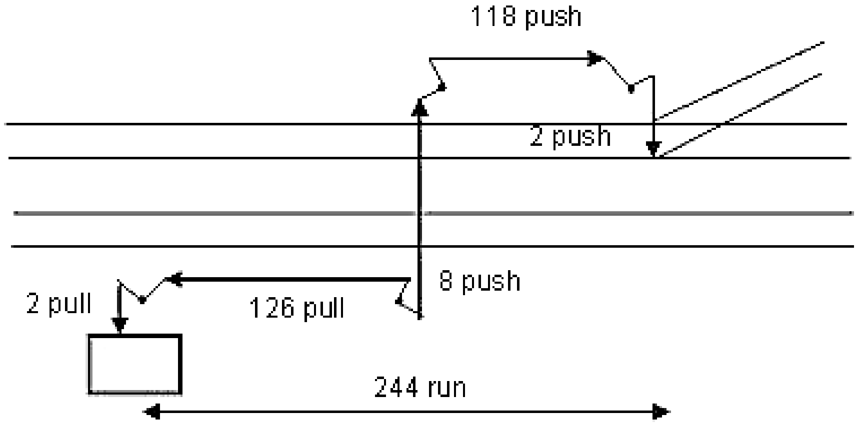
EXAMPLES OF COMPENSATION

Compensator



2 + 123 = 125 pull
121 + 4 =125 push

Compensation using cranks



2 + 126 = 128 pull
8 + 118 + 2 = 128 push

The calculations are based on amount of pull shall equal the amount of push not the total distance of the run.

CRANKS AND COMPENSATORS

Cranks and compensators are used to change the direction of rodding or swap the travel (i.e. from push to pull).

There are two basic types of compensator; horizontal, the most common, and vertical, only a few of which remain. Both types change the direction of travel and are essential to correctly compensate a rodding run.

There are many varieties of crank, most of which have more than one name. Most types change the direction of the rodding through 90°.

Pedestal cranks are usually found in the signal box, under the frame, changing the vertical drive from the frame to a horizontal drive towards the front plank.

When space is at a premium, accommodating cranks (originally of three heights), are used to turn the rodding.

Accommodating cranks have a curved arm or arms, any single stud crank can be fitted to one of the three heights of base.

Relief cranks are not in common use but are used to turn rodding through an angle (not 90°), generally to cater for points around a curve in the track.

Adjustable cranks (or 12" x 15" cranks), are used as the final drive to points to reduce the travel from the rodding run.

On all cranks, except on back drives, the outermost hole shall be used. This provides maximum stroke and results in minimum effort required to operate.

ADJUSTMENT

All points that are ‘hard to operate shall be reported as corrective maintenance.

Adjustments to points indicate either:

A) THE POINTS ARE MOVING OR GOING OUT OF GAUGE. OR

b) The rodding run is losing stroke.

Therefore there is wear in the pins, the cranks are moving on their bases or the rodding stools are allowing the run to rise and fall.

POINT FITTINGS

All points, when adjusted, shall fit well up to the stock rail on either side without excessive force being required.

The blades shall neither stop short; leave a neither gap nor over travel attempting to push the stock rail (Nip).

Too much ‘nip’ can cause serious wear on the lever frame and can injure the Signaller. It also causes unnecessary wear on point rodding and fittings.

In mechanical signal boxes, the 'A' end of the point is nearest the signal box. The 'B' and subsequent ends are further away.

Pins, bushes, joints, crank bosses, if worn, can all cause loss of travel. Loose rollers and stools and any crank base, if loose, loses travel.

All rodding shall be correctly fastened; no bolts shall be missing or loose.

Adjustable crank sleeves shall be tight and correctly fastened using both sets of screws. Lock nuts are usually provided. These shall also be secure.

Benches / foundations can be timber, concrete or steel. All shall be checked during operation of the points to check that no movement is taking place and all fastenings are secure.

LOCK AND CLEARANCE BARS

These are typically 50 feet (15m) in length and are supported on pivoted arms, which are bolted to the stock rail.

If any of the arms or clips are distorted or damaged the lock bar can become sufficiently distorted to be ineffective.

Worn pivot pins can allow the bar to become displaced and potentially enable the bar to be lifted under a train.

Washers shall be fitted to reduce side play and worn pins shall be replaced.

Excessively worn rails or faulty operation shall be reported as corrective maintenance.

If it becomes necessary to remove a clip or arm, it shall be replaced as soon as possible to prevent false operation. Always check that spares are available before dismantling the assembly.

The rodding from an operating lever is always connected at the opposite end of a lock bar to the lock plunger. This checks that if the equipment becomes disconnected from the operating Lever, the presence of a vehicle shall prevent the lock plunger from being withdrawn.

If temporary repairs require alternative arrangements to be put in place, the above safe method of operation shall be maintained.

LUBRICATION

Excess lubrication causes dirt to accumulate and can cause wear. Lack of lubrication can also cause wear.

The rodding run and rollers can only be lubricated using dry film lubrication. Use of other lubricants is prohibited.

Cranks and compensators require a minimum of lubrication.

The most suitable lubricant shall be used at all times. No item of equipment needs flooding. The correct amount shall be applied after old lubricant has been wiped / scraped away / removed.

All excess oil and grease shall be wiped away before completion of work to prevent dust collecting.

Crank centre bosses can seize. If there is any doubt about adequate spread of grease or oil, the cranks shall be de-assembled, cleaned, re-assembled, and re-lubricated.

Check that all nipples are clean and permit grease to pass.

Oil holes shall be kept clean and covered when possible.

End

Includes:	Point Rodding, Insulation, Crank, Compensator, Facing Point Lock, Mechanical Detector, Depression Bar, Lifting Bar, Adjuster, Joint, Lug, Extension Piece, Assister, Cover, Number Plate
Excludes:	Point fittings (see NR/SMS/PartC/PF01). Electrical Detectors (see NR/SMS/PartC/PD01). Mechanical detectors (see NR/SMS/PartC/PD03). Hand Points.

GENERAL

Any nut tightening or adjustments shall be reported.

REGULAR TESTS

1. Facing Point Locks

1.1 If provided, carry out NR/SMS/PartB/002 (FPL Test (Mechanical)).

1.2 If fitted examine lock faces and plungers.

SERVICE A

2. General

2.1 In liaison with the Signaller operate the points from the signal box and check for correct operation without excessive force being required.

NOTE: *More details can be found in NR/SMS/PartC/PA00 (Point Equipment: General).*

2.2 Remove vegetation and debris from cranks and rodding run and surrounding area.

2.3 Check all moving components are un-obstructed when operated.

3. Rodding Run

The rodding run and its fittings shall only be lubricated with dry film lubrication. Other lubricants are prohibited.

3.1 Check alignment and levels throughout.

3.2 Check for irregular movement of the stools during operation of the points. Report any movement, which is causing loss of stroke to your SM(S).

3.3 Check all roller-fixing bolts, pins and split pins.

3.4 Check freedom of movement of wheels on rollers.

3.5 Examine fishplates, joints and fixings. Check pins and split pins.

3.6 Examine rodding that passes under the rails. Check that any joints in the rodding are at least 305mm (1ft) clear of any rail for both normal and reverse lie of the points. The bolts on fishplates can jam under the rail; report any problems to your SM(S).

4. Cranks and Compensators.

4.1 Check that all moving parts are not obstructed and are clear of ballast. Rectify as necessary.

4.2 Check the installation is securely fitted, look for:

a) Loose crank bases.

b) Worn cranks.

c) Seized cranks.

d) Loose adjustable sleeve on cranks.

e) Worn cotter pins.

f) Rectify as necessary. Loose or worn fittings can impair the operation of the points.

4.3 Scrape, wipe and clean as necessary. Lubricate bearings and cotter pins. Items fitted with grease nipples, shall have new grease pumped in, to expel the existing grease in the bearing/pin. Grease filled automatic lubrication can also be used.

Oil lubricated cranks shall have new oil added to flood the bearing/pin. Any bearing covers (e.g. ‘Top Hats’) shall be replaced or renewed if missing. Dry film lubrication can also be used.

Excess grease and oil shall be wiped away.

4.4 Check operation of each crank.

4.5 Observe position of cranks in both normal and reverse positions.

4.6 Check each crank and compensator is correctly set up.

NOTE: *The crank should be at 90° when the points are halfway and should travel equal distances each side of this for normal and reverse positions.*

4.7 Check compensators are set up correctly and can operate at all temperatures. The arms shall be parallel (approximately depending on temperature) when the points are halfway.

5. Nuts and Screw Threads.

5.1 Check all nuts and lock nuts are secure and tight.

Lightly lubricate the exposed threads with grease or dry film lubrication. Do not allow lubricant to come in contact with the nut faces.

The nuts shall not move by application of a short-handled spanner.

More details on nuts & bolts can be found in NR/SMS/PartC/PF01 (Point Fittings). Report any damage as corrective maintenance.

6. Insulations.

6.1 Check insulations. Report any damage as corrective maintenance.

7. Points.

7.1 Observe correct operation.

7.2 Check fittings are not under excessive strain when the lever is operated.

7.3 Check the throw of the points. Details of point openings are given in NR/SMS/PartZ/Z02 (Point – Reference Values).

7.4 Check each point blade fits correctly to the stock rail.

The blade shall fit up correctly to the stock rail without excessive force. Adjustment might be required.

Before any adjustment to the points is carried out check the gauge of the track. This indicates whether the adjustment is to cater for a gauge error. After adjustment check the travel again.

7.5 Examine lock faces and plungers.

7.6 Look for vertical movement in cross rods driving the points. This can indicate the travel is incorrect.

8. Final Checks and Tests

8.1 If provided, carry out NR/SMS/PartB/002 (FPL Test (Mechanical)).

The final check before completion of the work is for the Technician to operate the points again from the signal box.

Also request the Signaller operates the points to their satisfaction.

Typical Drawing: Mechanical Point Components (Not to Scale)

Points shown unlocked.

Soleplate & sleepers omitted for clarity.

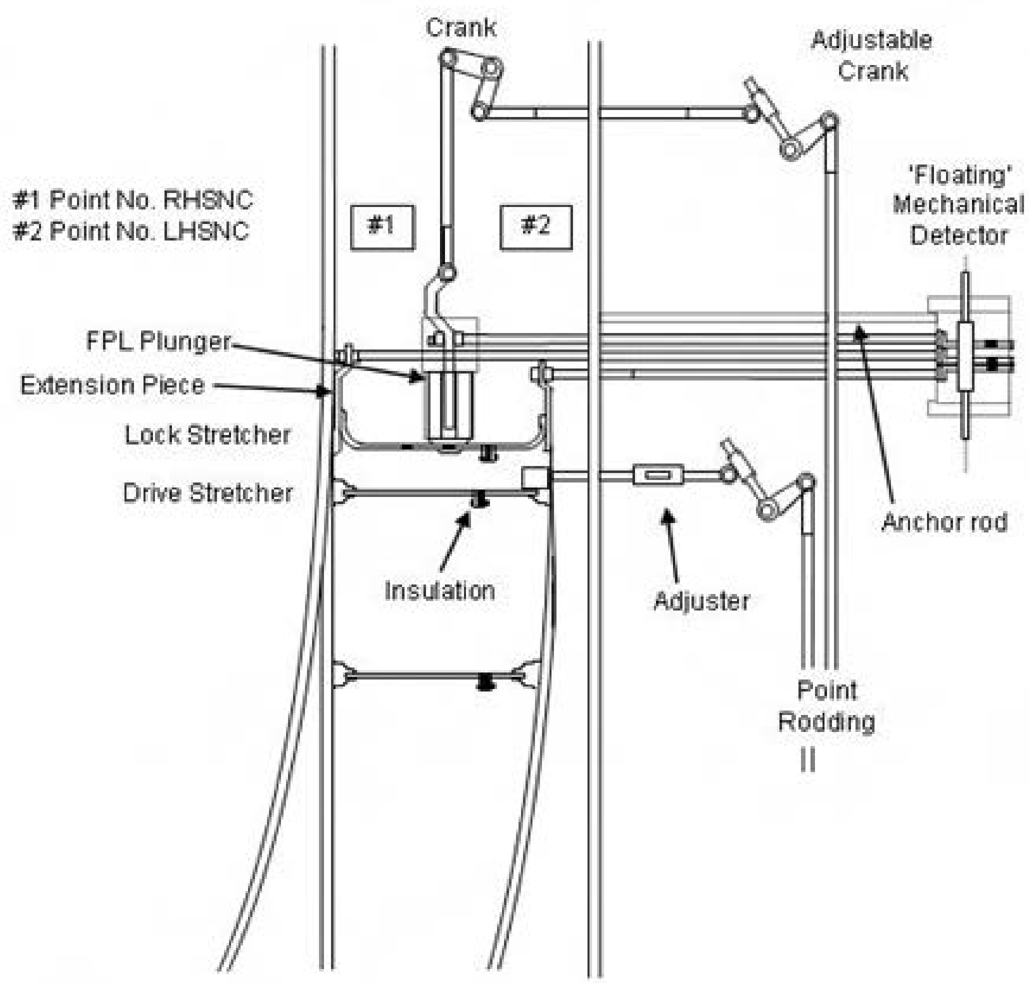


Figure 1 – Mechanical Point Components

END

Includes:	Siemens Point Adapter Modules, Motor Power Modules, and Point Detector Modules fitted inside trackside apparatus cases or equipment and relay rooms
Excludes:	Any other module types

General

Any corrective maintenance issues shall be undertaken as detailed in NR/SMS/PartA/A02 (Preventative & Corrective Maintenance).

SERVICE A

1. Points Adapter Module (PAM)

1.1 Check the following items on the Points Adapter Module:

a) The transformer, internal / external module fixings are tight, secure, and not damaged or corroded.

b) All internal components (modules, wires etc.) are intact and undamaged including trunking and loomed wires.

c) There is no chaffing on incoming cabling.

d) All plug couplers between modules are secure.

e) Earthing connections in the PAM are secure.

f) All glands are sealed and clamped are tight.

g) All relevant LEDs are illuminated.

h) The condition of the block Varistor the status windows should be showing green.

i) The operation of the internal light.

1.2 Carry out NR/SMS/PartB/Test/201 (Siemens Point Module Correspondence Test).

SERVICE B

2. Equipment Serviceability

2.1 Check (if applicable) that both the Motor Power Module and the Point Detector Module are within their service dates.

Any modules outside their service date or shall be outside their service date before the next service B shall be reported to your SM(S) and on your work order.

3. Equipment Tests

3.1 Carry out NR/SMS/PartB/Test/053 (Earth Leakage Detector (ELD): Testing and Calibration).

3.2 Carry out NR/SMS/PartB/Test/202 (Siemens Point Detection Module Test).

3.3 Carry out NR/SMS/PartB/Test/203 (Siemens Point Module Running Current Test).

END

1. Introduction

More information on clamp locks can be found in the Clamp Lock Handbook NR/L2/SIG/11774.

1.1 In-Bearer Clamp Lock (IBCL)

The IBCL without a supplementary drive provides a fully tampable S&C. Mechanical supplementary drives can be fitted to these systems.

1.2 Hy-Drive Points System

Installations fitted with IBCL and SO hydraulic supplementary drive are known as a Hy-Drive point system. These are fitted to both NR56v and NR60 layouts. The pump unit on the Hy-Drive system is a twin motor variant which is not interchangeable with the single motor pump unit that is fitted to RCPL / IBCL.

1.3 Clamp Lock Mk 3

The development undertaken on the Mk 3 Clamp Lock has brought about several subtle upgrades to the Mk 2 equipment. There have been changes made to the coatings, materials and geometry of the components. The changes have resulted in a system that has different maintenance requirements. Clamp Lock Mk 3 has been designed to be lubrication free, with the exception of the autolube system that applies lubricant to the slideway.

NOTE: *The ROSE process has not been applied to Mk 3 equipment so sits outside of the RCM maintenance regime (Services V1, R1 and R2)*

1.4 Lubrication for Mk 2 equipment only (See Figure 1)

NOTE: *Mk 3 equipment does not require any type of lubricant applied to any of the lubrication points described in this section*

The lock arm bush is designed to rotate on three bearing surfaces: the pivot pin, the lock arm, and the detector lug. It is essential that all three surfaces are properly lubricated.

Spray the areas arrowed in the following photograph.

Note that the arrows indicate the lubrication points.

It should be possible to rotate the lock arm bush.

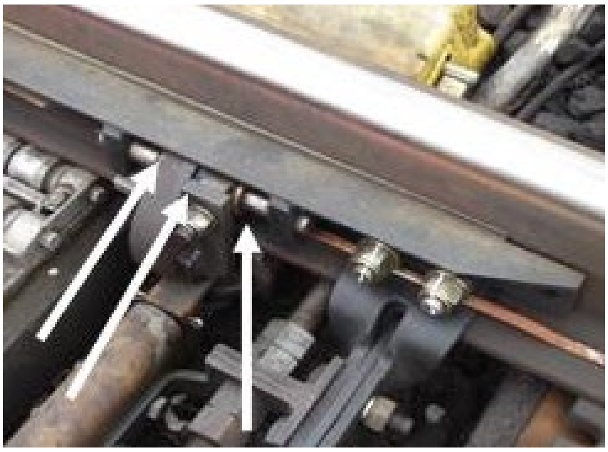


Figure 1 - Mk 2 pivot pin lubrication points

This is most easily done when the switch rail is fully open. If this cannot be done, and the parts are not readily freed, an extra coat of spray lubricant should be applied and left to penetrate for up to one week.

If after this treatment the lock arm bush still does not rotate, it shall be reported as corrective maintenance so that the associated parts can be disassembled and cleaned.

Once reassembled and new lubrication has been applied, the lock arm bush should now freely rotate.

If, however the bush still does not rotate, or damaged components are found, arrangements shall be made to rectify the situation.

1.5 Document References

Refer to the relevant sections in the Clamp Lock Installation Manual suite for instructions, See Table 1.

Clamp Lock Variant	S&C Design	Switch Opening	Supplementary Drive	Document Number
RCPL	CEN56 Full-Depth / UIC54 Shallow Depth	110	Mechanical	SRB0201ra
IBCL Mk 2	NR60 Mk 1	110	Mechanical / Hy-Drive	SRA0101ra
	NR56v	110	Mechanical / Hy-Drive	SRC0301ra
IBCL Mk 3	NR60 Mk 2	130	Mechanical	E05-01RA-1
		110	Hy-Drive	F06-01RA-1
	NR56v	110	Hy-Drive	G06-01RA-1
		110	Mechanical	H06-1RA-1

Table 1 – Document References

END

Includes:	Rail Clamp Point Lock (RCPL), In-Bearer Clamp Lock (IBCL)
Excludes:	Any other type of hydraulic points

General

The equipment shall not be operated electrically until any adjustments have been proved by hand pump operation.

Any tightening of nuts or adjustments shall be reported.

For clamp lock lubricated with dry film lubrication refer to Appendix C for lubrication process.

If degreaser is used on the clamp lock mechanism care should be taken to avoid application on the adjustable tie bar threads. Use of degreaser in this area can affect the factory applied grease contained within the tie bar.

See NR/SMS/PartA/A04 (Method Statement Summary) for information on safe working on point systems.

See NR/SMS/PartZ/Z02 (Point Reference Values) for all torque values used in this document.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/003 (Facing Point Lock Test).

SERVICE A

2. Pump Unit (all types)

2.1 Check the concrete base, power unit mounting and fixings.

NOTE: *The pump unit should be reasonably level (to the eye) and secure.*

2.2 Check the visible tail cable and route.

2.3 Remove the pump unit cover.

2.4 Check that the pump unit cover opens freely, lubricate as necessary.

2.5 Check the manual control selection mechanism and solenoid valve block. Check that the normal/reverse selector cannot be operated with the switch turned to ‘Power’.

2.6 Turn pump to “Manual” Position.

2.7 Check that the switch cannot be turned to power whilst operating the normal/reverse selector.

2.8 Examine cable entry, cable gland and tail cable sheath.

2.9 Clean and examine terminals, terminal block assembly and fixings. Protect as necessary.

2.10 Examine internal wiring.

NOTE: *Hydraulic fluid can cause degradation of insulation.*

2.11 Clean and examine the pump unit, motor assembly and all fixings. Look for leaks, particularly around the base of the hand pump mechanism, the cover plate gasket and at the base of the motor.

NOTE: *Unused ports should be sealed to prevent fluid from being expelled from the reservoir.*

2.12 Check for leaks.

NOTE: *Power packs are labelled:*

- MN, MR – Main Normal, Main Reverse.
- BN, BR – Supplementary Normal, Supplementary Reverse.

Power packs fitted with Snorkel Valves have a label saying ‘Snorkel Valve Fitted’ or a blue patch fixed to the power pack body.

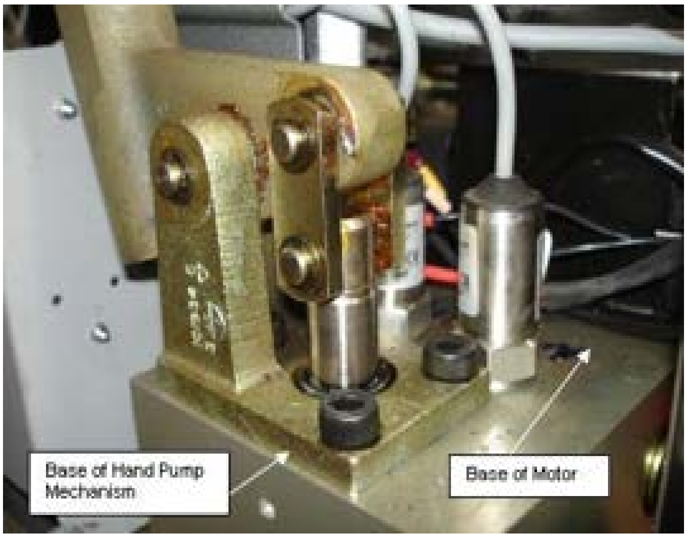


Figure 1 – Base of hand pump mechanism

2.13 Examine the motor brushes. Brushes shall slide freely in the holders and seat fully on the commutator. Brushes shall be replaced when worn to 10mm in length.

This task does not apply to brushless motors.

2.14 Check the hydraulic fluid level and (where fitted) the level indicator. If a top up greater than 0.5 litres is required check for leaks in the hydraulic system, rectify as required. If a leak cannot be found, report as corrective maintenance before the end of the shift. If more than 1 litres is required, carry out NR/SMS/PartB/Test/015 (Test for Air in the System).

2.15 Examine hydraulic ram hoses and connections. Pay particular attention to:

a) Signs of leakage.

b) Chafing and damage.

c) Security.

d) Significant corrosion.

Do not over tighten hose connections.

2.16 Check that the hose length does not exceed the requirement for purpose. Beware of excess length of hose being wrapped around the power pack. Report as corrective maintenance any hose with excessive length.

2.17 Check the locking wires on hose connectors are installed correctly.

2.18 Examine the manual override pins for signs of contamination/corrosion. Clean the manual override pins and apply mineral oil to the pins.

2.19 Operate the normal/reverse selector a number of times and check that it does not stick or remaining depressed following operation.

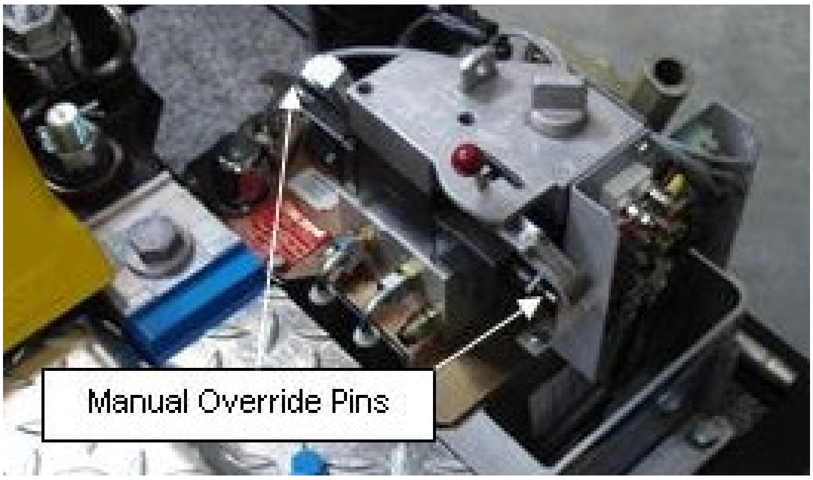


Figure 2 - Pump unit manual override pins

2.20 Refit the cover to the unit and lock with a RKB221 padlock. Check that a RKB222 padlock is fitted to the local control unit hinged lid.

Hy-Drive Systems

2.21 Check hose connections for signs of leakage or damage. Check that the locking wires are intact on the supplementary drive distribution manifold fitted on the in-bearer centre thrust bracket.

3. Lock & Detector Mechanism (Clamp Lock Body, All variants)

3.1 Remove and examine cover pins and covers.

3.2 Clean and examine the following on the lock body assembly:

a) Body casting (or fabrication).

b) Rail adapter blocks.

c) Micro-switches.

d) Terminal Blocks.

3.3 Check the fixing bolts (2) and confirm they are not loose.

3.4 Check the top Allen screws (2) that secure the microswitch plate to the body and confirm they are not loose.

3.5 Check the micro-switch assembly bolts (2) and confirm they are not loose.

3.6 Check cable glands, cable cores, wiring and terminations. Protect terminals as necessary.

3.7 Examine tappets (2) and microswitch plungers (2).

3.8 On the exterior of the lock body, examine the lock body cam follower pivot pin, tab washer, and hex screw. Check that they are secure and not corroded.

3.9 Remove fire risks and potential obstructions from the area of the mechanism and within the hollow bearer.

Installations with Auto-lube canisters only:

3.1 Check there is enough lubricant still in the canister and that the flexible hoses (if fitted) to the lock bodies are not damaged. Rectify as necessary.

NOTE: *Details of how to change the Auto-lube canister and minimum fill levels can be found in Appendix A for Grease-O-Matic systems or Appendix B for Simalube systems.*

4. Lock & Detector Mechanism (Clamp Lock Body, Mk 1 Only)

4.1 Check the following:

a) Heater mounted stud bolts.

b) Locating studs (113lb rail).

c) Support Bracket.

d) Lock body bolts (6 each side).

e) Tab washer and spirol pin.

4.2 Examine the rail close to the lock body. Report as corrective maintenance significant wheel burns, rail defects, and poor permanent way.

4.3 Check the body for obvious signs of cracking, carry out NR/SMS/PartB/Test/017 (Mk1 RCPL - Clamp lock - Testing for Cracking).

4.4 The cam lock follower pivot and drive lock slide/ drive bracket coupling shall not be lubricated.

5. Switch Rail Bracket Assembly (Open Switch)

5.1 Examine switch rail bracket assembly and fixing bolts. Verify the bolts are torqued in line with NR/SMS/PartZ/Z02 (Point Reference Values) and that the bolts protrude through the lock nuts.

5.2 Clean, examine and check for security the following:

All variants

a) Lock arm pivot-pin, bushes and split pins (2).

b) Pivot pin is free to rotate.

c) Lock arm and detector blade are free to slide on the pivot pin.

d) Fixed cam (should be secure).

e) Drive lock slide and slide-way.

Mk 1 & Mk 2 only

- Drive lock slide / bracket coupling pin and bolt.

Mk 3 only

a) Spherical Bearing is free to articulate.

b) Drive lock slide / actuator coupling.

NOTE: *Movement of the lock arm does not prove the 3mm to 6mm lock arm clearance on both sides of the lock arm.*

5.3 **Mk 1 & Mk 2 only** – – Lubricate using dry film lubricant, grease or spray as necessary the following wearing surfaces:

a) Fixed and adjustable cams.

b) Lock arm.

c) Locking piece.

d) Lock arm pivot.

5.4 Check for wear on the fixed cam and adjustable cam. Report wear as corrective maintenance.

NOTE: *Wear occurs at the field side end of the adjustable cam where the LH cam follower sits with the points open. This can be detected by the LH cam follower lowering as the switch rail reaches the open position. The detection test and cam follower screw length checks also indicate cam follower wear.*

6. Switch Rail Bracket Assembly (Closed Switch)

6.1 Wipe, examine and lubricate the cam adjusting screw.

6.2 Check the clearance between top of drive lock slide coupling and bottom of lock arm (4mm - 12mm). See Figure 3.

Figure 3 - Drive Lock Slide / Actuator Clearance (Mk 3 equipment shown)

6.3 Check the drive lock slide 'fully locked' position.

Clamp Lock Variant	Drive lock slide protrusion
Mk 1	Flush (+/- 5mm) with the end of the lock body
Mk 2	25mm – 30mm
Mk 3	> 71mm

Table 1 – Drive lock slide protrusions

6.4 Gauge 3mm – 6mm clearance between the drive lock arm and the drive lock slide.

6.5 Repeat 5.1 to 6.4 for the opposite position of the points.

7. Hydraulic Fittings (Four Foot)

7.1 Check the locking wires on hose connectors are intact.

7.2 Clean and check the hydraulic rams for leaks, in both normal and reverse positions.

7.3 Clean and examine the following:

All variants

- Centre thrust bracket, fixing bolts and spirol pins (if fitted).

Mk 1 & Mk 2 only

a) Ram cover plates (2) and fixing bolts (4).

b) Ram thrust plate, packing pieces, split pins (2) fixing bolts (2) and washers.

Mk 3 only

a) Actuator ram piston surface.

b) Actuator socket mounting bolts (4) on the centre thrust bracket.

7.4 Mk 3 only – check the lock nuts on the actuator adjuster collar and adjuster locking pin.

7.5 Mk 1 & Mk 2 only – examine the following on the tie bar:

a) Nuts and bolts.

b) Welds.

c) Lock nuts and screw thread.

7.6 Check all the nuts on tie bars (especially locking nuts) are tight. Rectify as necessary. The minimum clearance between tie bar components (welds, nuts etc) and rams / thrust brackets is 3mm.

8. Final Tests and Checks

8.1 Carry out NR/SMS/PartB/Test/003 (Facing Point Lock Test).

8.2 Check that the tab washers for the locking piece retaining screws are present and bent over.

8.3 Restore to power operation.

8.4 Refit all covers and Lubricate padlocks (RKB 221 and 222 padlocks on the lock body, pump unit cover and local control lids).

8.5 If provided:

Visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

8.6 Ask the Signaller to operate the points to normal and reverse positions (twice if possible). Check that the centre thrust bracket does not move during operation.

8.7 Observe correct operation.

SERVICE B

9. Clamp Lock Body

9.1 Check the cam follower tappet screws protrude no more than 25mm.

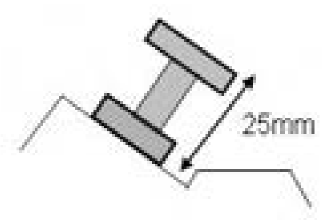


Figure 4 – Tappet Screw Adjustment

9.2 Check with the switch rail open approximately 25mm, that the Left-Hand and Right-Hand tappets are level.

Mk 1 Fabricated Body

9.3 Clean the body frame as necessary.

9.4 Examine the Spirol pins; Check they are flush with lock body.

9.5 Check that the clamp lock support bracket is fitted.

9.6 Examine the lock body and welds for cracking.

9.7 Carry out NR/SMS/PartB/Test/017 (Dye Penetrate Test or Eddy Current Test).

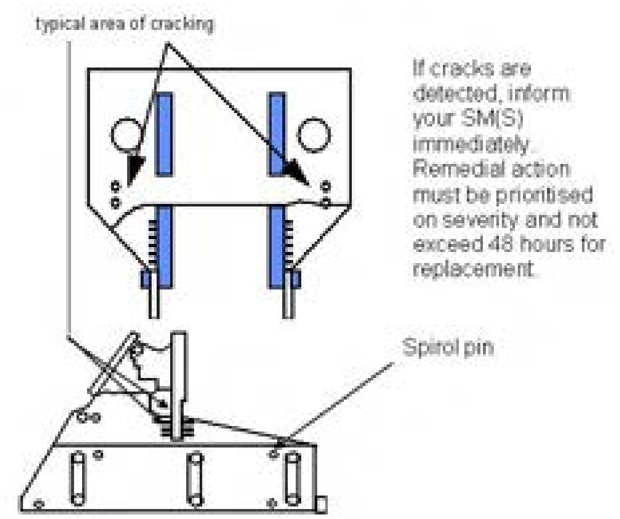


Figure 5 – Mk 1 Fabricated Lock Body

10. Disconnection Boxes (if Provided)

10.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

10.2 Refit the lid and (if provided) padlock, check they are fitted securely.

11. Final Tests and Checks

11.1 Check power pack motor brushes are free to slide in their holders and replace if less than 10mm in length.

11.2 Carry out NR/SMS/PartB/Test/003 (Facing Point Lock Tests – Clamp Lock)

11.3 Carry out NR/SMS/PartB/Test/013 (Detection Test (Clamp Lock).

11.4 If any of the tests in 11.2 or 11.3 fail, carry out the NR/SMS/PartB/Test/014 (Lock and Detector Full Test (Clamplock).

11.5 Select 'Power' and ask the Signaller to operate the points with an obstruction placed in the open switch rail. Check the time cut-out operates (6-9s). Check the centre thrust bracket for movement during operation.

If not monitored by ELD:

11.6 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

11.7 Ask the Signaller to restore the points and remove the obstruction.

11.8 Refit and lubricate the padlocks (RKB 221 and 222 padlocks on the lock body, pump unit cover and local control lids).

11.9 Ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

12. Local Policy Requirement 1

12.1 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.

SERVICE V1

Includes:	Rail Clamp Point Lock (RCPL) Mk 2 and In-Bearer Clamp Lock (IBCL)
Excludes:	Rail Clamp Point Lock (RCPL) Mk 1 and IBCL Mk 3, or any other type of hydraulic points

When requesting permission from the Signaller to work on a set of points, ask the Signaller to operate points in both directions to verify and prevent any confusion on the set of points you have requested.

13. Visual Checks

13.1 Check for potential fire risks and obstructions around the S&C and within close proximity of the POE mechanism and fittings.

13.2 Check sleeper beds are clear of any obstructions.

13.3 Check cables and cable routes for any visible damage and are clear from any rodding runs.

13.4 Check hydraulic fluid level.

a) If hydraulic fluid level is low check for evidence of leaks / oil loss at the hydraulic components including supplementary drive in Hy-drive systems e.g. the Rams, hoses, and their connections (Particularly at spigots and centre thrust bracket).

b) Look for leaks, particularly around the base of the hand pump mechanism, the cover plate gasket and at the base of the motor.

c) If a top up greater than 0.5 litres is required check for leaks in the hydraulic system, rectify as required. If a leak cannot be found, report this to your SM(S) before the end of the shift.

d) If more than 1 litre is required NR/SMS/PartB/Test/015 (Clamp Lock : Test for Air in the System).

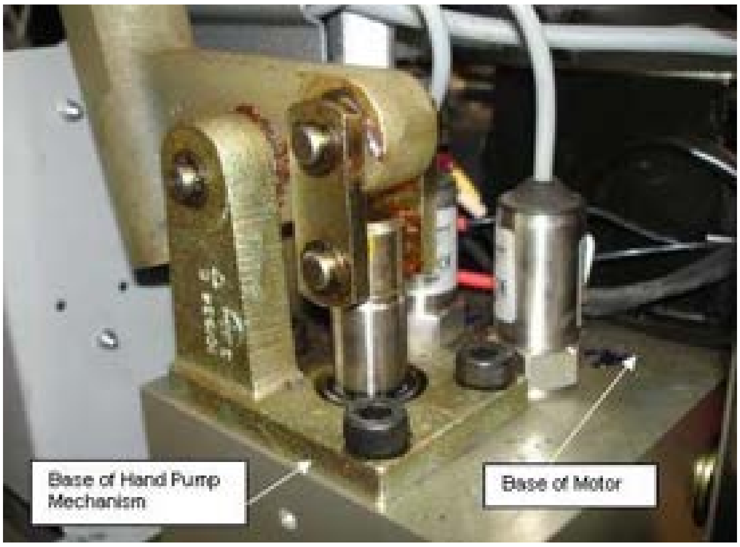


Figure 6 – Base of hand pump mechanism

13.5 Examine 'open' switch rail bracket assembly and fixing bolts. Check that the bolts protrude through the lock nuts.

13.6 Check for tightness using torque values shown in NR/SMS/PartZ/Z02 (Point Reference Values). If any fixing nut/bolt require tightening, then this shall be reported.

13.7 Repeat for opposite switch rail bracket.

14. Drive slide lubrication

14.1 Check level of lubricant in auto lube canister. If empty, replace.

14.2 Check drive slides and slideways are lubricated, if not check function of auto lube delivery system.

14.3 If no auto lube fitted, manually lubricate drive lock slides and slideway.

14.4 Details of how to change the Auto-lube canister can be found in Appendix A & B.

14.5 Check Power Pack lid is not seized or damaged and lubricate.

14.6 Check all covers are fitted, secure and not damaged.

14.7 Check correct padlocks are fitted to the pump unit and detection mechanisms.

15. Regular Tests

15.1 Carry out NR/SMS/PartB/Test/003 (Facing Point Lock Test).

15.2 Report any adjustment / replacement / further work being carried out to remove the defective condition within the POE.

15.3 Report any hydraulic hoses that are not the correct length.

15.4 Observe the operation of the points and investigate any issues found.

Before leaving site arrange for the Signaller to operate the points in both directions and confirm with the Signaller that detection has been obtained.

SERVICE R1

These tasks should be performed in addition to the VISUAL CHECKS (V1) tasks.

16. Remote Condition Monitoring

If the points that you have requested to work on are fitted with Remote Condition Monitoring, check that the asset has been placed into maintenance mode prior to commencing work.

Prior to commencing work, previous current traces should be made available from the Remote Condition Monitoring system and checked for any abnormalities.

Also, on completion of the work new traces should be recorded and viewed so they can be compared with the traces produced before the maintenance activity.

When requesting permission from the Signaller to work on a set of points, ask the Signaller to operate points in both directions to verify and prevent any confusion on the set of points you have requested.

DO NOT lubricate the Cam Follower Pivot Pin.

DO NOT lubricate the Insulated Drive Lock Slide / Drive Bracket Coupling.

Figure 7 - Drive Lock Slide / Drive Bracket Coupling

17. Switch Rail Bracket Assembly (Open Switch Rail)

The following maintenance shall be completed with the points in both the Normal & Reverse position.

17.1 Turn the control switch on the Power Pack to Manual. (See figure 8).

DO NOT use degreasing/ solvent agents.

17.2 Clean all exposed components.

17.3 Check the Pivot Pin is free to rotate.

17.4 Lock Arm Bush is Free to rotate on the Detector Lug and Lock Arm.

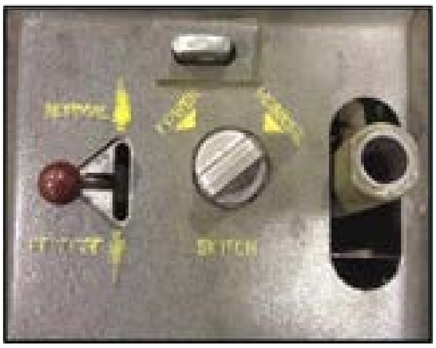


Figure 8 – Power pack Control switch

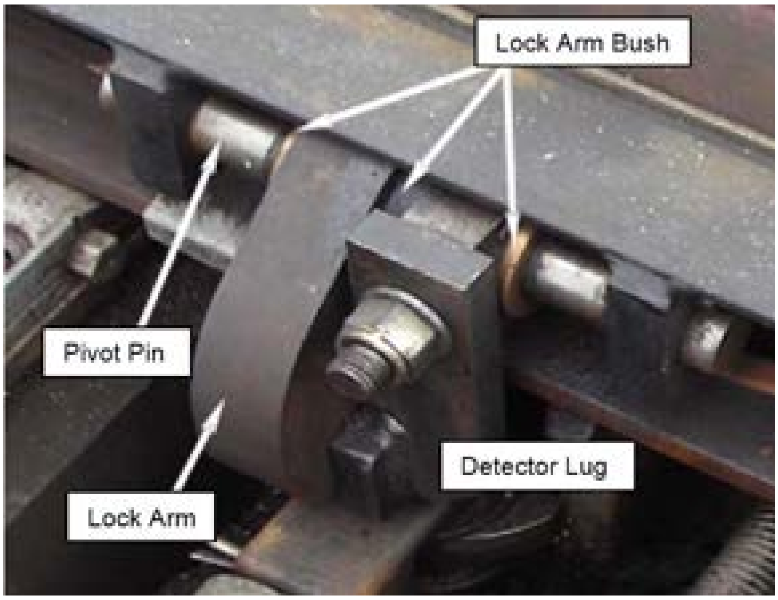


Figure 9 – Mk 2 Switch Rail Bracket Assembly

18. Lubrication – Mk 1 & Mk 2 only

18.1 Lubricate using dry film lubricant, grease or spray as necessary the following wearing surfaces:

a) lock arm.

b) fixed cam.

c) adjustable cam.

d) locking piece.

e) drive lock slide.

f) detector blade lug at the point of pivot on the switch rail bracket pin, cam adjusting screw.

18.2 Lubricate the Lock Arm Pivot-Pin and Lock Arm Bush as shown in Figure 10.

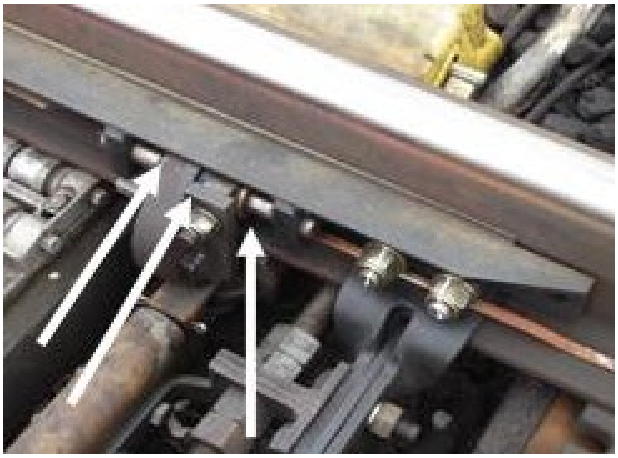


Figure 10 – Mk 2 Pivot Pin Lubrications Points

Lubrication Advice – Mk1 / Mk2 only. Does not apply to Mk3 equipment

The lock arm bush is designed to rotate on three bearing surfaces: the pivot pin, the lock arm, and the detector lug.

It is essential that all three surfaces are properly lubricated. Dry film lubrication spray - Interflon Lube TF is the preferred lubricant. Rocol Clamp Lock lubricant in spray cans can also be used.

The can shall be shaken well before each use. Spray the areas arrowed in Figure 10.

It should be possible to rotate the lock arm bush. This is most easily done when the switch rail is fully open. If this cannot be done, and the parts are not readily freed, an extra coat of spray lubricant should be applied and left to penetrate for up to one week.

If after this treatment the lock arm bush still does not rotate, report as corrective maintenance so that the associated parts can be disassembled and cleaned.

Once reassembled and new lubrication has been applied, the lock arm bush should now freely rotate. If the bush still does not rotate or damaged components are found, rectify the situation.

18.3 Examine the manual override pins for signs of contamination/corrosion. Clean the manual override pins and apply mineral oil to the pins.

Operate the normal/reverse selector a number of times and check that they do not stick or remaining depressed following operation.

Figure 11 – Manual Override Pins

18.4 Switch Rail Bracket Assembly

a) Check for flattening of split Pins against the Switch Rail Bracket Lugs and replace as necessary.

b) Check centre thrust bracket for dynamic movement (dynamic test).

Figure 12 - Split Pins and Switch Rail Bracket Lugs

19. Final Checks

19.1 Restore to power operation.

19.2 Refit all covers and Lubricate padlocks (RKB 222 padlock on the local control lid).

19.3 Report any adjustments made, components replaced or out of specification items on a WAIF.

Before leaving site arrange for the Signaller to operate the points in both directions and confirm with the Signaller that detection has been obtained.

19.4 Observe the operation of the points and investigate any issues found.

19.5 Where Remote Condition Monitoring has been fitted check with local RCM team to confirm asset trace has not deteriorated following maintenance, if no issues take out of maintenance mode.

SERVICE R2

These tasks should be performed in addition to the Visual checks (V1) and Service (R1).

20. Operation

20.1 Test manual operation by pumping the points to the opposite position and then back to the original position.

20.2 Check for smooth operation of the Clamp Lock when the points are being pumped across.

20.3 Examine for any signs of abnormal operation and whether the points are difficult to operate during the manual operation.

20.4 Examine the pump unit and detector mechanism cable glands / plug couplers for security.

20.5 Examine the concrete base, power unit mounting and fixings.

NOTE: *The pump unit should be reasonably level (to the eye) and secure.*

20.6 Examine hydraulic rams, hoses and connections, including back-drive on Hy-drive systems. Check for:

a) Chafing and damage.

b) Security.

c) Significant corrosion.

20.7 Examine the pump unit and detector mechanism cable, internal wiring and terminations for damage, degradation, contamination and security.

20.8 Check the torque of the lock body rail bolts.

Where fitted, check that cartridge (pencil) lock body heater is secured correctly. See Figures 13 and 14.

Figure 13 – Pencil Heater

Figure 14 – Pencil heater fitted into lock body

20.9 Check the gap between top of drive lock coupling & bottom of lock arm is greater than 4mm. See Figure 15.

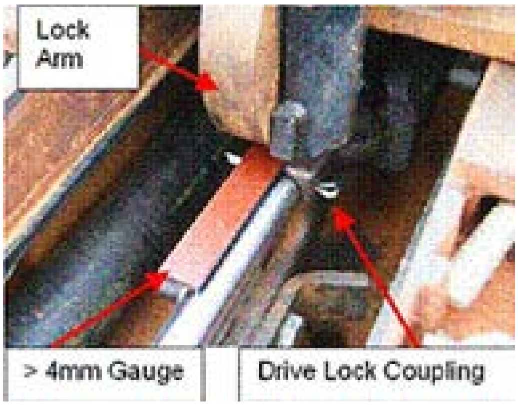


Figure 15 – Lock arm clearance

20.10 With switch rail bracket in the closed position check the drive lock slide ‘fully locked’ position. See figure 16.

NOTE: *Mk2 – lock slide protrudes approx. 25mm - 30mm beyond the lock body.*

Repeat 20.10 for opposite position.

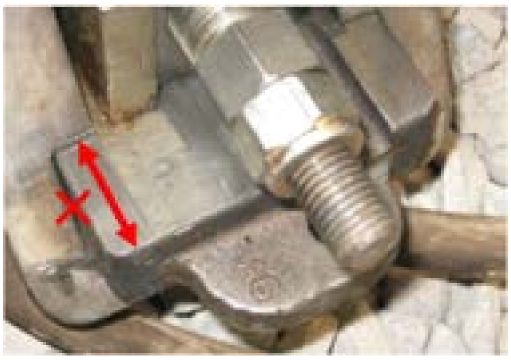


Figure 16 – X = 25mm – 30mm (Mk 2 Only)

20.11 Check the lock arm bush position on the pivot pin is correct. See Figure 17.

NOTE: *The lock arm bush should be relatively central, as pictured in Figure 17 and not too close to the switch rail bracket bushes.*

Figure 17 – Lock arm bush position

20.12 Examine tie bar for corrosion & signs of movement at the central lock nut.

NOTE: *Any threaded joints, which appear to be 'bleeding' a red rust solution could be due to some kind of fretting process.*

Check there is a 3mm clearance between tie bar, rams and thrust brackets. Apply a check-torque to the adjustable tie bar lock-nut.

NOTE: *A special fitting is required for this nut: PADS No. 039/052030*

20.13 Check micro-switch bellows for damage (see Figure 18).

Figure 18 – Micro-switch bellows damage

20.14 Check cam follower tappet screws do not protrude more than 25mm (See Figure 19).

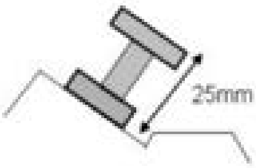


Figure 19 - Cam Follower Tappet Screw

20.15 Check with the switch rail open approximately 25mm, that the Left-Hand and Right-Hand tappets are level.

20.16 Where points are remote condition monitored, apply meter to measure motor supply voltage.

Where a pressure test port is available:

NOTE: *This test can be completed in conjunction with 20.19 below*

20.17 Connect pressure gauge to test port, operate points, hydraulic pressure should read between 95-105 bar. After 1 minute pressure should not fall below 60 bar.

If readings are below these parameters, then check relevant hoses and ram for leaks.

If no leaks are present, report to your SM(S) to arrange renewal of pump unit.

20.18 Repeat 20.17 for opposite position.

20.19 Select 'Power' and ask the Signaller to operate the points with an obstruction placed in the open switch rail. Check the time cut-out operates (6-9s). Note the motor supply voltage at this time. (For comparison with task 21.7).

20.20 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted. Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation. Check the following:

a) Terminations for security, corrosion, arcing, and risk of short circuit / disconnection and protect as necessary.

b) Cable glands are fitted and effective.

20.21 If not monitored by ELD, carry out a NR/SMS/PartB/Test/052 (Dynamic Earth Test).

20.22 Report any adjustments made, components replaced or out of specification items on a WAIF.

21. Final Check & Tests

21.1 Check Power Pack motor brushes are free to slide in their holders and replace if less than 10mm in length.

21.2 Carry out NR/SMS/PartB/Test/003 (Facing Point Lock Test).

21.3 Carry out NR/SMS/PartB/Test/013 (Detection Test – Clamp Lock).

21.4 If any of the tests in 21.2 or 21.3 fail, carry out the NR/SMS/PartB/Test/014 (Lock and Detector Full Test – Clamp Lock).

21.5 After completion of the service, switch the Power Pack to Power.

21.6 Observe the operation of the points and investigate any issues found.

21.7 Refit all covers and Lubricate padlocks (RKB 221 and 222 padlocks on the lock body, pump unit cover and local control lids).

21.8 Where RCM is fitted check with the local RCM team to confirm asset trace has not deteriorated following maintenance.

NOTE: *Nominal operation motor current at.*

- 110v = 7.0 Amps
- 90v = 5.9 amps
- 130v = 8.5 amps

Any variation should be investigated.

21.9 If there are no issues, take out of maintenance mode.

21.10 Before leaving site arrange for the Signaller to operate the points in both directions and confirm with the Signaller that detection has been obtained.

22. Local Policy Requirement 2

22.1 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.

APPENDIX A - Replacement of the Grease-O-Matic Auto-lube Canister.

To be replaced when level reaches 20ml. (Note not compatible with dry film lubrication systems).

1. Remove the plastic canister from the rail clip.

2. Unscrew the old canister and attach the new canister to the 45° connector.

3. Activate the Auto-lube canister by aligning the white arrow the selection 12 dispense value, once aligned push the red button. Rotate the black knob clockwise until a 'click' is heard (approximately 6 turns).

4. Push the new canister back into the rail clip. Check that the grease level indicator is visible.

Figure 20 – Auto-lube Canister

APPENDIX B - Replacement of the Simalube Auto-lube Canister.

To be replaced when empty. (for dry film lubrication systems only)

1. Remove the plastic canister from the rail clip if applicable

2. Unscrew the old canister, cut off the small yellow nipple and attach the new canister to the connector.

3. Activate the canister by aligning the white arrow with the 12-marker value, using an Allen key

4. Push the new canister back into the rail clip if applicable. Check that the lubricant level indicator is visible.

APPENDIX C - Dry film Lubrication application and maintenance.

Dry film lubrication practices require to be briefed by a competent person prior to use and applied in a controlled manner.

1. Initial application of dry film lubrication requires the removal of old lubricant types with an evaporating degreaser (Interflon Metal Clean/EM30+). Surfaces should be clean and dry before application of lubricant.

NOTE: *Once converted to dry film, refer to step 4.*

2. Interflon Lube TF should be applied to the bush and pin area as directed and to the manual override pins within the pump unit. Lube TF might also be used on locks and hinges as required. The lubricant should be allowed time to penetrate prior to wiping away any excess.

3. Interflon Lube EP should be used on all other surfaces as directed above. Any excess should be wiped away.

4. For maintenance activities, dry film lubrication should not be degreased. However, the application of further dry film lubricant will allow for cleaning and restoration of lubrication to the equipment. Exposed surfaces should have excessive lubricant wiped away. Lube TF and Lube EP should be used as described above.

5. Fitting of the Simalube auto lube system requires the flushing of old grease from the system or the fitting of new unfilled pipes. A flushing pump is available. Once clean the pipework requires priming with Interflon Lube EP before fitting the Simalube unit. This should be done as outlined in Appendix B.

NOTE: *If dry film lubricant has been cross-contaminated with other lubricants then a process restart using initial application degreaser should be started as above.*

END

General

Yard points are hydraulic operated points that use a clamp lock pump unit driving a set of simple rams to move the points. There is no facing point lock so the points are trailable and detection is done with a standard BR998 detector.

The equipment shall not be operated electrically until any adjustments have been proved by hand pump operation.

SERVICE A

1. Pump Unit

1.1 Check the concrete base, power unit mounting and fixings. The pump unit shall be reasonably level (to the eye) and secure.

1.2 Check the visible tail cable and route.

1.3 Check that the normal / reverse selector cannot be operated with the switch turned to 'Power'.

1.4 Turn to 'manual' position.

1.5 Examine cable entry, cable gland and tail cable sheath.

1.6 Clean and examine terminals, terminal block assembly and fixings. Protect as necessary.

1.7 Examine internal wiring. Hydraulic fluid can cause degradation of insulation.

1.8 Clean and examine the pump unit, motor assembly and all fixings.

1.9 Check for signs of leaks, particularly around the base of the hand pump mechanism, the cover plate gasket and at the base of the motor.

1.10 Check unused ports are be sealed to prevent fluid from being expelled from the reservoir. Check for leaks.

Smiths Industries power packs are labelled:

a) MN, MR – Main Normal, Reverse.

b) BN, BR – Supplementary Normal, Reverse.

1.11 Check power packs fitted with snorkel valves have a label or blue patch fixed to the power pack body.

1.12 Check the hydraulic fluid level and level indicator (where fitted). Top up as necessary. Report any top up greater than 0.5 litres before the end of the shift.

1.13 If more than 1 litre is required, Carry out NR/SMS/PartB/Test/015 (Test for Air).

1.14 Examine hydraulic ram hoses and connections. Pay particular attention to:

a) Signs of leakage.

b) Chafing and damage.

c) Security.

NOTE: *Do not over tighten hose connections.*

1.15 Check that the hose lengths are excessively long, If they are, advise your SM(S).

1.16 Check the locking wires on hose connections are intact.

1.17 Lightly Lubricate hand pump and selector mechanism (guides, pivots, and joints).

1.18 Check and refit cover to unit.

2. Hydraulic Fittings

2.1 Check the locking wires on hose connectors are intact.

2.2 Clean and check the hydraulic rams for leaks, in both normal and reverse positions.

2.3 Clean and examine:

a) Ram fixing brackets and fixing bolts.

b) Tie Bar fixing nuts & bolts.

Bolts shall be of correct length to accommodate the lock nut thread.

3. Final Tests and Checks

3.1 Carry out NR/SMS/PartC/PD01 (BR 998 Detector) Service A and any associated tests.

3.2 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3.3 Refit all covers and lubricate padlocks (RKB 222 padlock on the local control lid).

3.4 The final check before completion of the work is to request the Signaller to operate the points to normal and reverse positions (twice if possible), while observing the movement of the points is correct and in the absence of a Facing Point Lock, that the switch blades fully close up to the rail.

SERVICE B

4. Pump Unit

4.1 Turn to 'Manual' position.

4.2 Examine (where possible) the motor commutator. Clean with a lint free cloth moistened with cleaning fluid. The motor commutator shall be a light coffee colour.

4.3 Check the motor brushes slide freely and seat fully on the Commutator. If the brush is less than 10mm long it shall be renewed.

NOTE: *This task does not apply to brushless motors.*

5. Disconnection Boxes (if Provided)

5.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Final Tests and Checks

6.1 Carry out NR/SMS/PartC/PD01 (BR 998 Detector) Service B and Tests called by that SMS.

6.2 Select 'Power' and ask the Signaller to operate the points with an obstruction placed in the open switch rail. Check the overload cut-out operates (6-9s).

6.3 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

6.4 Ask the Signaller to restore the points and remove the obstruction.

6.5 Refit and lubricate the padlocks (RKB 222 padlock on the local control lid).

6.6 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). At the same time observe the movement of the points is correct and in the absence of a facing point lock, that the switch blades fully close up to the rail.

END

Includes:	Chairlock point mechanism CE, EP valve point auxiliary (D) valve, fitted on Northern City Line (NCL)
Excludes:	All other types of Point Machine

General

Nuts that are tight shall not move by the application of a short-handled spanner.

REGULAR TESTS

1.1 Carry out the facing test point in accordance with the equipment specification.

SERVICE A

2. Chairlock

2.1 Wipe and examine the valve fixing brackets including fixing bolts.

2.2 Examine and lightly lubricate the (D) valve and cover plate retaining clamp screws. Check that the lock nut is tight against the clamp (Auxiliary Valve only).

2.3 Examine the air inlet pipe connection.

2.4 Examine the air outlet flexible hose connection.

2.5 Examine the flexible hose connections together with the jubilee retaining clips.

2.6 Clean and examine the valve caps and lightly lubricate the cap threads with oil.

2.7 Wipe and examine the magnetic valve stem and lightly lubricate with oil.

NOTE: *Prise aside the valve retaining clip to extract the valve. This can be clearly seen in place and engaged, on the top surface of the valve before replacement of the cap.*

2.8 Visually check the electromagnet, transformer and rectifier, together with the associated wiring and terminations on the inside of the glass case.

NOTE: *The valve cores shall not be removed.*

2.9 With the air supply turned on, check the valve and connections for air leaks.

2.10 Isolate the EP valve calling circuit by removing the fuses, links, or OCB’s.

2.11 Isolate both ground lock and cylinder air supplies and the 1 ½ inch air main.

2.12 Remove all retained air pressure by slowly depressing the valve magnets manually to open the exhaust ports until all the air is heard to escape.

Do not depress the armature completely as this might cause partial operation of the Auxiliary D valve from the called position.

2.13 Remove all valve stems.

2.14 Place a point scotch between the open switch and its stock rail.

2.15 Examine the drive tie rod, drive bar, lock crank and connections. Adjust and tighten where necessary. Lubricate crank pins with oil.

2.16 Examine the lock arm bracket, fastenings and switch rail packing, adjust and tighten where necessary.

2.17 Examine the switch detection rod, setting/locking nuts and sleeve nut. Tighten where necessary. Lubricate the visible threaded portion of rod.

2.18 Examine the switch detection lever, crank pin and split pin. Lubricate the pin with oil at the nipple provided.

2.19 Examine the Chairlock holding down and stock rail bolts. Tighten where necessary.

2.20 Examine each Chairlock for body cracks.

2.21 Examine the main cover and fixing. Lightly lubricate the fixing screw with oil. Check that the sealing gasket is secure and effective.

2.22 Examine the air cylinder mounting bracket and holding down bolts. Tighten where necessary.

2.23 Lubricate the air cylinder with oil at the nipples provided and examine the cylinder for air leaks. Any air leaks detected shall be reported as corrective maintenance.

2.24 Examine the ram bellows for wear and check the fixing clips are in good condition.

2.25 Examine the manual (crowbar) operation attachment for security.

2.26 Examine the air cylinder pipe connections, securing clips and hoses for damage and leaks, particularly those resulting from the effects of conductor rail arcing or ballast pressure.

Check that the hoses are not buried under ballast and are clear of the conductor rail and any moving parts of the point layout.

2.27 Examine the ground lock air cylinder pipe connections and hose together with the T piece connection on the valve side of the points, for any damage or leaks.

2.28 Examine the ‘paddle’ terminations and fixing clamps.

2.29 Examine the circuit controller fixing and insulations.

2.30 Examine the circuit controller contacts. Clean the contacts with a lint free cloth moistened with a approved cleaner.

2.31 Examine the ground lock.

2.32 Examine the cam top bearing fixing. Check that the locking tabs are correctly set.

2.33 Examine the switch detection cam fixing and split pin.

2.34 Lubricate (using an oil gun), the following:

a) Ground lock nipple.

b) Cam point bearing cup.

c) Cam follower coupling.

d) Cam, faces and rollers.

2.35 Lubricate the slide chairs with approved lubricant.

2.36 Remove all rubbish and fire hazards around the mechanism, cables, and air hoses.

2.37 Repeat items 2.14 to 2.36 for the opposite chair lock.

2.38 Remove the point scotch from between the open switch and its stock rail.

2.39 Reconnect all valve stems, air supplies, and the EP valve calling circuit.

2.40 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

2.41 Observe the correct operation of the points from the controlling point when all work is complete, and all covers replaced and padlocked.

SERVICE B

3. Glass Enclosed Electro Pneumatic Valve and Point Auxiliary (D) Valve.

3.1 Examine and clean the air filters.

4. Disconnection Boxes (if Provided)

4.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

4.2 Refit the lid and (if provided) padlock, check they are fitted securely.

END

Includes:	JOSS Lock Points
Excludes:	All other type of hydraulic points

GENERAL

The equipment shall not be operated electrically until any adjustments have been proved by hand pump operation.

Nuts that are tight shall not move by the application of a short handled spanner.

REGULAR TESTS

1. Facing Point Lock & Fluid Level

1.1 Carry out NR/SMS/PartB/Test/001 (FPL Tests (Machine)).

1.2 Check the hydraulic fluid level and level indicator (where fitted). Top up as necessary. Report any top up greater than 0.5 litres before the end of the shift.

If more than 1 litre is required, NR/SMS/PartB/Test/015 (Clamp Lock: Test for air in the system).

1.3 Check the RKB 222 padlock is fitted to the Local Control hinged lid.

SERVICE A

2. Pump Unit (all types)

2.1 Check the concrete base, power unit mounting and fixings. The pump unit shall be reasonably level (to the eye) and secure.

2.2 Check the visible tail cable and route.

2.3 Remove the pump unit cover

2.4 Check that the normal / reverse selector cannot be operated with the switch turned to ‘Power’.

2.5 Turn to ‘manual’ position.

2.6 Examine cable entry, cable gland and tail cable sheath.

2.7 Clean and examine terminals, terminal block assembly and fixings. Protect as necessary.

2.8 Examine internal wiring. Hydraulic fluid can cause degradation of insulation.

2.9 Clean and examine the pump unit, motor assembly and all fixings.

2.10 Look for leaks, particularly around the base of the hand pump mechanism, the cover plate gasket and at the base of the motor.

2.11 Unused ports shall be sealed to prevent fluid from being expelled from the reservoir. Check for leaks.

Smiths Industries power packs are labelled:

a) MN, MR – Main Normal, Reverse.

b) BN, BR – Supplementary Normal, Reverse.

2.12 Check power packs fitted with snorkel valves have a label or blue patch fixed to the power pack body.

2.13 Examine the motor brushes, renew as necessary. They shall slide freely in their holders and seat fully on the commutator.

NOTE: *This task does not apply to brushless motors.*

2.14 Check the hydraulic fluid level and level indicator (where fitted). Top up as necessary. Report any top up greater than 0.5 litres before the end of the shift.

If more than 1 litre is required, carry out NR/SMS/PartB/Test/015 (Clamp Lock: Test for air in the system).

2.15 Examine hydraulic ram hoses and connections. Pay particular attention to:

a) Signs of leakage.

b) Chafing and damage.

c) Security.

Do not over tighten hose connections.

2.16 Check that the hose length does not exceed the requirement for purpose.

Beware of excess length of hose being wrapped around the power pack. Arrange for excess length hoses to be replaced.

2.17 Check the locking wires on hose connectors are intact.

2.18 Lightly lubricate hand pump and selector mechanism (guides, pivots, and joints).

2.19 Check and refit cover to the unit.

3. Point Mechanism Exterior (Cover on).

3.1 Examine the machine covers, studs, and padlocks.

3.2 Check the visible tail cables and route.

3.3 Check the air pipes and connections for leaks.

3.4 Check the baseplate and castings for cracking. Operate the machine under power and check that it is secure. Tighten as necessary.

3.5 Remove any potential obstructions and fire risks.

3.6 Clean and apply an adhesive grease to the point drive and lock and detector movements.

4. Point Mechanism Interior (Covers Removed)

4.1 First isolate the machine.

Examine the hydraulic actuators to point drive (lug, split pin and locknut).

4.2 Clean and examine the:

a) Base assembly and fixings.

b) Point Drive.

c) Escapement.

d) Lock assembly.

e) Baseplate castings, rivets, and fixings.

f) Point drive bar and slider plates.

g) Escapement pivot and bolts.

h) Throw bar, drive lug and split pin.

i) Rollers and grease nipples.

j) Lock blades, lock dogs, and notches chamfering, and swarf indicates the points are out of adjustment.

k) Connection to the detector box (lug, bolt, and split pin).

4.3 Lubricate with a lithium grease the point drive and lock movement grease nipples.

4.4 Lubricate with oil the wearing surfaces of the drive mechanism.

5. Contact Assembly (Style HV)

5.1 Remove the cover; check the seal and the casting.

5.2 Check that the drain holes and ventilators are clear. Remove accumulated moistures and debris.

5.3 Clean and examine the following:

a) Locking bar and dogs.

b) Lock slide and notches. Look particularly for wear (swarf) and chamfering (bright corners).

c) Detector slides and notches.

d) Guides, rollers and fixings.

e) Cover plate and fixings.

5.4 Lubricate the slides with lithium grease.

5.5 Fill the oil cups with mineral oil.

5.6 Examine the detector actuators, rollers, pivots, and split pins. Lubricate with a mineral oil. Rollers shall fully engage in the notches and rotate freely.

5.7 Examine the shuttle mechanism, pay attention to:

a) The moving block and return spring assembles.

b) Terminal blocks and fixings. Tighten and protect as necessary.

c) Contacts and springs, clean and protect as necessary. Protection shall not be applied to contact faces.

d) Cables, cable entries, wiring and terminations.

5.8 Where fitted, check the heaters.

6. Test and Final Checks

6.1 Carry out NR/SMS/PartB/Test/001 (FPL Tests (Machine)).

6.2 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

6.3 Replace all the covers and secure using padlocks. A RKB222 shall be fitted.

6.4 The final check before completion of the work is to ask the Signaller to operate the points normal and reverse positions (twice if possible). Observe correct operation.

SERVICE B

7. Pump Unit

7.1 Turn to manual position.

7.2 Where possible, examine the motor commutator. Clean with lint free cloth moistened with cleaning fluid. It shall be a light coffee colour.

7.3 Check power pack motor brushes are free to slide in their holders and replace if less than 10mm in length.

NOTE: *This task does not apply to brushless motors.*

8. Point Mechanism - General

8.1 Clean and wipe the machine and cover.

9. Disconnection Boxes (if Provided)

9.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

9.2 Refit the lid and (if provided) padlock, check they are fitted securely.

10. Local Policy Requirement

10.1 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.

11. Final Checks and Tests

11.1 Carry out NR/SMS/PartB/Test/011 (Detector Tests (Electrical Detectors)).

11.2 Carry out NR/SMS/PartB/Test/001 (FPL Tests (Machine)).

11.3 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests).

11.4 Replace covers and secure using padlocks. An RKB222 shall be used.

11.5 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

END

Includes:	Hydraulic Derailers (Type BRB 817) powered by SPX Hydraulic Pumps and Actuators
Excludes:	All Other types of Derailer

GENERAL

The equipment shall not be operated on power until any adjustments have been proved by hand pump operation.

Hydraulic Derailer's use a standard Clamplock pump unit and a pair of Clamplock rams to drive a Derailer mechanism. Detection is accomplished using a standard circuit Controller or a 998 unit. See Figure 1.

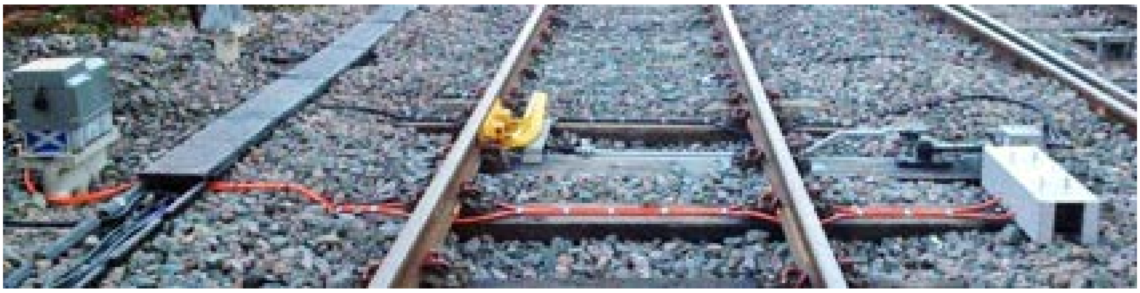


Figure 1 – Hydraulic Derailer Type BRB 817

SERVICE A

1. Derailer Unit

1.1 Remove the pump unit cover and turn to "Manual" before carrying out close inspection.

1.2 Examine the derailer for signs of cracking or damage.

1.3 Check the unit is correctly aligned

1.4 Check the torque settings of the nuts for the bolts holding the derailer mechanism to the rail at 80Nm

1.5 Check the unit is not obstructed by ballast.

2. Actuator Mounting Frame

2.1 Clean the frame holding the rams and check it is secure on its base and fixings.

2.2 Check for slackness in the mechanical connections by rocking the derailer mechanism by hand.

2.3 Clean and check the hydraulic rams for leaks.

Check the locking wires on hose connectors are intact.

2.4 Check that when operated the driving crank between the Hydraulic Pump Unit and connecting rod, operates smoothly.

Confirm that the driving angle does not interfere with the Detector Box.

2.5 Check that the crank is greased and is fitted with respective grease nipples in the crank stud and joint pins.

3. Pump Unit

3.1 Check the concrete base, power unit mounting and fixings. The pump unit shall be reasonably level (to the eye) and secure.

3.2 Check the visible tail cable and route.

3.3 Check the manual control selection mechanism and solenoid valve block.

3.4 Check the normal/reverse selector cannot be operated with the switch turned to 'Power'.

3.5 Examine cable entry, cable gland and tail cable sheath.

3.6 Clean and examine terminals, terminal block assembly and fixings. Protect as necessary.

3.7 Examine internal wiring. Hydraulic fluid can cause degradation of insulation.

3.8 Clean and examine the pump unit, motor assembly and all fixings.

a) Look for leaks, particularly around the base of the hand pump mechanism, the cover plate gasket and at the base of the motor.

b) Unused ports shall be sealed to prevent fluid from being expelled from the reservoir. Check for leaks.

3.9 Examine the motor brushes, renew if less than 12mm. They are designed to slide freely in their holders and be seated fully on the Commutator.

NOTE: *3.9 do not apply to brushless motors.*

3.10 Check the hydraulic fluid level and level indicator (where fitted). Top up as necessary.

Report any top up greater than 0.5 litres before the end of the shift.

3.11 If more than 1 litre is required, carry out NR/SMS/PartB/015 (Clamp Lock: Test for air in the system).

3.12 Examine hydraulic ram hoses and connections. Pay particular attention to:

a) Signs of leakage.

b) Chafing and damage.

c) Security.

Do not overtighten hose connections.

3.13 Check that the hose length does not exceed the requirement for purpose. Beware of excess length of hose being wrapped around the power pack. Arrange for excess length hoses to be replaced.

3.14 Check the locking wires on hose connections are intact.

3.15 Lightly Lubricate hand pump and selector mechanism (guides, pivots and joints).

3.16 Check switch is turned to “Power” and refit cover to unit.

4. Additional Services (If Required) and Final Checks

4.1 Where a Circuit Controller is used as detection, carry out NR/SMS/PartC/LV31 (Circuit Controllers) - Service A.

4.2 Where a 998 Detector is used for detection, carry out NR/SMS/PartC/PD01 (BR998 Detector) - Service A. (Detection Tests in PD01 are not applicable to derailers)

4.3 The final check before completion of the work is to ask the Signaller to operate the derailer to normal and reverse positions (twice if possible), while observing the movement is correct.

SERVICE B

5. Pump Unit

5.1 Turn to ‘Manual’ position.

5.2 Examine (where possible) the motor commutator. Clean with a lint free cloth moistened with cleaning fluid.

The motor commutator should be a light coffee colour.

5.3 Examine the motor brushes, renew if less than 12mm. They are designed to slide freely in their holders and be seated fully on the Commutator.

NOTE: *5.2 & 5.3 do not apply to brushless motors.*

5.4 Lubricate padlocks (RKB 222 padlock on the Pump Unit local control lid).

6. Additional Services (If required)

6.1 Where a Circuit Controller is used as detection, carry out NR/SMS/PartC/LV31 (Circuit Controllers) - Service B.

6.2 Where a 998 Detector is used for detection, carry out NR/SMS/PartC/PD01 (BR998 Detector) - Service B. (Detection Tests called in PD01 are not applicable to derailers.)

7. Detection Test

7.1 Carry out the derailer detection test as described in NR/SMS/PartB/Test/020 (Hydraulic Derailer (Type BRB 817) Tests)) - Section 2.

8. Final Checks

8.1 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests), unless monitored by ELD or fed directly from SSI module.

8.2 Refit and lubricate the padlocks (RKB 222 padlock on the local control lid).

8.3 Ask the Signaller to operate the derailer to normal and reverse positions (twice if possible), while observing the movement of the derailer is correct.

END

Includes:	Derailers connected to Lever frames (Cambois Keithley Whitby)
Excludes:	All other Hydraulic Derailers – Non-Interlocked Derailers

GENERAL

Mechanical Derailer's use a standard mechanical channel rod connections to drive a Derailer mechanism. Detection can be accomplished using a standard circuit Controller or a 998 unit (NR/SMS/PartC/PD01) or with a convention circuit breaker (NR/SMS/PartC/LV31) or a mechanical detector (NR/SMS/PartC/PD03) as applicable.

SERVICE B

1. Derailer Unit

1.1 Examine the derailer for signs of cracking or damage.

1.2 Check the unit is correctly aligned.

1.3 Check the torque settings of the nuts for the bolts holding the de-railer mechanism to the rail at 80Nm.

1.4 Check the unit is not obstructed by ballast.

1.5 Check, when operated, the driving crank between the connecting rod operates smoothly and that the driving angle does not become chocked.

1.6 Check that grease nipples are fitted in the crank stud and joint pins.

1.7 Lubricate the bearings and grease the crank(s).

1.8 Check the drive does not interfere with the detector box connections.

2. Additional Services and Final Checks

2.1 Where a circuit controller is used as detection, carry out NR/SMS/PartC/LV31, (Circuit controllers) - Service A.

2.2 Where a 998 Detector is used for detection, carry out NR/SMS/PartC/PD01 (BR998 Detector) - Service A, (Detection Tests in PD01 are not applicable to Derailers).

2.3 The final check before completion of the work is to operate the derailer to normal and reverse positions (twice if possible), while observing the movement is correct.

END

Includes:	Train Operated (Hydro-Pneumatic) Points
Excludes:	All other Train Operated Points

The equipment shall not be operated electrically until any adjustments have been proved by hand pump operation.

Nuts that are tight shall not move by the application of a short handled spanner.

Any tightening of nuts or adjustments shall be reported as a corrective maintenance as per NR/SMS/PartA/A02 (Preventative & Corrective Maintenance).

SERVICE A

1. General

1.1 Remove fire risks and potential obstructions from the area of the mechanism.

1.2 Examine the following:

a) Accumulator and hand pump case castings. Look particularly for cracking.

b) Ramps and fixings.

c) Guard assemblies.

d) Fixings - check all bolts are tight.

1.3 Examine accumulator, actuators and hand pump unit. Remove any foreign bodies Look for signs of hydraulic fluid leakage.

1.4 Check the position of the pressure gauge needle in the accumulator unit.

Warning: If the needle is in the RED sector, the apparatus shall be treated as failed, taken out of service and the Signaller informed immediately.

1.5 Carry out NR/SMS/PartB/Test/018 (Train Operated Points Detection Test).

1.6 Hand-pump the points to the reverse position. Operate the valve and observe the points return to the normal position within 17-20 seconds.

1.7 Check a RKB222 padlock is fitted to the hand pump unit.

1.8 Lubricate hinges and padlocks.

SERVICE B

2. Exterior

2.1 Clean accumulator and hand pump units.

2.2 Examine all bolts and set screws.

Typical Drawing

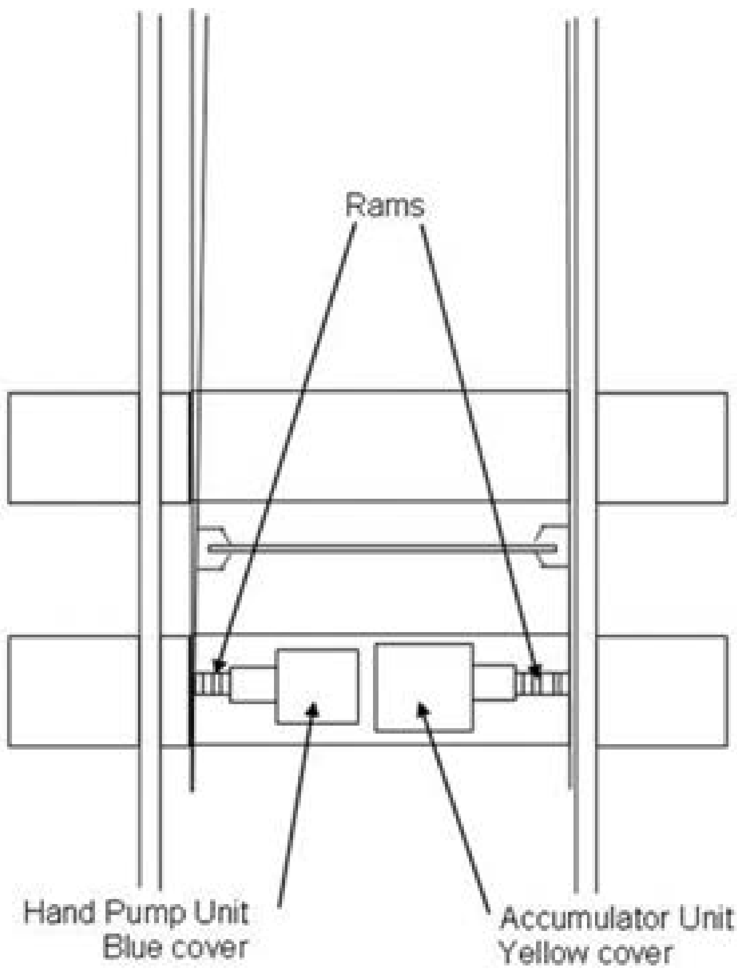


Figure 1 – Accumulator Layout

END

Includes:	HW1000, HW2000 Style point drive machines
Excludes:	Point inspections, Point fittings and Supplementary drives

GENERAL

The machine shall not be operated electrically until all adjustments have been verified by crank handle operation.

Nuts that are tight shall not move by the application of a short-handled spanner.

Any tightening of nuts or adjustments shall be reported as corrective maintenance.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

SERVICE A

2. Exterior

2.1 Observe the point machine operation under power. Check that there is no movement relative to the bearers. If movement is observed, tighten fixing bolts to 100-120Nm.

2.2 Remove the covers, clean and examine lock and detector blades, throw bar and insulations. Check all nuts are tight.

2.3 Check the machine covers for cracks and damaged, loose, or missing components.

2.4 Remove fire risks and potential obstructions.

2.5 Examine and lubricate the crank handle cut out contact cover plate and hinge.

2.6 Check the visible tail cables and route. Check that cables are not trapped or covered by P/Way materials.

3. Interior Mechanism (Cover removed)

3.1 Examine the crank handle cut-out contact. Check that when the crank handle is inserted the contact breaks.

Operation of the crank handle cut-out contact isolates the machine.

Crank handle cut-out broken isolating the machine (crank handle removed for clarity). See Figure 1.

The recommended opening of the crank handle cut-out contact is 6mm.

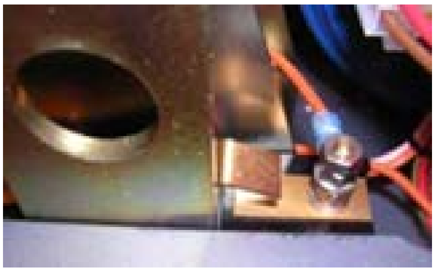


Figure 1 – Crank Handle Contact

3.2 Operate the machine via the crank handle and examine the lock dog. Look particularly for wear (swarf) and chamfering (bright corners).

The lock dog is shown mid stroke. Heads of split pins can be seen above the lock slide rollers. Figure 2.

NOTE: *The detection slides have been removed in Figure 2.*

Figure 2 – Lock Dog

With point switch fully closed (x), there shall be a 1.5mm clearance on each lock face (y & z).

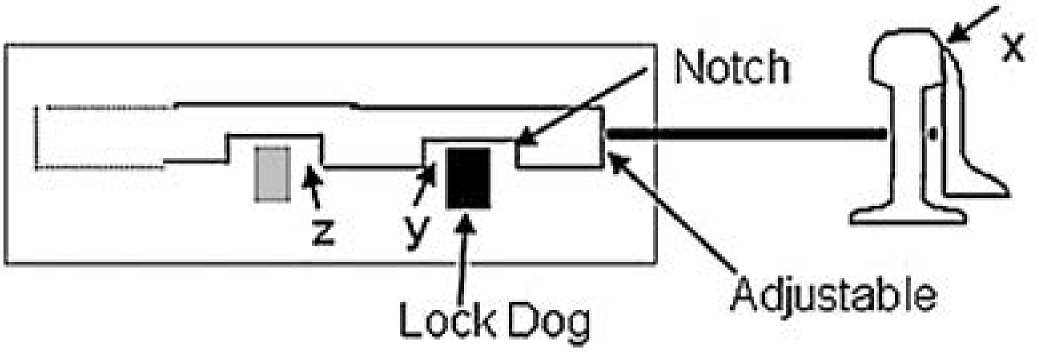


Figure 3 – Lock Slide and Dogs (not to scale).

Temperature changes can cause expansion/contraction of the detector rod and result in a tight lock.

3.3 Examine the nut on main gear stud in centre of bevel gear casting.

3.4 Examine the resistor and rectifier/diode units.

3.5 Examine the cable cores, internal wiring, terminals, and plug couplers. Clean and protect as necessary.

3.6 Examine the following:

a) Tail cable sheath.

b) Tail cable plug coupler.

c) Cable gland and blanking plates.

d) Drain holes.

3.7 Check the heaters.

3.8 Wipe and examine locking bar wear plates and bolts.

3.9 Remove the gear train cover. Report as corrective maintenance any missing or loose (unable to correctly fasten down due to sheared bolts) gear train covers.

3.10 Examine the following:

a) Clutch springs and nuts (HW1000).

b) Magnetic clutch (HW2000).

3.11 Examine holding bolts on:

a) Motor (3 fixing bolts plus casing through bolts).

b) Intermediate gear train.

c) Throw bar retainer plate.

d) Bevel gear casting.

e) Contact Assembly.

3.12 Check the tightness of the four corner bolts securing the Detection Frame.

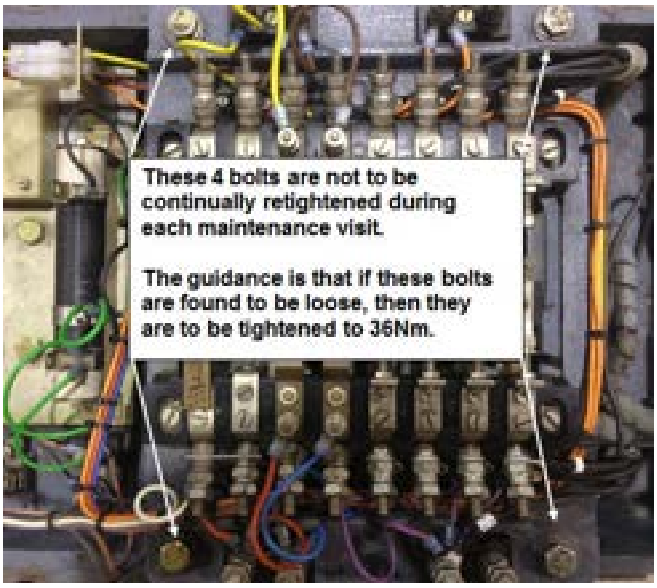


Figure 4 – Detection Frame bolts

3.13 Check that the spirol pin securing the pinion gear to the motor shaft is in place and secure.

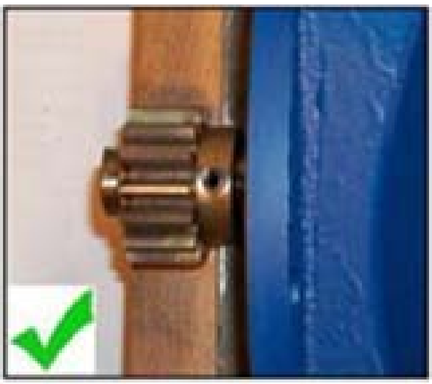


Figure 5 – Correct spirol pin position

Figure 6 – Spirol pin working loose

3.14 Examine the ball races and retaining screws on gear train. The presence of swarf indicates a problem.

Figure 7 - Gear train on a HW2000 machine with the gearbox cover removed

3.15 Lubricate the gear teeth with lithium grease.

3.16 Lubricate the gear train cover retaining with lithium grease screws, then replace the gear train cover.

3.17 Check, clean and lubricate the bearing surfaces of the throw bar, locking bar, lock, and detector blades with dry film lubricant (EP) or lithium grease.

3.18 Check, clean and lubricate the external surfaces of the throw bar, locking bar, lock, and detector blades with dry film lubricant (EP) or adhesive grease.

3.19 Check, clean and lubricate the throw bar and detection rollers with dry film lubricant (EP) or oil.

4. Contact Assembly

4.1 Check where visible split pins on the following:

a) Detection roller.

b) Lock slide connection arms.

c) Lock arm roller.

Split pins in situ can be seen in the picture of the lock slide in Figure 2.

4.2 Observe the rollers whilst winding the machine. Rollers shall rest on bottom of notches in both N & R positions and rotate freely.

An image of the lock slide roller split pins can be seen in Figure 2.

Figure 8 - Rollers

The rollers can be seen below the contacts (See Figure 8) from a HW1000 machine. Note that the lock slide is mid-stroke and the detection slides have been removed.

4.3 Check the contact centre fixing screws.

4.4 Examine the following:

a) Motor control and detection contacts. If the motor control contact has been fully plated (i.e., to include the braid) it requires replacement.

b) Snubbing contacts (HW1000).

c) Magnetic clutch contacts (HW2000).

4.5 Contacts that are worn or show signs of arcing shall be cleaned or replaced as required.

4.6 Check the contact fingers. Clean as necessary.

4.7 Do not apply any lubrication to the contact surfaces.

5. Tests and Final Checks

5.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

5.2 Remove the crank handle and confirm the crank handle cut-out contacts are closed. Observe the operation of the points in both directions under power operation.

5.3 On HW1000 machines observe that the snubbing is effective.

If the snubbing is not working correctly there can be 'kick-back' on the motor; this is defined as angular movement of the crown gear.

This does not affect HW2000 machines as the motor is disconnected by the electro-magnetic clutch at the end of operation.

5.4 Check for foreign bodies in the machine; replace all the covers and check that RKB222 padlock is fitted to crank handle cover. Lubricate the padlock.

5.5 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

5.6 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

SERVICE B

6. General

6.1 Isolate the machine by inserting the crank handle and confirming the crank handle contact breaks.

6.2 Clean the cover (inside and out) and the casting.

7. Motor / Drive Mechanism

7.1 Remove the motor brush/commutator cover and examine the motor commutator (it shall be a light brown/coffee colour).

7.2 Clean as necessary by pressing a clean, lint free cloth moistened with an approved cleaner onto the surface of the commutator and rotating by means of the crank handle.

7.3 Examine the motor brushes and spring retainers.

Brushes shall slide freely in the holders and seat fully on the commutator.

Brushes shall be replaced when worn to 10mm long.

After examination check that the brushes are replaced in their original positions.

Figure 9 - A new motor brush before insertion in its holder

8. Contacts

8.1 Examine the condition of and clean as necessary using lint free cloth moistened with an approved switch cleaner:

a) Snubbing contact (HW1000).

b) Clutch control contacts (HW2000).

c) Normal and reverse detection contacts.

d) Motor control contacts.

e) Crank handle cut-out contact.

<u>Point Detector Contacts (HW1000 and HW2000)</u>

8.2 Check the following:

a) The springs are not deformed.

b) The open contact; spring (1) bears against adjusting screw (2).

c) The closed contact; spring (3) has approximately 2mm clearance to the head of the adjusting screw (4).

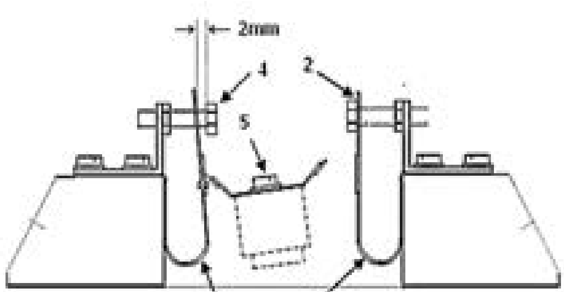


Figure 10 - HW1000 and HW2000 Contacts

d) The screw on the rocker (5) is secure.

e) When the rocker is operated, all detection contacts make at the same time. Check for both normal and reverse positions.

The bending of detection springs is not permitted; any deformed detection spring shall be replaced as corrective maintenance.

Details of adjustments are in Appendix A.

Clutch Control Contacts (HW2000 only)

8.3 Check the following:

a) The closed contact spring is making a good contact on the spring (5).

If not, it shall be replaced as corrective maintenance.

b) The contact (4) does not foul rivet head (1) on spring (2).

c) The open contact (3) is approximately 5mm.

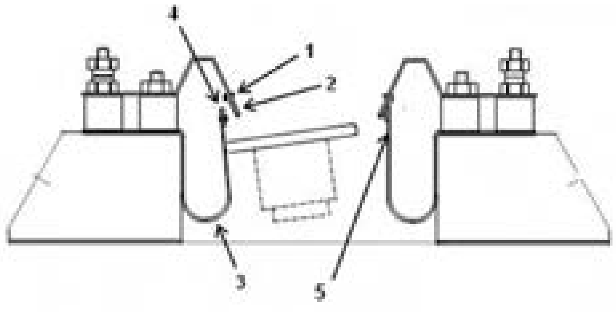


Figure 11 – Clutch Contacts

Motor Control Contacts

8.4 Measure the gap between the fixed contact and the spring contact. The contact gap shall be between 6.3mm and 8mm. If it is more than 8mm, the spring pressure can be too light.

8.5 Check that the open spring contact is free to move.

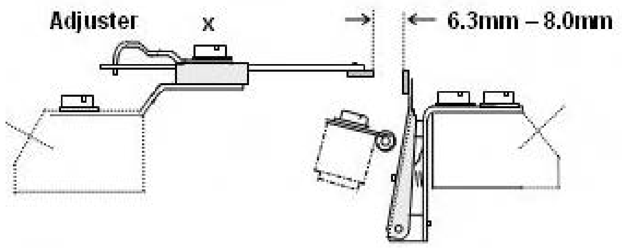


Figure 12 – Motor Contacts

9. Disconnection Boxes (if provided)

9.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

d) Where fitted, check that the plug couplers are fastened so that they cannot vibrate loose.

9.2 Refit the lid and (if provided) padlock, check they are fitted securely.

10. Local Policy Requirement

10.1 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Detection Loop Test) as directed.

11. Tests and Final Checks

11.1 Carry out NR/SMS/PartB/Test/011 (Detector Tests (Electrical Detectors)).

11.2 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

11.3 Before completing this task confirm the following:

a) Hands and clothing shall be kept clear of all moving parts whilst carrying out this test.

b) If any adjustments are required to machine, the machine shall be re-isolated. If a meter has been used to complete the drive circuit it shall be unclipped and moved away from the machine.

c) The meter used shall be capable of measuring the currents involved.

Place a current clamp meter around the drive circuit cable or connect a multi-meter across the open cut-out contacts. Record the operating current whilst operating the points N-R and R-N (max 10A). Ignore the initial surge current.

An increase in the current required to operate the machine can indicate an underlying problem.

Any increases shall be investigated as corrective maintenance.

11.4 With an obstruction between switch and stock rail. Record the operating current whilst operating the points N-R and R-N. Observe correct operation of the overload cut out protection within 6 to 9 seconds.

Before adjusting the clutch on a HW1000, if a meter has been used to complete the drive circuit it shall be unclipped and moved away from the machine before any adjustments are made.

The clutch slip current shall be set to 12A ±2A.

NOTE: *The clutch can be adjusted on the HW1000, but not on the HW2000. See Appendix B.*

11.5 Return the point machine to power operation and confirm the crank handle cut-out contacts are closed.

11.6 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

This can be undertaken as part of the location or equipment room tasks.

11.7 Check for foreign bodies in the machine; replace all the covers and check that RKB222 padlock is fitted to crank handle cover. Lubricate the padlock.

11.8 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

11.9 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

SERVICE V1

12. Visual Inspection

12.1 Check for potential fire risks and obstructions around the S&C and within close proximity of the POE mechanism and fittings.

12.2 Check sleeper beds are clear of any obstructions.

12.3 Check cables and cable routes for any visible damage and are clear from any rodding runs.

12.4 Check the correct padlock is fitted.

12.5 Check the covers are fitted and not damaged.

12.6 Observe the operation of the points and investigate any issues found.

12.7 Check while points are operating that there is no movement relative to the bearers.

12.8 Report any significant wheel burns, rail defects and poor permanent way.

12.9 If applicable, report any adjustment / replacement / further work carried out to remove a defective condition within the POE.

12.10 Before leaving site arrange for the Signaller to operate the points in both directions and confirm with the Signaller that detection is obtained.

SERVICE R1

Remote Condition Monitoring

If the points that you have requested to work on are fitted with Remote Condition Monitoring, check that the asset has been placed into maintenance mode prior to commencing work.

Prior to commencing work, it is recommended that the previous current traces are made available from the Remote Condition Monitoring system and checked for any abnormalities.

Also, on completion of the work it is recommended that new traces are recorded and viewed, so they can be compared with the traces produced before the maintenance activity.

When requesting permission from the Signaller to work on a set of points, ask the Signaller to operate points in both directions to verify and prevent any confusion on the set of points you have requested.

13. Operation

13.1 Observe the motion of the points, while the Signaller is operating them, look for signs of resistance to movement which could be caused by:

a) Stretcher Bars Bowing.

b) Roller set-up.

c) Supplementary Drive set-up.

d) Overdriving.

e) Contaminated base plates.

f) Binding kicking strap.

13.2 Observe the point machine operation under power. Check that there is no movement relative to the bearers. If movement is observed, tighten fixing bolts to 100-120Nm.

13.3 Once the Signaller has confirmed you have possession of the points, insert the crank handle and check that the cut-out contact is broken.

13.4 Remove the covers and observe the travel of the Lock and Detector Blades and Throw bar.

13.5 Check tightness of the four bolts securing the bevel gear mounting plate, Figure 13.

13.6 Check the tightness of all other point machine fixings.

13.7 Check the Spirol pin securing the pinion gear to the motor shaft is in place and secure, Figures 14 and 15.

Figure 13 – Mounting plate bolts

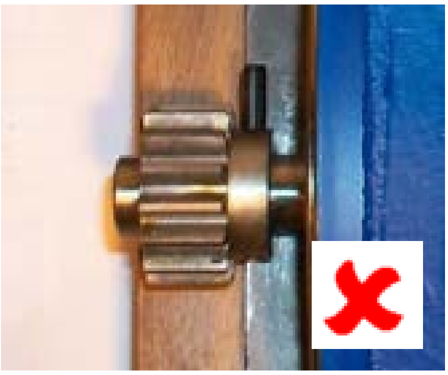


Figure 14 – Incorrect fitting

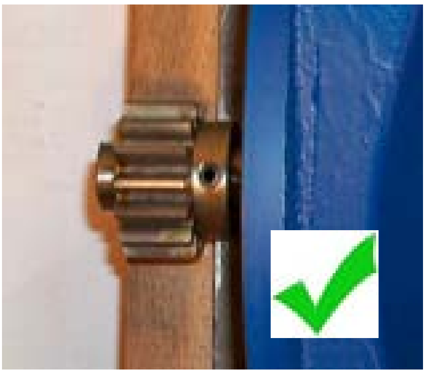


Figure 15 – Correct fitting

13.8 Check the tightness of the four corner bolts securing the Detection Frame.

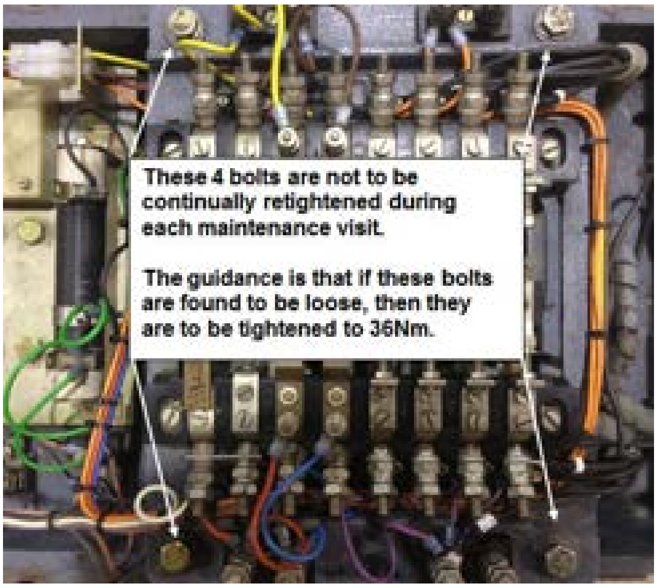


Figure 16 – Detection Frame bolts

13.9 Examine the Lock blades notches for signs of swarf or impact damage.

13.10 Examine the Point Machine case for signs of cracking.

13.11 Check the wiring is secured of to prevent it being damaged and kept away from moving parts.

13.12 Check cable glands / plug couplers securely hold the cables and are preventing water ingress.

13.13 Where fitted, check that Plug Couplers are correctly fastened so that they cannot vibrate loose.

Figure 17 – Plug Couplers

13.14 Lubricate the Lock and Detector Blades, Throw-bar, Gear teeth, Crank handle Cut-Out Mechanism and Padlock.

13.15 Examine all the contacts for signs of wear, arcing or deformation - clean or replace as necessary.

13.16 Check that the Cut-out contact is made.

13.17 Report any adjustments made, components replaced or out of specification items on a WAIF.

13.18 Replace the covers and lids.

13.19 Before leaving site arrange for the Signaller to operate the points in both directions and confirm the Signaller obtain detection.

Figure 18 – Cut-out Contact

13.20 Where Remote Condition Monitoring is fitted and work on this set of points has been completed, check with local RCM team that asset trace has not deteriorated following maintenance. If there are no issues take out of maintenance mode.

SERVICE R2

These tasks should be performed in addition to Service R1.

14. Inspection and Service

For HW1000 only

14.1 Check that snubbing stops the motor rapidly and cleanly in both direction when moved on power.

All Types

14.2 Check the motor brushes are, the correct type, free to slide within holder and greater than 10mm in length.

14.3 Check the brush holder is free from excessive carbon and clean commutator so that it's a bright copper colour.

15. Local Policy Requirements

15.1 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Detection Loop Test) as directed.

16. Test

16.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

16.2 Carry out NR/SMS/PartB/Test/011 (Detector Test Electrical Detectors).

16.3 Check all closed contacts are correctly adjusted.

16.4 Check the Motor Control Contacts are correctly adjusted to an opening of between 6.3mm and 8mm.

16.5 Check the split pin has not broken and centre pin has not moved, see Figure 19.

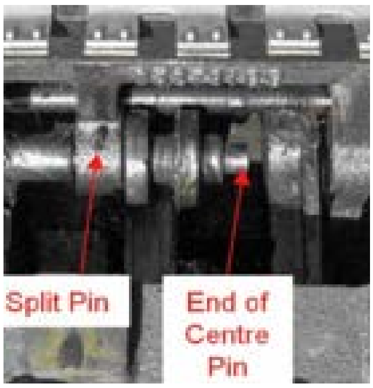


Figure 19 – Centre Pin

16.6 Check the Cotter/Split pins holding the Yoke have not broken, see Figure 20.

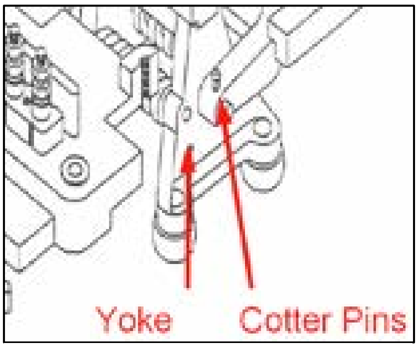


Figure 20 – Cotter Pins

16.7 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

16.8 Report Any adjustments made, components replaced or out of specification items on a WAIF.

16.9 After completion of the service, remove the point handle.

16.10 Check the cut-out contact is made.

16.11 Replace the covers and lids.

16.12 Before leaving site arrange for the Signaller to operate the points in both directions and confirm the Signaller obtain detection.

16.13 Where Remote Condition Monitoring is fitted and work on this set of points has been completed, check with local RCM team to confirm the asset trace has not deteriorated following maintenance. If there are no issues take out of maintenance mode.

APPENDIX A - Adjustment of Contacts

Before adjustment of any contacts investigate why adjustment is required. Other factors can be causing the need for adjustment. Motor contacts wear due to the high currents they carry, replacement can be more advisable. Detection and clutch (on HW2000) contacts should not need adjusting.

Individual Detection Contacts

The fine adjustment of individual detection contacts can be undertaken by the adjusting screw, slacken off the lock nut then using a screwdriver adjust the screw. Tighten the lock nut on completion.

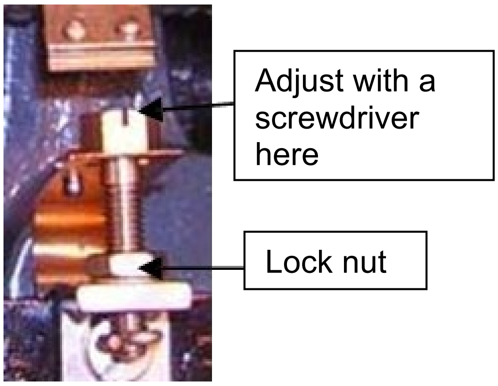


Figure 21 - Detection Contact

Motor Contacts

Loosen the retaining screw enough to lift the retaining spring from the adjustment hole. Move the contact into the required position and tighten down the retaining spring in the new adjustment hole.

Figure 22 - Motor Contact

All Contacts

The contact assembly is factory set and any adjustment affects all the contacts.

Adjustments shall only be undertaken if your SM(S) has deemed you competent and the points are in failure mode.

Release locking tabs.

1. Loosen two screws in contact block assembly.
2. Adjust as required.
3. Retighten screws and turn up locking tabs.
4. Re-measure all contacts.

Figure 23 – Locking Screws

APPENDIX B - Clutch Adjustment

All clutches are pre-set, if adjustments are required further investigations into the reason why should be undertaken before adjustments are made.

HW1000:

The dry plate clutch is adjusted mechanically by increasing or decreasing the clutch spring pressure by means of the four nuts on the clutch gear.

To increase the slip turn the nuts clockwise, conversely to decrease the slip turn the nuts anticlockwise.

Figure 24 - Mechanical clutch on a HW1000 machine

HW2000:

The electro-magnetic clutch is adjusted by means of a variable resistor.

This clutch cannot be adjusted mechanically.

Figure 25 - Electromagnet clutch on a HW2000 machine

APPENDIX C - Point Layout

- Typical Drawing of a HW Point Layout (Right Hand Machine) not to scale.
- The sole plate and sleepers have been omitted for clarity.

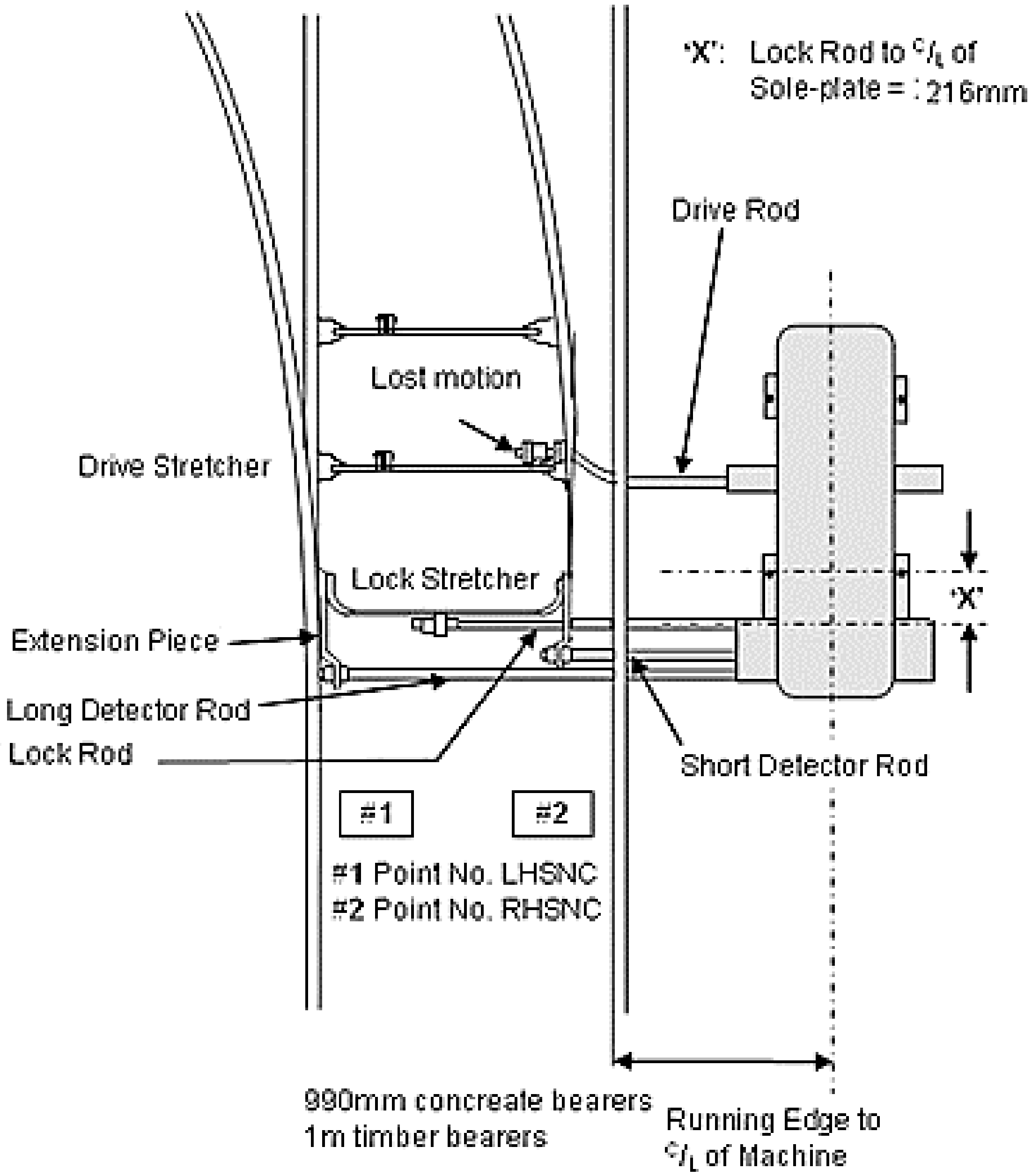


Figure 3 – Point Layout

APPENDIX D - Schematic Diagram of a HW (Left Hand) machine.

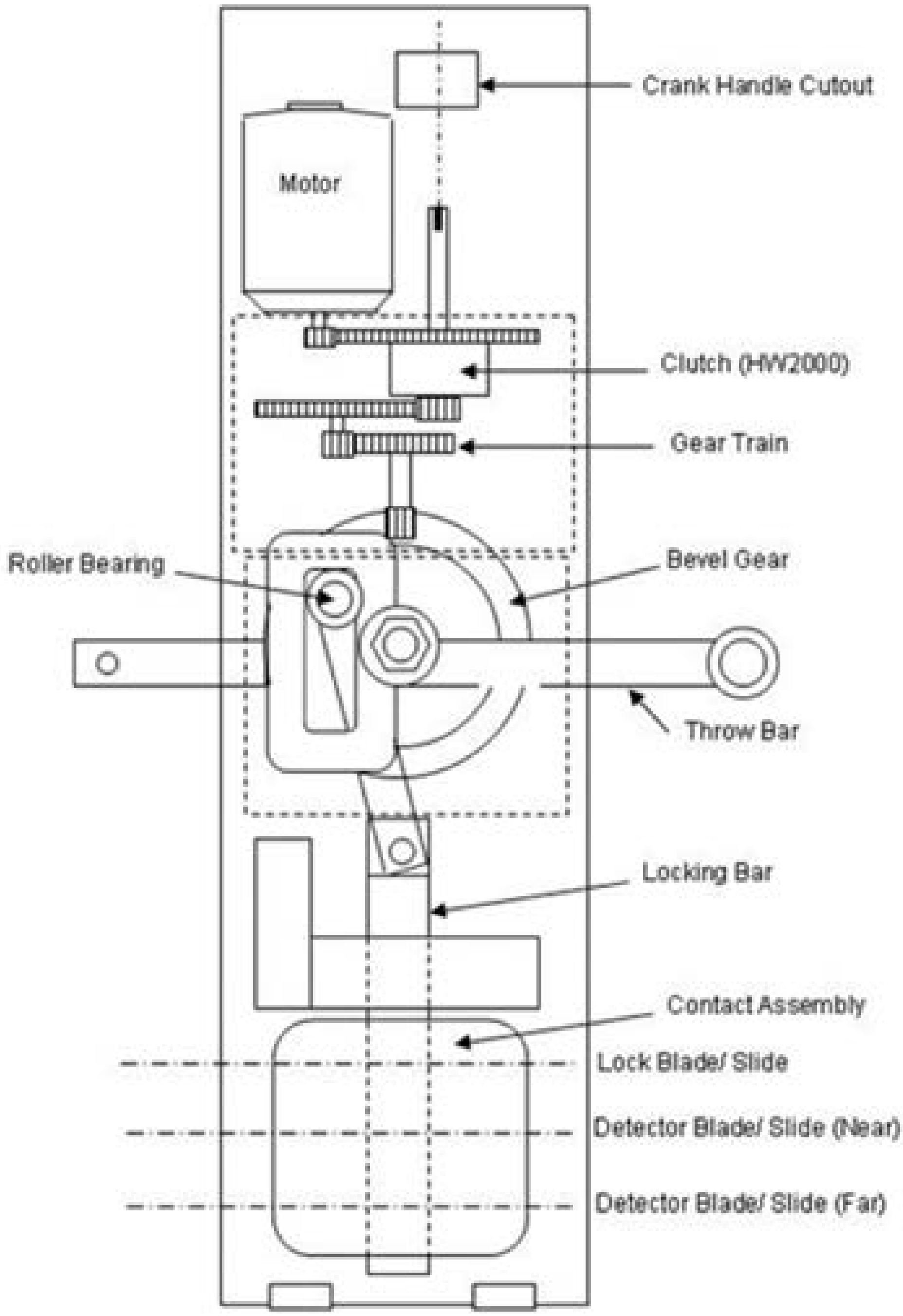


Figure 4 - Schematic Diagram of a HW (Left Hand) machine

END

Includes:	Models 5A, 5E and 5P point drive machines
Excludes:	Point inspections, Point fittings and Supplementary Drives.

General

The machine shall not be operated electrically until all adjustments have been verified by crank handle operation.

Nuts that are tight shall not move by the application of a short-handled spanner.

Any tightening of nuts or adjustments shall be reported as corrective maintenance.

Further information on these machines is available in the ML Manual JEA50/ML3-1.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

SERVICE A

2. Exterior

2.1 Check and tighten point machine fixings.

Operate machine under power and observe that there is no movement relative to the bearers. If movement is observed, tighten fixing bolts to 100- 120Nm and arrange a re-check at the next visit.

2.2 Clean and examine lock and detector blades, throw bar, and insulations (tighten as necessary).

2.3 Remove cover plates. Clean and protect throw bar, lock, and detector slides with adhesive grease.

NOTE: *Do not allow excessive amounts of grease to enter the machine.*

2.4 Check machine covers and base casting for cracks.

2.5 Remove fire risks and potential obstructions.

2.6 Examine and lubricate crank handle cut out contact cover plate and hinge.

2.7 Check visible tail cables and route. Check cables are not trapped or covered by P/Way materials.

3. Motor Assembly

NOTE: *Before starting any work, isolate the machine using the crank handle cut out. In some areas the cut out is in a separate switch box which can isolate several point ends at once. If in doubt, ask your SM(S).*

3.1 Remove cover plate. Check casting, latch, and water seal.

3.2 Check motor is securely mounted and not damaged.

3.3 Check the following items:

a) Commutator. It shall be a light brown / coffee colour.

b) Brush and brush holder spring assemblies. Moisture and dirt can cause the brushes to stick in the holders, which can result in a motor failure.

c) Terminal blocks, braids, wiring, terminations and insulation.

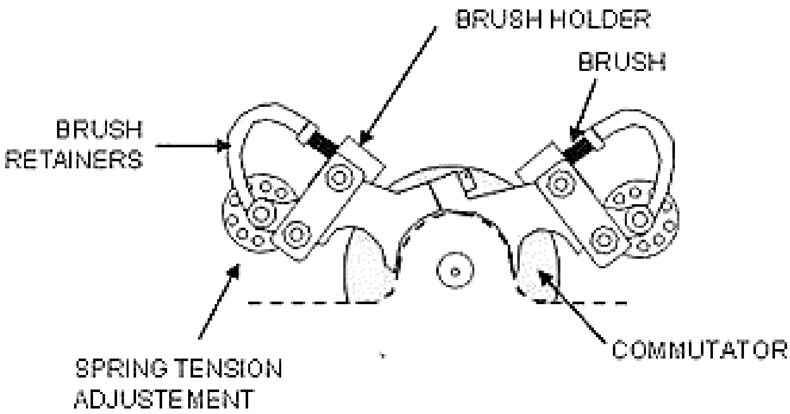


Figure 1 – Brush Holder Assemble

3.4 Check heaters and wiring, where fitted. The commutator and brushes are susceptible to condensation.

3.5 Replace and secure cover with RKB 221 padlock.

4. Drive & Clutch Assembly

4.1 Remove cover, check casting, latch, and water seal.

4.2 Remove moisture and debris from interior of machine casting. Check drain holes are clear.

4.3 Examine casting for cracking.

4.4 Check heaters and wiring, where fitted.

4.5 Clean and examine the clutch.

NOTE: *Where the clutch is fitted with a phosphor bronze bearing, the oil dash-pot should have been removed and the oil feed blanked off.*

Any still fitted shall be reported. Do not refill with oil.

<u>Operate the machine using crank handle.</u>

4.6 Clean and examine gears, wheels, and bearings.

4.7 Check main nut and gear fixings.

4.8 Clean and examine lock plunger, lock dog and throw bar, where visible Look for signs of chamfering and metal swarf.

This indicates that the FPL is incorrectly adjusted.

5. Crank Handle Cut-Out

5.1 Clean and examine the crank handle cut-out mechanism including; casting and fixings, Split pins, pivots, Linkage rods and arms, contact plunger, and insulation

5.2 Check latch operation and contact spring/plunger alignment.

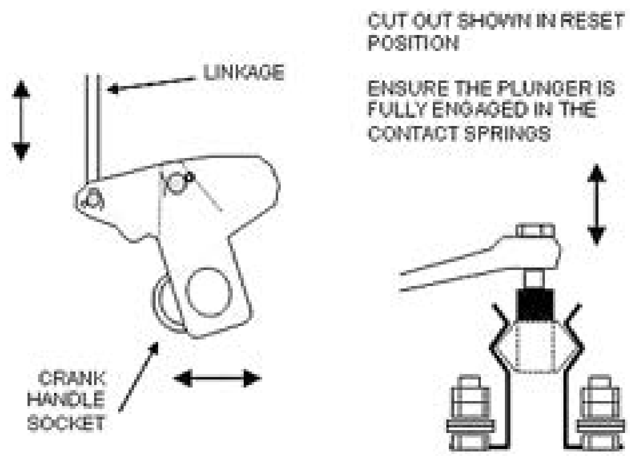


Figure 2 – Crank Handle Operation

5.3 Clean (using a lint free cloth) and examine crank handle cut-out contact, including:

a) Contact springs. These might be subject to arcing.

b) Terminals.

c) Wiring & terminations.

Protect as necessary, excluding contact faces.

6. Contact and Terminal Assembly

6.1 Remove cover; Check casting, latch and water seal.

6.2 Remove moisture and debris from interior of machine casting. Check drain holes are clear.

6.3 Examine casting for cracking.

6.4 Examine tail cable entry and gland.

6.5 Check heater and wiring, where fitted.

6.6 Examine cable cores, internal wiring and terminals. Clean and protect as necessary.

<u>Model 5P Only</u>

6.7 Clean and examine the polarised contactor unit, termination board, and resilient mounts. Disconnection of the contactor causes the detection to become broken.

<u>Model 5A & 5E Only</u>

6.8 Examine the pole changer assemble;

a) Check the wires, terminations.

b) Contact fingers.

c) Check insulation for degradation.

Protect as necessary, excluding contact surfaces.

6.9 Check contact assembly holding bolts and terminal block fixings.

6.10 Check split pins on the following:

a) Detection roller.

b) Lock slide connection arms

c) Lock arm roller

6.11 Examine detection contact adjustment. Rollers shall rest on bottom of notches in both N & R positions and rotate freely.

6.12 Check contact alignment and centre fixing screws.

6.13 Examine motor control and detection contacts: Contacts that are worn, abrased or show signs of arcing shall be cleaned or replaced as required.

6.14 Check contact fingers. Clean and protect as required. Do not apply anything to the contact surfaces.

7. Lubrication

7.1 Lubricate with lithium grease the following items:

a) Lock plunger and throw bar surfaces.

b) Surfaces of lock and detector blades.

c) Gear teeth.

d) Bearing grease nipples.

7.2 Lubricate with mineral oil the following items:

a) Detector carriage rollers.

b) Crank handle linkage pivots.

c) Dash pots on main gears.

d) Dash pot on clutch (where provided).

e) Wick feeds to gear bearings.

f) Ball bearing roller in the upper end of intermediate gear shaft.

g) Driving roller (through the hole in the main gear wheel.

h) Detector rod covers securing bars, latches and padlocks.

8. Tests & Final Checks

8.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

8.2 Reset the crank handle cut-out and detection circuit. Check that the cut-out contacts fully engage.

8.3 Observe correct operation of the machine. There shall not be any excessive ‘kick-back’ on the motor.

8.4 Check for foreign bodies in the machine, replace cover, and check that RKB222 padlock is fitted to crank handle cover. Lubricate the padlocks.

8.5 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

8.6 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

SERVICE B

NOTE: *Isolate as for Service A if not already done so.*

9. General

9.1 Clean the cover (inside and out) and casting.

10. Motor Assembly

10.1 Examine the motor commutator (it shall be a light brown / coffee colour). Rotate using the crank handle and clean by pressing a clean, lint free cloth moistened with an approved cleaner onto the surface of the commutator.

10.2 Examine the motor brushes and spring retainers. Brushes shall slide freely in the holders and seat fully on the commutator. The spring retainers shall have a tension of 900 – 1140g (2 – 2 ½ lb).

The tension can be adjusted by unlocking and rotating the knurled wheel. Brushes shall be replaced when worn to 2mm (minimum) from brush holders.

They shall be replaced sooner where points are frequently operated. New brushes require grinding in.

11. Contacts

11.1 Clean using lint free cloth moistened with switch cleaner:

a) Normal and reverse detection contacts.

b) Motor control contacts.

c) Crank handle cut-out contact.

d) Pole changer contacts (Models 5A & 5E only).

12. Point Detector Contacts

NOTE: *Measurements shall be taken using a suitably marked rule. If the gaps are correct, the spring tension is correct.*

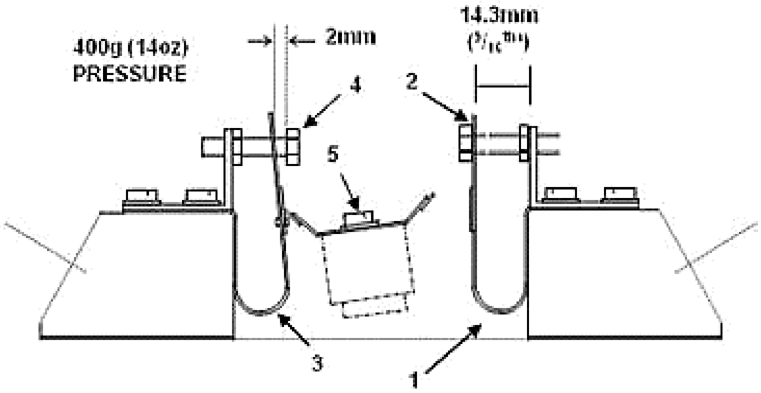


Figure 3 – Detection Contact Layout

12.1 Check the following:

a) Open contact; spring (1) bears against adjusting screw (2).

b) Closed contact; spring (3) has 2mm clearance to the head of the adjusting screw (4).

c) Screw on rocker is secure.

d) When the rocker is operated, detection contacts make at the same time. Check for both positions.

12.2 To adjust contact block alignment, use the following sequence:

a) Release locking tabs.

b) Loosen two screws in contact block assembly.

c) Adjust.

d) Retighten screws and turn up locking tab.

e) Gauge as above.

13. Pole Changer Unit (Models 5A and 5E)

13.1 Check that the contact fingers make a good contact with the control block.

13.2 Check that the magnetically operated member of the pole changer follows the action of the controlling point lever or switch by the following method:

a) Operate the point lever or switch to the opposite position (N-R or R-N).

b) Before the point movement is complete return the lever to its original position.

c) Check that machine action follows the movement of the lever and returns the points to their original position.

13.3 Move the points to the opposite lie and check that the contact fingers make a good contact with the control block.

14. Disconnection Boxes (if Provided)

14.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

14.2 Refit the lid and (if provided) padlock, check they are fitted securely.

15. Tests and Final Checks

15.1 Carry out NR/SMS/PartB/Test/011 (Detector Test Electrical Detectors).

15.2 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

15.3 Carry out NR/SMS/PartB/Test/019 (Detection Loop Test).

<u>Return to power operation</u>

15.4 Clutch test: record the operating current whilst operating the points N-R and R-N (max 10A).

15.5 Repeat test 15.4 but with an obstruction between switch and stock rail. The clutch slip current shall be set to 12A ±2A.

If this is incorrect, adjust the clutch (Appendix A/B). Observe correct operation of the overload cut-out protection (6 - 9s).

This test shall be undertaken using a meter or a current clamp meter capable of measuring the currents involved.

15.6 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

It is recommended that this test be carried out from the location case or equipment room if possible.

15.7 Check for foreign bodies in the machine, replace cover, and check that RKB222 padlock is fitted to crank handle cover. Lubricate the padlocks.

15.8 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

APPENDIX A - Clutch Adjustment Model 5P

1. Loosen the clutch locking screw (General layout), the clutch plate can then be rotated to increase or decrease the clutch pressure as required. Retighten the clutch locking screw.

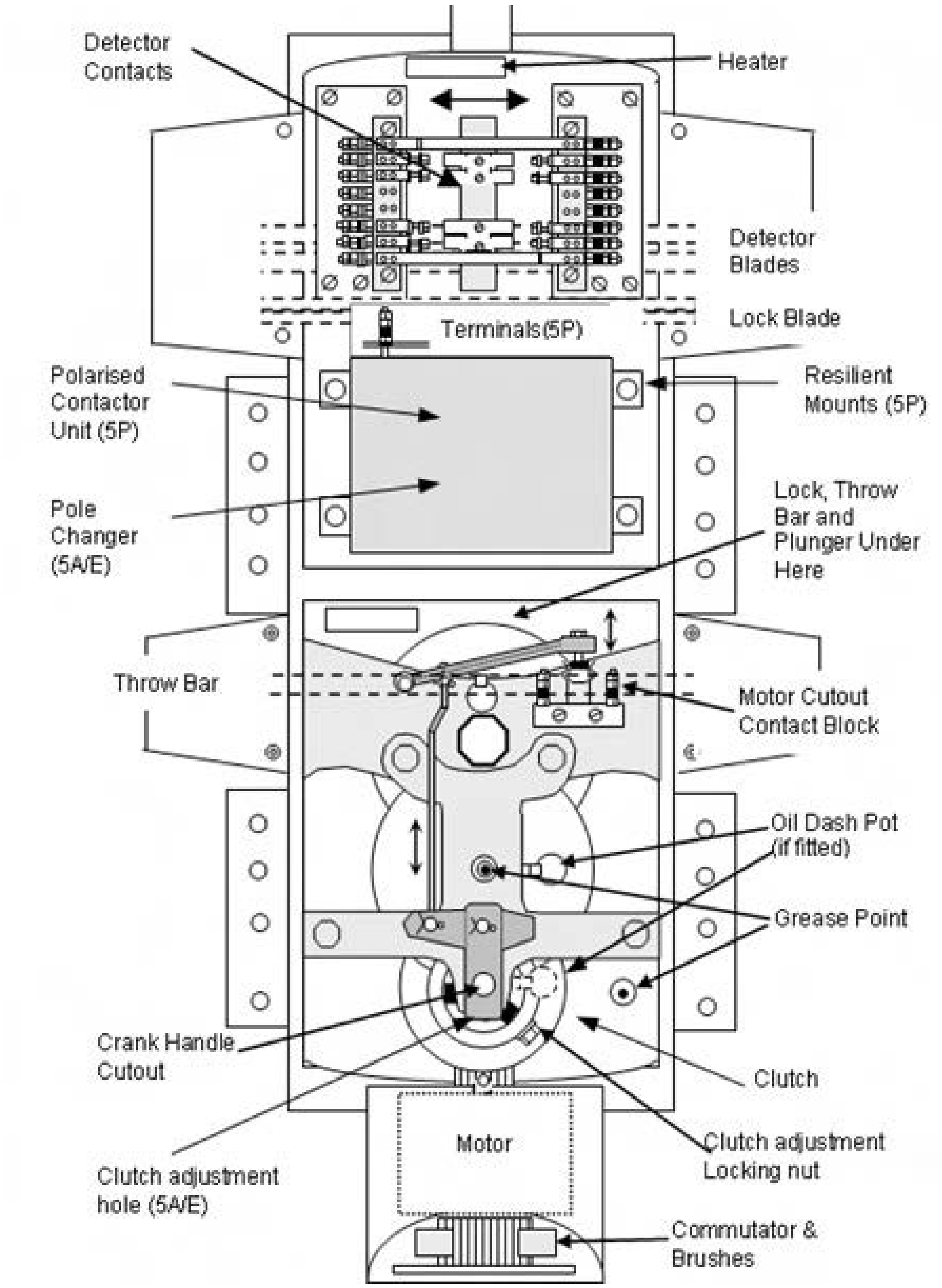
APPENDIX B - Clutch Adjustment Model 5A and 5E

1. Loosen the clutch locking screw (General layout); locate a 5mm pin through the hole in the bracket casting and into one of the holes of the adjusting nut.

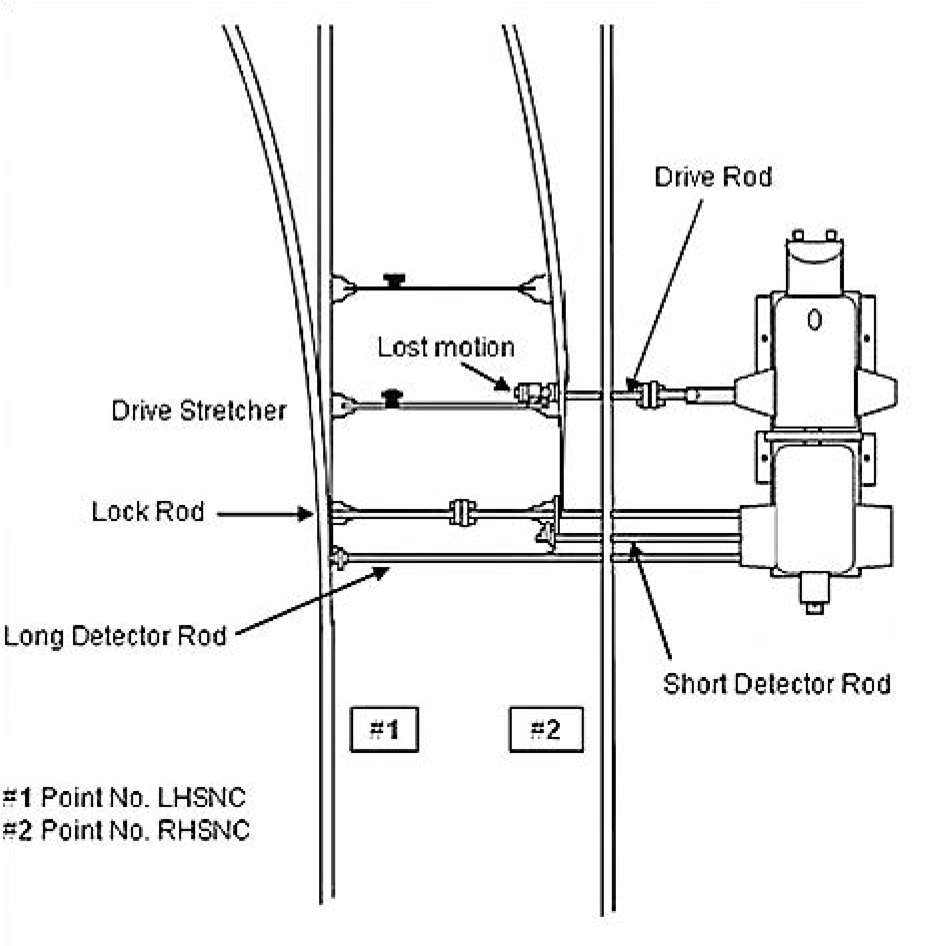
2. Insert the crank handle. To decrease the clutch pressure, turn the crank handle clock-wise, to increase the clutch pressure turn the crank handle anti-clock wise. Retighten the clutch locking screw.

3. If the clutch is so loose that the friction is not enough to tighten the adjusting nut, rotate the clutch body until the friction has increased enough to allow adjustment with the crank handle.

APPENDIX C - General Arrangement (Not to Scale)



APPENDIX D - Typical Drawing: 5P Point Layout – Right Hand Machine
(Not to Scale) (Sole-plate & sleepers omitted for clarity)



END

Includes:	Point Machine SGE Style HB
Excludes:	Point inspections, Point fittings and Supplementary Drives

General

The machine shall not be operated electrically until all adjustments have been verified by crank handle operation.

Nuts that are tight shall not move by the application of a short-handled spanner.

Any tightening of nuts or adjustments shall be reported as corrective maintenance.

Further information on these machines is available in SGE Maintenance Manual.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

SERVICE A

2. Exterior

2.1 Check and tighten point machine fixings. Operate machine under power and observe that there is no movement relative to the bearers.

If movement is observed, tighten fixing bolts to 100-120Nm and arrange a re-check at the next visit.

2.2 Remove cover plates and machine covers. Clean and examine lock and detector blades, throw bar, and insulations (tighten as necessary).

2.3 Apply adhesive grease to the throw bar, lock and detector slides.

NOTE: *Do not allow excessive amounts of adhesive grease to enter the machine.*

2.4 Remove fire risks and potential obstructions.

2.5 Check machine covers and fittings for cracks.

2.6 Check visible tail cables and route. Check cables are not trapped or covered by P/Way materials.

3. Interior Mechanism

Before starting any work, isolate the machine using the crank handle contact.

3.1 Clean interior of machine casting, remove moisture and debris. Check ventilators and lid gaskets.

3.2 Examine motor assembly holding bolts & spigots and casing bolts.

3.3 Examine clutch adjustment assembly:

a) Spring.

b) Castellated Nut.

c) Split Pin.

Lubricate with adhesive grease.

3.4 Examine crank handle latch assembly see Figure 1

Lubricate pins and slides with mineral oil. (Illustration shows machine isolated).

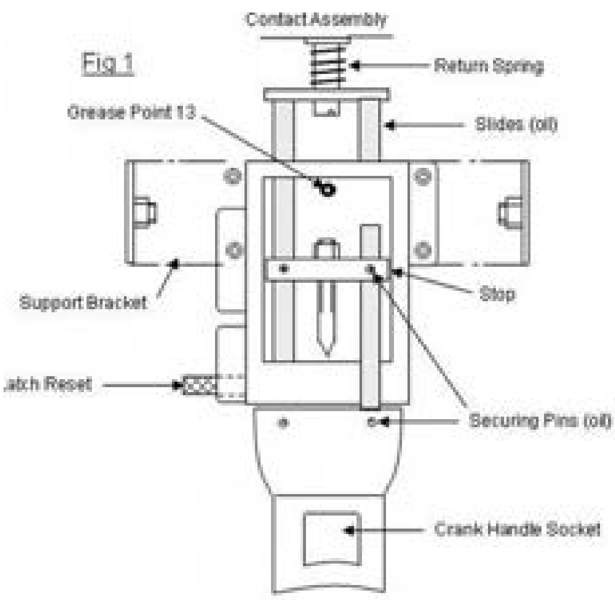


Figure 1 – Crank Handle Latch Assembly

3.5 Examine main and bevel gears and visible parts of throw bar and locking bar assembly.

3.6 Lubricate machine at grease points with lithium grease:

a) Motor bearings.

b) External casing.

c) Drive and throw bar mechanism.

3.7 Fill throw bar dashpots with mineral oil.

3.8 Examine the following:

a) Cable entry.

b) Tail cable sheath.

c) Wiring.

d) Ducting.

4. Motor Control Contact Assembly

4.1 Remove and examine cover plate and fixings.

4.2 Examine cam slot in locking bar, lubricate with lithium grease.

4.3 Check and clean vents and drain holes.

4.4 Examine the following (see Figure 2 for details):

a) Motor control arm pivot and roller.

b) Terminal blocks and fixings, tighten and protect as necessary.

c) Contacts and springs, clean and protect as necessary.

Protection shall not be applied to contact faces.

Contacts that are worn or have signs of arcing shall be cleaned or replaced as necessary.

d) Wiring and terminations.

e) Snubbing resistor.

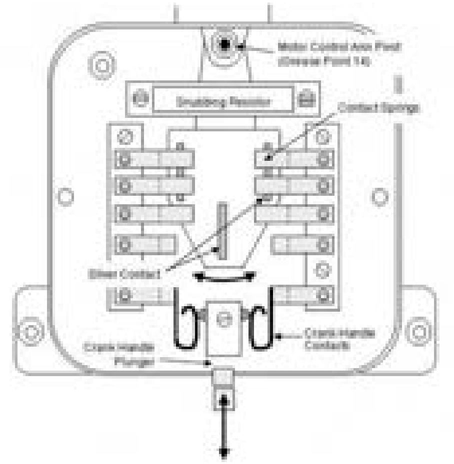


Figure 2 - Motor Control Contact Assembly

5. Lock & Detector Contact Assembly (Quick Acting)

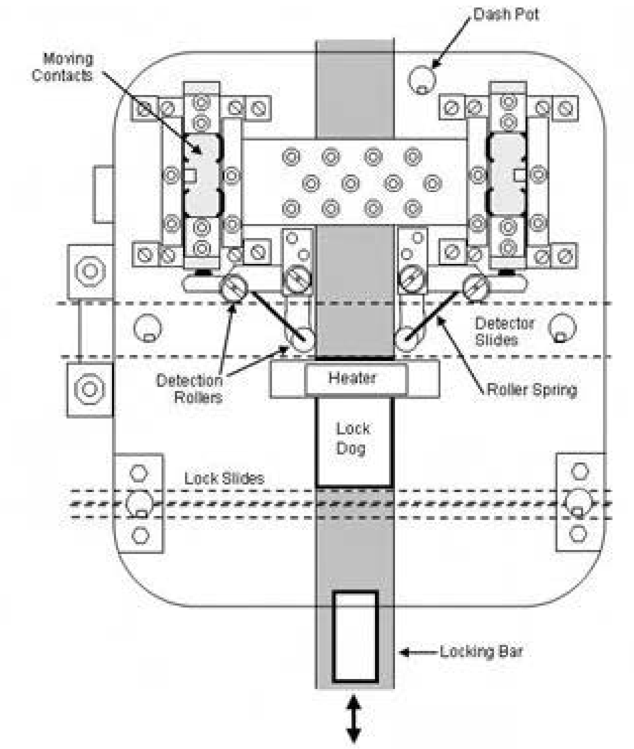


Figure 3 - Lock & Detector Contact Assembly

5.1 Check drain holes and clean moisture and debris.

5.2 Clean and examine: (operate using crank handle).

a) Locking bar and dogs.

b) Lock slides and notches.

c) Detector slides.

d) Cover plates, rubbing plates and fixings.

Look particularly for wear (swarf) and chamfering (bright corners).

With point switch fully closed (x), there shall be a 1.5mm clearance on each lock face (y & z).

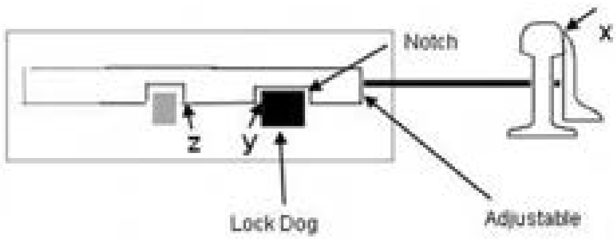


Figure 4 – Lock Blade Layout

5.3 Lubricate slides with lithium grease.

5.4 Fill the 5 dashpots with mineral oil.

5.5 Examine the following:

a) Detector actuators.

b) Rollers, lubricate with mineral oil.

c) Springs.

5.6 Examine the following:

a) Moving contact assemblies.

b) Terminal blocks & fixings, tighten / protect as necessary.

c) Contacts and springs, clean and protect as necessary. Protection shall not be applied to contact faces.

d) Cables, cable entries, wiring and terminations.

5.7 Check heaters, where fitted.

6. Tests & Final Checks

6.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine))

6.2 Reset the crank handle cut-out and observe correct operation of the machine. There shall not be any excessive ‘kick-back’ on the motor.

6.3 Observe the snubbing is effective.

6.4 Check for foreign bodies in the machine, replace covers and check that RKB222 padlock is fitted to crank handle cover. Lubricate the padlock and cover hinges.

6.5 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

6.6 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

SERVICE B

Isolate as for Service A if not already done so.

7. General

7.1 Clean the cover (inside and out) and casting.

8. Motor / Drive Mechanism

8.1 Examine the motor commutator (it shall be a light brown / coffee colour). Rotate and Clean by pressing a clean, lint free cloth moistened with an approved cleaner onto the surface of the commutator.

8.2 Examine the motor brushes and holders. Brushes shall slide freely in the holders and seat fully on the commutator. Brushes shall be replaced when worn to within 3mm of brush holders.

New brushes require grinding in.

9. Contacts

9.1 Clean all contacts using lint free cloth moistened with an approved cleaner.

10. Disconnection Boxes (if Provided)

10.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

10.2 Refit the lid and (if provided) padlock, check they are fitted securely.

11. Tests and Final Checks

11.1 Carry out NR/SMS/PartB/Test/011 (Detector Test Electrical Detectors).

11.2 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

11.3 Carry out NR/SMS/PartB/Test/019 (Detection Loop Test).

11.4 Return to power operation.

11.5 Clutch test: record the operating current whilst operating the points N-R and R-N (max 10A).

11.6 Repeat test 11.5 but with an obstruction between switch and stock rail.

Observe correct operation of the overload cut-out protection (6 - 9s).

This test shall be undertaken using a meter or a current clamp meter capable of measuring the currents involved.

The clutch slip current shall be set to 12A ±2A.

The mechanical clutch is adjusted mechanically by increasing or decreasing the clutch spring pressure.

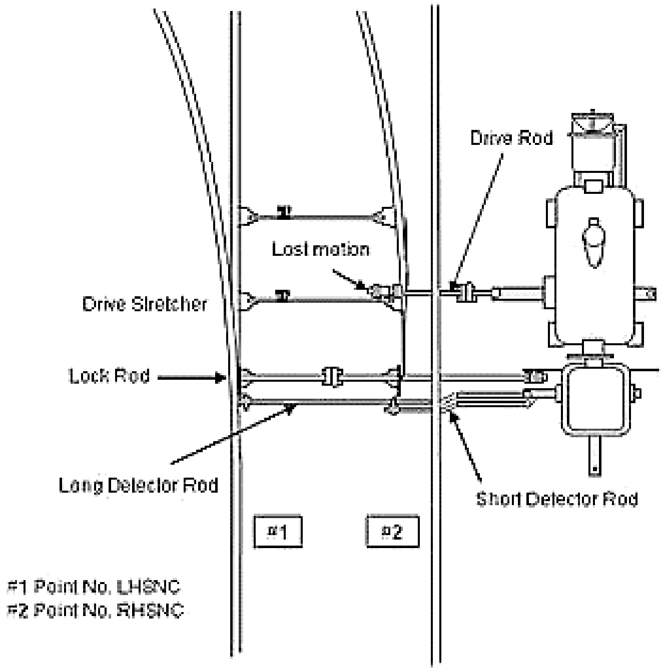
To do this, remove the pin and rotate the castellated nut. When correct, replace the split pin.

11.7 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

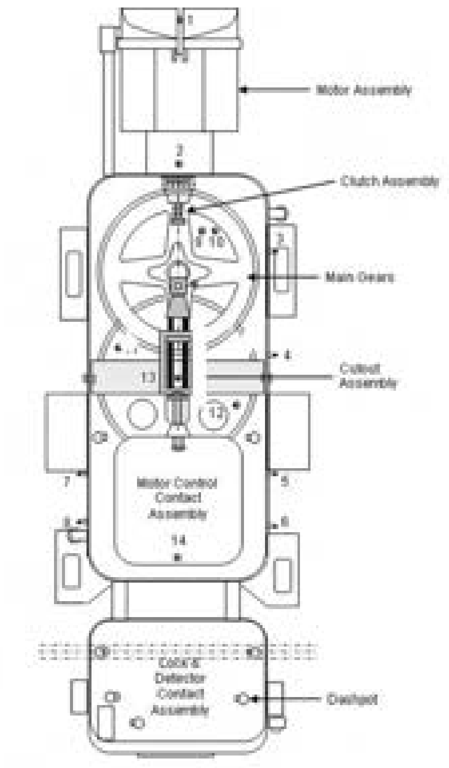
It is recommended that this test be carried out from the location case or equipment room if possible.

11.8 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

APPENDIX A - Typical Drawing: HB Point Layout – Right Hand Machine
(Not to Scale) (Sole-plate & sleepers omitted for clarity)



APPENDIX B - Grease Nipple Locations



END

Includes:	Point Machine SGE Style HA
Excludes:	Point inspections, Point fittings and Supplementary drives

General

The machine shall not be operated electrically until all adjustments have been verified by crank handle operation.

Nuts that are tight shall not move by the application of a short-handled spanner.

The HA point machine was designed for installation with a minimum of ground connection alterations, where replacement of standard BR mechanical point & FPL layouts was required.

A separate detector is provided (See NR/SMS/PartC/PD01 (BR998 Detector) – NR/SMS/PartC/PD02 (Electrical Points Detectors). Further information is available in SGE Maintenance Manual.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

SERVICE A

2. General

2.1 Remove fire risks and potential obstructions.

2.2 Check the visible tail cables and route. Check that cables are not trapped or covered by P/Way materials.

2.3 Remove machine cover, check machine cover and fittings for cracks. Examine lid gasket.

2.4 Check the crank handle access can be removed and replaced correctly.

2.5 Check point machine fixings (4 external, 2 internal).

Operate machine under power and observe that there is no movement relative to the bearers. If movement is observed, tighten fixing bolts to 100- 120Nm and arrange a re-check at the next visit.

2.6 Clean and examine the machine casting.

Remove accumulated moisture and debris and examine casting for cracks. Clear drain holes.

2.7 Check heaters, where fitted.

3. Motor Assembly

Before starting any work, isolate the machine using the crank handle contact.

3.1 Clean and examine motor assembly, including:

a) Field & armature assembly and casing.

b) Spindle bearings and fixing bolts. The motor shall be held securely and shall not rock.

c) Motor terminal block, terminations and wiring.

4. Drive Mechanism

4.1 Clean and examine point and lock drives, including:

a) Main and bevel gears.

b) Worm drive and wheel, spindle bearings and fixings.

c) Drive pin.

d) Contact operating arm and pivot.

e) Cams, cam faces, and fixings.

f) Point drive escapement, crank, pivot and key-way.

The point drive is susceptible to wear in the key-way. This results in slackness of the external drive relative to the machine operation. This can be checked by manually operating the machine.

g) Lock drive, pivots, and key-ways.

4.2 Clean and examine the friction clutch assembly, including:

a) Clutch plate and spring.

b) Castellated clutch tension nut and split pin. The clutch can be adjusted by rotating the castellated nut to loosen or tighten the spring. Always refit the split pin.

5. Crank Handle Cut-Out

5.1 Clean and examine crank handle cut out assembly, including:

a) Bevel gears.

b) Springs and plungers.

c) Hand crank drive.

d) Latch mechanism.

Insert the crank handle and check that the cut-out contacts correctly operate.

Remove the crank handle and check that the contacts do not remake until the latch is reset.

5.2 Examine isolating contacts, terminals, and wiring. These contacts are prone to arcing.

6. Snubbing Mechanism

6.1 Clean and examine:

a) Contact operating pin and escapements.

b) Contact operating levers, pivots, split pins, spring assembly and fixings.

c) Contact blocks and fixings.

d) Slide plates. Work machine by hand and observe correct operation and the mechanism does not bind.

e) Contact springs, mounting blocks, plate, and fixings. These contacts are prone to arcing and might require replacement. Check the springs to confirm a good contact is made with the contact blocks.

f) Terminals and wiring.

7. Snubbing Relay

7.1 Clean and examine:

a) Relay coil / housing and armature.

b) Contacts, terminals and wiring.

c) Mounting plate and fixings.

8. Cables and Wiring

8.1 Examine all wiring and ducting. Look particularly for:

a) Degraded or damaged (chafing) insulation.

b) Trapped wires.

c) Unsupported wires.

d) Risk of short circuit (electrical contact with adjacent terminals, casing or metal parts).

e) Fouling by moving parts.

f) Contamination.

8.2 Examine tail cable gland and insulation.

9. Lubrication

9.1 Lubricate with lithium grease:

a) Worm drive and wheel.

b) Main and bevel gears.

c) Cam faces.

d) Point lock and drive pins.

9.2 Lubricate with adhesive grease:

a) Clutch spring.

b) Surfaces of point and lock drive arms.

9.3 Lubricate with mineral oil:

a) Crank handle selector.

b) Oil points in escapement and crank pivots.

c) Worm drive spindle bearings.

d) Contact arm pivots, spring and slides.

10. Facing Point Lock

10.1 The FPL and associated cranks and rodding shall be maintained to NR/SMS/PartC/PA01 (Mechanical Points).

11. Tests & Final Checks

11.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

11.2 Reset the crank handle cut-out and observe correct operation of the machine.

There shall not be any excessive ‘kick-back’ on the motor.

11.3 Observe that the snubbing is effective.

11.4 Check for foreign bodies in the machine and replace covers. Lubricate the padlock.

11.5 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

SERVICE B

Isolate as for Service A if not already done so.

12. General

12.1 Clean the cover (inside and out) and casting.

13. Motor / Drive Mechanism

13.1 Examine the motor commutator (it shall be a light brown / coffee colour). Rotate and clean by pressing a clean, lint free cloth moistened with an approved cleaner onto the surface of the commutator.

13.2 Examine the motor brushes and holders. Brushes shall slide freely in the holders and seat fully on the commutator.

The correct brush gear position is indicated by a painted line on the brush rocker, which shall line up with a similar mark on the end plate. New brushes require grinding in.

14. Contacts and Terminals

14.1 Clean all contacts using lint free cloth moistened with an approved cleaner.

14.2 Protect terminals and contacts as necessary.

15. Disconnection Boxes (if Provided)

15.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

15.2 Refit the lid and (if provided) padlock, check they are fitted securely.

16. Tests & Final Checks

16.1 Carry out NR/SMS/PartB/Test/011 (Electrical Detection Test (Machine)).

16.2 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

16.3 Carry out NR/SMS/PartB/Test/019 (Detection Loop Test).

Return to power operation.

16.4 Clutch test: record the operating current whilst operating the points N-R and R-N (max 10A).

16.5 Repeat test 16.4 but with an obstruction between switch and stock rail. Observe correct operation of the overload cut-out protection (6 - 9s).

This test shall be undertaken using a meter or a current clamp meter an approved of measuring the currents involved.

The clutch slip current shall be set to 12A ±2A.

The clutch is adjusted mechanically by increasing or decreasing the clutch spring pressure. To do this, remove the pin and rotate the castellated clutch tension nut.

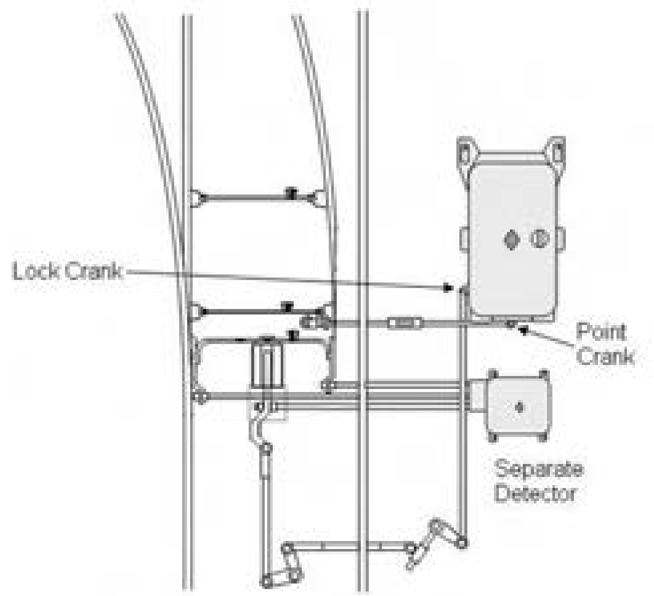
16.6 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

It is recommended that this test be carried out from the location case or equipment room if possible.

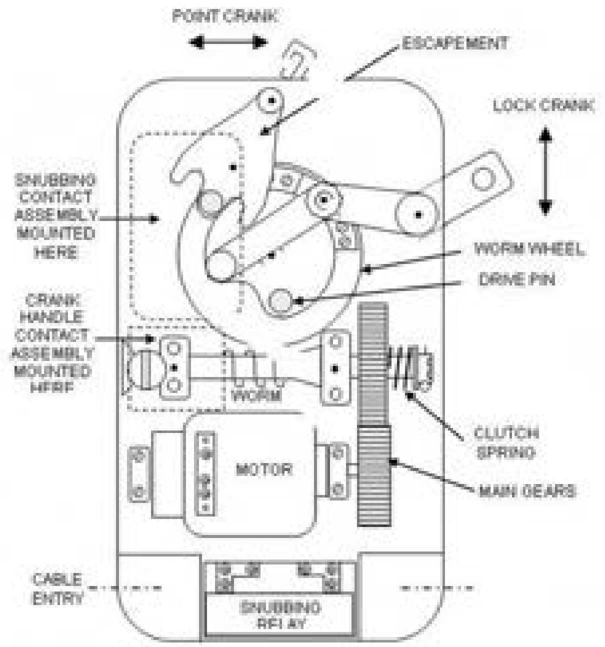
16.7 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

APPENDIX A - Typical Drawing: HA Point Layout – RH Machine with Separate SGE Detector and FPL

(Not to Scale with Sole-plate & sleepers omitted for clarity)



APPENDIX B - Machine Internal Layout



END

Includes:	Point Machine WRSL Style 63
Excludes:	Point inspections, Point fittings and Supplementary Drives

General

The machine shall not be operated electrically until all adjustments have been verified by crank handle operation.

Nuts that are tight shall not move by the application of a short-handled spanner.

Further information on these machines can be found in NR/GN/SIG/19002.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

SERVICE A

2. Exterior (lid closed)

2.1 Check the point machine fixings. Operate the machine under power and check that it does not move on the bearers. If you do see any movement, tighten the fixing bolts to a minimum torque of 100 – 120 Nm and re-check at the next visit.

2.2 Remove the weatherproof covers and clean and examine the lock and detector blades, throw bar and insulation pieces. Tighten the fixings if necessary.

2.3 Smear adhesive grease onto the throw bar, lock, and detector slides.

NOTE: *Do not allow too much grease to enter the machine.*

2.4 Check the base casting for signs of cracking, especially in the area of the crank handle opening. Examine the crank handle cover, knurled screw, and securing bolts.

2.5 Wipe and check the side retainer plates (detector or lock slides and throw bar).

2.6 Remove fire risks and any possible obstructions.

2.7 Check the visible tail cables and route. Check that cables are not trapped or covered by P/Way materials.

3. Interior

Before you start any work, isolate the machine by operating the crank handle cut out.

3.1 Examine the lid and check the gasket is providing a good seal.

3.2 Examine the cable entry, cable cores, internal wiring, and terminals. Clean and protect as necessary.

3.3 Check the drain holes are clear.

3.4 Check the two heaters working.

Not all style 63 machines are fitted with heaters.

4. Interior mechanism

4.1 Use the crank handle to operate the points. Examine the lock dogs and notches. Look for wear (swarf) and chamfering (bright corners).

4.2 Examine the clutch assembly:

a) Spring.

b) Adjustment nut and lock nut.

c) Drive belt.

Check that the vertical play is between 2mm and 5mm.

4.3 Remove the ball-screw cover, then:

a) Check the ball-nut and screw-thread.

b) Clean the ball-nut and lubricate with lithium-based grease (1 grease nipple).

c) Examine the yolk securing bolts. The yolk bolts shall be tightened to 23Nm (17lb.ft).

If the snubbing is not working, the yolk bolts can break when the yolk moves from right to left. This can cause the ball screw to seize.

4.4 Examine the holding down bolts on:

a) Plummer block. (These can break if the snubbing is not working).

b) Escapement crank cover.

c) Circuit controller and Circuit controller contact blocks.

4.5 Clean and examine the following:

a) Lock blades, detector blades and throw bar; Lubricate with lithium-based grease (6 grease nipples and surfaces).

b) Drive slide; lubricate with lithium-based grease (one grease nipple and surface).

c) Escapement crank, escapement drive rollers, throw bar drive roller and plummer block; Lubricate with lithium-based grease (4 grease nipples).

d) Drive screw thrust bearing; Lubricate with lithium-based grease (grease nipple).

4.6 Clean the ball-screw cover; then replace the ball- screw cover.

4.7 Clean the motor casing and examine the motor holding down bolts. Check that the jacking screws at the base of the motor are locked (where fitted).

5. Detector Rocker Arm

5.1 Clean the following:

a) Detector rocker arm pivot. Check that the cir-clip on the centre pivot is intact and correctly positioned. Lubricate with a drop of mineral oil.

b) Rollers. Lubricate rubbing surfaces with a drop of mineral oil.

6. Circuit Controller

6.1 Clean the following:

a) Circuit controller.

b) Camshaft bearings and cams.

c) Push-rods.

The preferred type of push-rods are coloured dark grey. Red push-rods can remain in service providing the 2mm minimum contact openings are achieved.

6.2 Examine the detection contacts:

a) Check that the fixed contacts are secure and lying flat on the circuit controller chassis. If they are not the circuit controller can remain in service providing a gap of 2mm between the fixed and moving contact is achieved. This shall be reported to your SM(S).

b) Gauge the two detection contacts in both normal and reverse positions of the points. Use 2mm non-metallic gauge J13523/2.

When open, there shall be a gap of at least 2mm between the fixed and moving contacts. **If the gap is less than 2mm, the points shall be booked out of use.**

Adjustment of the gap is not permitted in preventative or corrective maintenance.

c) Observe, during manual operation, the detection contacts remain broken throughout the movement.

d) Clean and protect the contact fingers as necessary, excluding contact faces.

6.3 Examine the motor control and snubbing contacts.

a) Check that the contact surfaces are not heavily worn or burned by arcing.

b) Apply contact lubricant as necessary.

7. Centrifugal snubbing

7.1 Examine the centrifugal snubbing switch (where fitted).

a) Check the contacts operate when the pendant is moved by hand.

b) Continue to move the pendant gently until the outer spring is restricted by the backstop (or hold-on coil where fitted).

c) Check the pendant arm does not pass beyond the inner spring.

d) Release the pendant and observe that it returns to the central position.

e) Examine the hold-on coil and wing armature (where fitted).

f) Lubricate the back of the snubbing contacts and pendant striker with a slight smear of silicone grease (except where Nylon rollers are fitted to the striker).

8. Tests and Final Checks

8.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

8.2 Reset the crank handle cut-out contacts and observe the operation of the points in both directions from the signal box. Check the following:

a) Motor drive.

b) Snubbing.

This can easily be checked by observing the pulleys at the end of the stroke. If the snubbing is performing correctly, they will stop rapidly and cleanly. If, the snubbing is faulty the drive side will contact its end stop. This will cause ‘wind up’ of the ball screw and the pulleys will be seen to reverse their rotation for a few degrees after stopping.

c) Operation of the contacts. There shall be no excessive sparking or arcing.

8.3 Check the machine for foreign bodies.

8.4 Close and secure the lid. Lubricate the hinges and padlock.

8.5 Close and secure the crank handle cut-out cover. Lubricate the hinges and padlock (RKB222).

8.6 Replace the weatherproof covers.

8.7 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

8.8 The final check before you finish the work is to ask the Signaller to operate the points and reverse positions (twice if possible and watch for correct operation).

SERVICE B

Isolate as for service A if not already done so.

9. General

9.1 Clean the lid (inside, outside and casting).

10. Motor and drive mechanism

10.1 Clean and examine the motor commutator, where possible.
Rotate the commutator using the crank handle; the surface shall be a light brown coffee colour.

Clean by pressing a clean lint free cloth, slightly moistened with an approved cleaner onto the surface.

Brushes can soak up excess cleaner and stick in their holders. Alternatively, use a very fine emery cloth (grade 1000) to carefully remove carbon deposits.

10.2 Examine the motor brushes and spring retainers. The brushes shall slide freely in their holders and seat fully on the commutator. They shall also be replaced when worn down to the shoulder of their holder (or sooner depending on machine usage).

10.3 Lightly Lubricate the motor bearings (2 grease nipples) with one shot of lithium-based grease.

NOTE: *Too much grease will contaminate the clutch housing.*

10.4 Remove the crank handle cover plate. Clean and examine the crank handle cut-out contacts. Check the crank handle cut-out contacts break and re-make when the crank handle is inserted and then reset.

10.5 Check the gasket seal and refit the cover plate and fixings.

11. Circuit Controller

11.1 Snubbing and slow acting motor contacts.

a) Clean the contact segments with a surface cleaner.

b) Lubricate contact segment surfaces with an approved contact lubricant.

c) Operate by hand and check that the contacts lift 1-2mm when the contact segments engage and make contact with them.

11.2 Quick acting motor cut-off contacts

a) Manually operate the machine to mid-stroke position and check that both contact arms are held back by the latch.

b) Close and lock the points normal and Gauge the gap between the shorting strip and the shorting strip carrier, using gauge J12129/1. The gauge shall be a slide fit (Appendix B).

c) Repeat for reverse lie of points.

d) Make sure the moveable contact nuts are tight.

e) Check the contacts operate correctly both ways.

11.3 Examine the circuit controller camshaft drive rack on the drive slide (2 fixing screws).

11.4 Examine the circuit controller nylon gear wheel.

12. Diode Snubbing (non ac immune machines)

12.1 Examine the diodes and wiring.

12.2 Using a meter, check the diodes using the digital meters use the diode test function.

13. Centrifugal Snubbing

13.1 Closely examine the centrifugal snubbing switch and black motor end casing for metallic dust (gold coloured). If there is any dust, the leather washers are badly worn, and the steel tips are wearing the brass housing. You shall arrange to replace the motor before the snubbing switch fails.

It is possible to remove the centrifugal snubbing switch for a closer examination, but this is difficult on site without removing the motor.

13.2 Examine the hold on coil assembly, where fitted.

13.3 Examine the centrifugal snubbing contacts.

a) Check the ends of the inner springs are clear of the clutch housing.

b) Check the gap between each carbon contact (3mm).

c) The clearance between the back of the outer spring and its spring keeper shall be 3mm (0.5mm with magnetic hold-on).

d) Adjust the springs and keepers to suit.

14. Clutch

14.1 Reset the isolating contacts and restore the drive and detection fuses.

14.2 Check that when the points are operated on power, a pencil mark across the clutch housing moves no more than 10mm. When the points are moved to the original position, the pencil marks should roughly re-align.

14.3 Measure and record the motor operating current whilst operating the points to both positions (ignore the initial surge current).

14.4 Measure and record the motor operating current whilst operating the points to both positions with the points obstructed. The clutch slip current shall be set to 12A ±2A.

Check that overload protection operates between 6 and 9 seconds.

If any adjustments are required, you shall isolate the machine first.

15. Disconnection Boxes (if Provided)

15.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

15.2 Refit the lid and (if provided) padlock, check they are fitted securely.

16. Tests and Final Checks

16.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

16.2 Carry out NR/SMS/PartB/Test/011 (Detector Test Electrical Detectors).

16.3 Carry out NR/SMS/PartB/Test/019 (Detection Loop Test).

16.4 Reset the crank handle cut-out contacts and observe by operation in both directions from the signal box:

a) Motor drives.

b) Snubbing is effective.

c) Operation of the contacts. There shall be no excessive sparking or arcing.

16.5 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test)

It is recommended that this test be carried out from the location case or equipment room if possible.

16.6 Check for foreign bodies in the machine.

16.7 Close and secure the lid. Lubricate the hinges and padlock with mineral oil.

16.8 Close and secure the crank-handle cut-out cover. Lubricate the hinges and padlock (RKB 222) with mineral oil.

16.9 Replace the weatherproof covers (if removed).

16.10 The final check when you have finished the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible) and watch for correct operation.

SERVICE V1

When Requesting permission to from the Signaller to work on a set of points, ask the Signaller to operate points in both directions to verify and prevent any confusion on the set of points you have requested.

17. Visual Checks

17.1 Check for potential fire risks and obstructions around the S&C and within close proximity of the POE mechanism and fittings.

17.2 Check sleeper beds are clear of any obstructions.

17.3 Check cables and cable routes for any visible damage and are clear from any rodding runs.

17.4 Check the correct padlock is fitted.

17.5 Check the covers are fitted and not damaged.

17.6 Check while the points are operating that there is no movement relative to the bearers.

17.7 Report any significant wheel burns, rail defects and poor permanent way.

17.8 Report any adjustment, replacement or further work being carried out to remove the defective condition within the POE.

17.9 Before leaving site arrange for the Signaller to operate the points in both directions and confirm with the Signaller that detection has been obtained.

17.10 Observe the operation of the points and investigate any issues found.

SERVICE R1

Remote Condition Monitoring

If the points that you have requested to work on are fitted with remote condition monitoring check that the asset has been placed into maintenance mode prior to commencing work.

Prior to commencing work, it is recommended that the previous current traces are made available from the remote condition monitoring system to check for abnormalities.

Also, on completion of the work it is recommended that the new traces are recorded and viewed so they can be compared with the traces produced before the maintenance activity.

When requesting permission from the Signaller to work on a set of points, ask the Signaller to operate points in both directions to verify and prevent any confusion on the set of points you have requested.

18. Observations

18.1 While the Signaller is operating the points, look for signs of resistance to movement which could be caused by:

a) Stretcher bars bowing.

b) Roller set-up.

c) Supplementary Drive set-up.

d) Overdriving.

e) Contaminated base plates.

f) Binding kicking strap.

At this point, the machine is not electrically isolated from the operation supply.

19. Machine Isolation Check

19.1 Once the Signaller has confirmed you have possession of the points, insert the point handle.

19.2 Test the operation of the handle cut-out.

19.3 With the handle cut-out reset, connect a meter across terminal C & 38 in ohms and confirm near short circuit.

19.4 With the handle cut-out reset, connect a meter across terminals D & 42 in ohms and confirm near short circuit.

19.5 Insert the crank handle.

19.6 Check that the isolation is effective by connecting the meter across C & 38 in ohms and confirm open circuit.

19.7 Check that the isolation is effective by connecting a meter across terminals D & 42 in ohms and confirm open circuit.

19.8 Clean the exterior and remove weather proof covers.

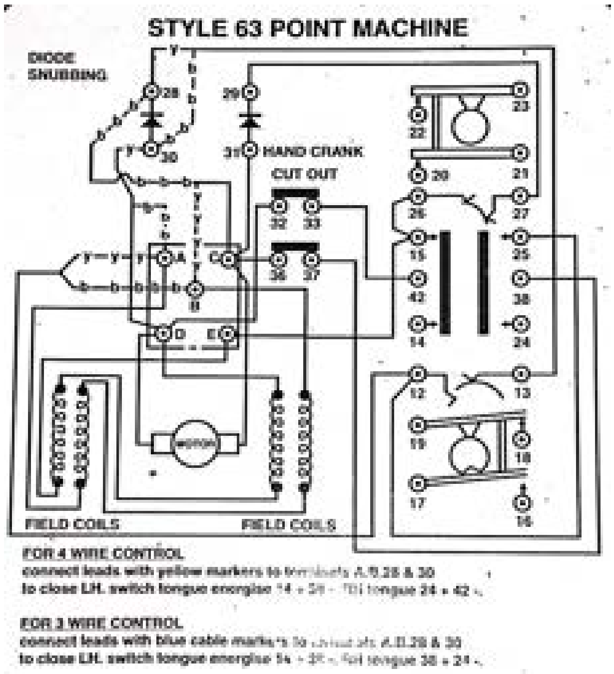


Figure 1 – Internal Wiring

19.9 Clean the lock and detector blades and the throw-bar.

19.10 Check the tightness of all point fittings

19.11 Check all contacts, checking for signs of deformation, wear or arcing.

19.12 Examine lock blade notches for signs of swarf or impact damage.

19.13 Examine detector blades for wear, arrange replacement if necessary, via a WAIF.

19.14 Check the security of wiring to prevent it being damaged.

19.15 Check for loose wires on terminations, BEWARE this could cause a loss of detection.

19.16 Check the heater is working correctly.

19.17 Check cable glands and plug couplers securely hold the cables and are preventing water ingress.

19.18 Check drain holes are not blocked.

19.19 Check condition of the drive belt.

19.20 Check the drive belt vertical play is between 2mm & 5mm, adjust when necessary.

19.21 Measure the two detection contacts in both the normal and reverse positions of the points using a 2mm non-metallic gauge J13523/2.

19.22 Lubricate lock & detector blades, throw-bar, ball screw, thrush bearing, all grease nipples and padlocks.

19.23 Lightly lubricate the detection rollers.

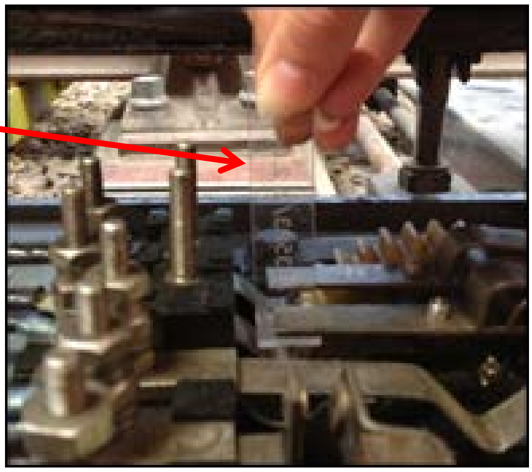


Figure 2 – 2mm Non-metallic Gauge

20. Tests

20.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

20.2 Carry out NR/SMS/PartB/Test/011 (Detector Test Electrical Detectors).

The following is not applicable if continuing to carry out service R2.

20.3 Replace weatherproof covers.

20.4 Remove Chog from open switch.

20.5 Remove crank handle & operate the cut-out reset.

20.6 Confirm point operation by asking the Signaller to operate the points in both directions and confirm the Signaller obtains both normal and reverse detection.

20.7 Where local Remote condition monitoring is fitted and work on the set of points has been completed, check with the local RCM team to confirm the asset trace has not deteriorated. If there are no issues take out of maintenance mode.

SERVICE R2

21. Checks

21.1 Check when the Signaller is moving the points, that snubbing stops the motor/ drive slide rapidly and cleanly. If the snubbing is not working correctly then the worm drive cradle comes to a halt with noticeable “clunk” and eventually the holding bolts shear.

Figure 3 – Worm Drive Cradle

21.2 Check motor brushes are the correct type, free to move in their holder and not worn to the shoulder of their holder, if so replace.

21.3 Check the motor commutator is a light brown / coffee colour – clean as necessary.

21.4 Examine the base of the machine near the centrifugal snubbing switch, as pictured, for build-up of brass dust. If evident arrange replacement of motor within 48 hrs.

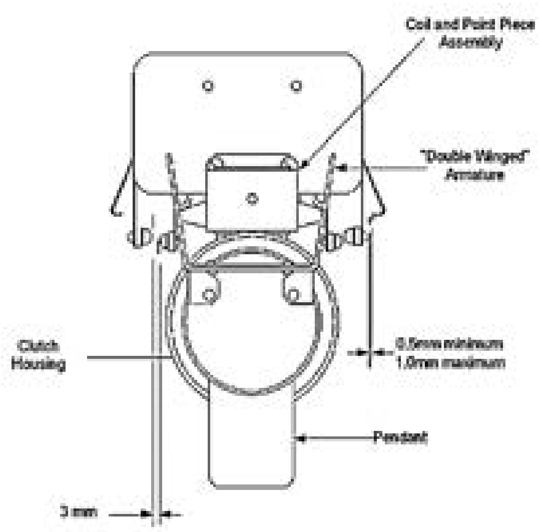


Figure 4 - Centrifugal Snubbing

22. Tests

22.1 Carry out NR/SMS/PartB/Test/019 (Detection Loop Test).

22.2 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

It is recommended that this test be carried out from the location case or equipment room if possible.

22.3 Replace the main cover.

22.4 Remove the point handle.

22.5 Remove chog from open switch and rest the cut-out.

22.6 Before leaving site arrange for the Signaller to operate the points in both directions and confirm with the Signaller that detection has be obtained.

22.7 Observe the operation of the points and investigate any issues found.

22.8 Where Remote condition monitoring is fitted and work on this set of points has been completed check with the local RCM team to confirm asset trace has not deteriorated. If there are no issues take out of maintenance mode.

APPENDIX A - How to Gauge the Detection Contacts

When open, the gap between the fixed and moving contacts shall be at least 2mm. Use gauge J13523/2. If the gap is less than 2mm, the points shall be booked off.

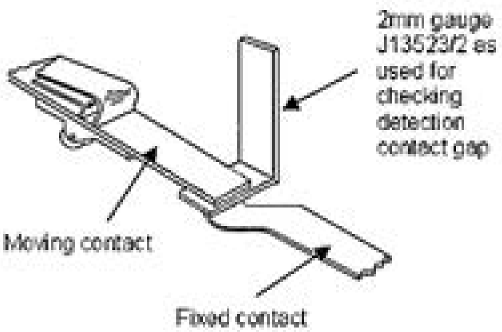


Figure 5 – Gauge Position

The gauge shall enter the gap freely. If it does not enter freely the circuit controller shall be replaced.

APPENDIX B - How to Set the Quick-Acting Cut-Off Contacts

The shorting strip between contacts 14-15 and 24-25 shall have a nominal 1mm gap between the strip and the carrier.

If the spring tension is correct, a gap of that size gives the correct contact force.

The 1mm gap shall be checked using gauge J12129/1.

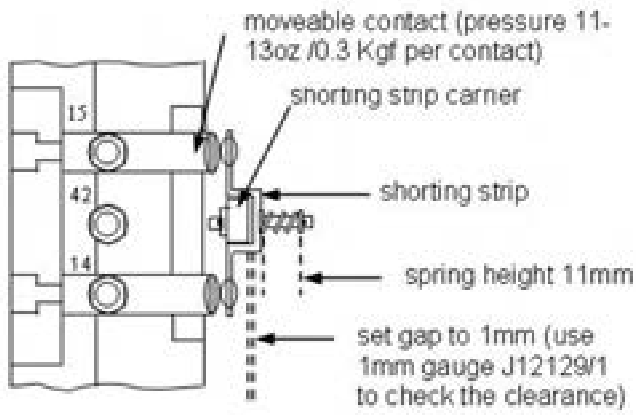


Figure 6 - Quick Acting Contacts

To adjust the contact, you shall first crank the machine to the mid-stroke position. This makes sure that the camshaft striker is not bearing on the reset roller, which would cause excessive pressure on the shorting strip carrier and prevent you from correctly adjusting the contact. Loosen the 0BA nuts of the stud terminals and slide the moveable contacts as necessary.

APPENDIX C - Internal Layout

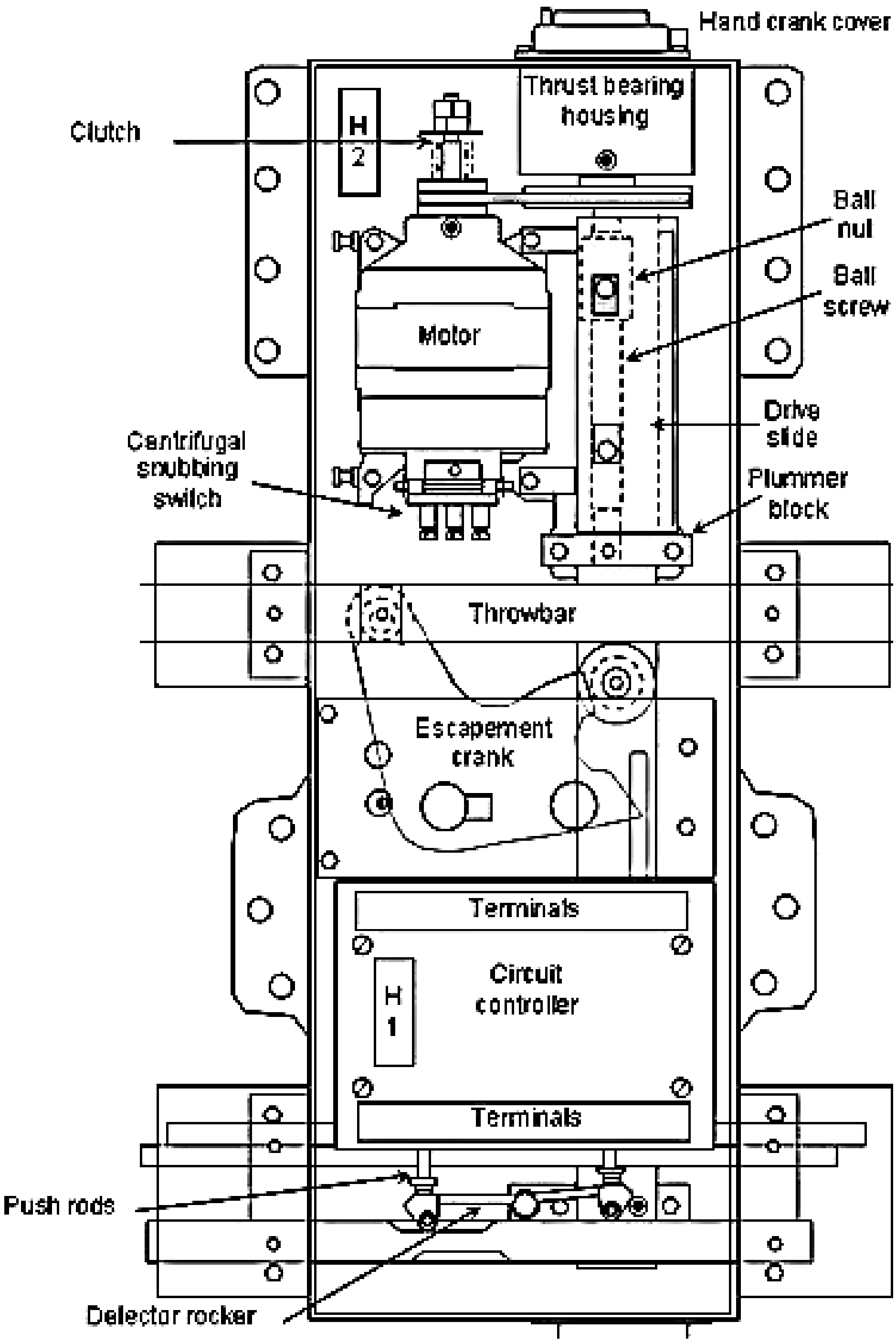


Figure 7 – Internal Layout

APPENDIX D - Typical Drawing: 63 Point Layout – Right Hand Machine (Not to Scale)

(Sole-plate & sleepers omitted for clarity)

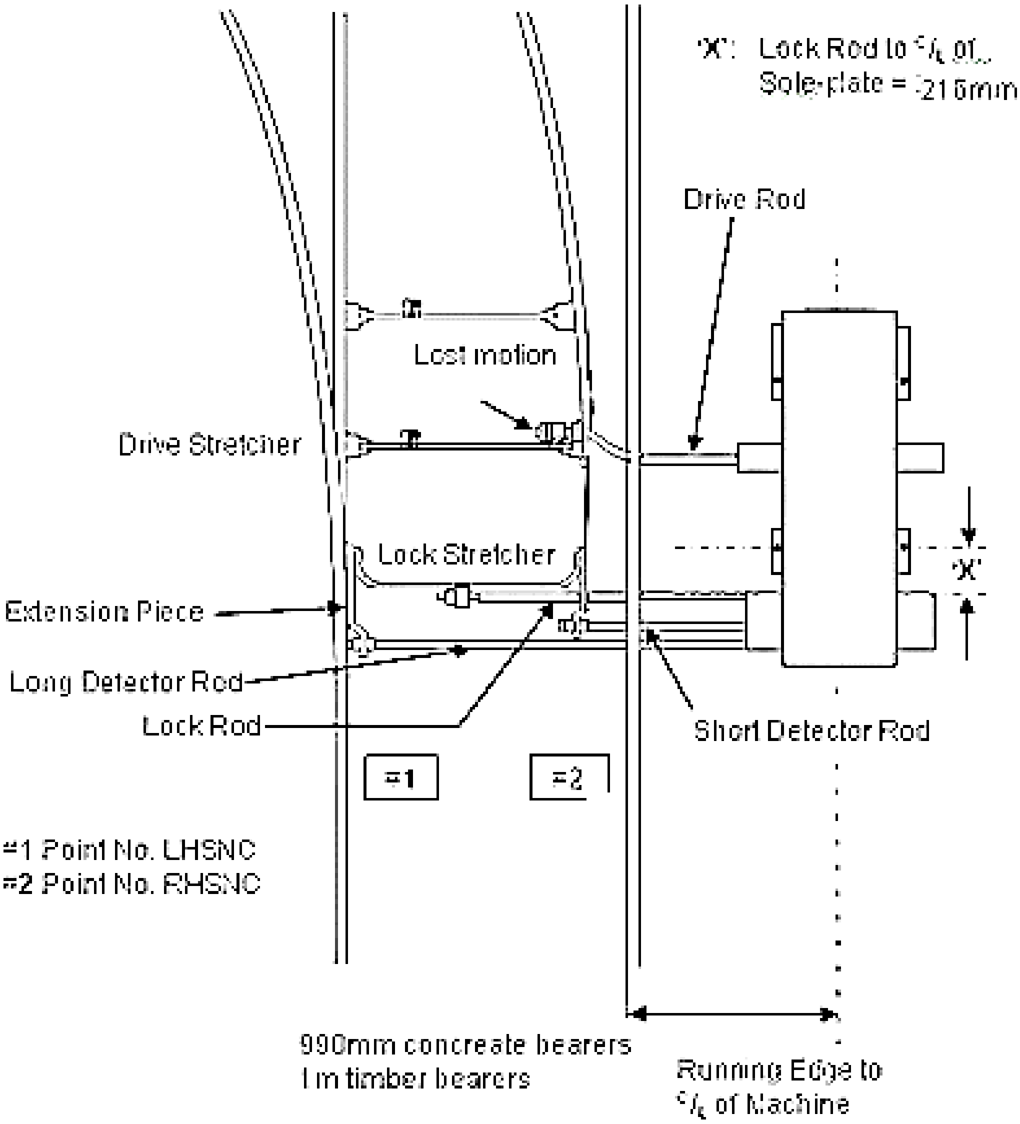


Figure 8 - 63 Point Layout

END

Includes:	Point Machine WRSL Styles M3 & M3A
Excludes:	Point inspections, Point fittings and Supplementary drives

The machine shall not be operated electrically until all adjustments have been verified by crank handle operation.

Nuts that are tight shall not move by the application of a short-handled spanner.

Any tightening of nuts or adjustments shall be reported as corrective maintenance.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

SERVICE A

2. Exterior

2.1 Check and tighten point machine fixings. Operate machine under power. If any movement is observed, relative to the bearers, tighten fixing bolts to 100 – 120Nm and recheck at the next visit.

2.2 Remove and examine throw bar and detector rod covers.

2.3 Clean and examine connections to throw bar, lock blades and detector rods. Protect with adhesive grease.

Do not allow too much grease to enter the machine.

2.4 Examine machine covers and base casting for cracks.

2.5 Remove potential obstructions and fire risks.

2.6 Check visible tail cable and route.

2.7 Lubricate throw bar and detector rod cover fixing bolts and refit covers.

3. Machine Interior (General)

Before you start any work, isolate the machine by operating the motor cut out.

NOTE: *The machine is isolated by removal of the pin when the crank handle cover is taken off.*

3.1 Remove and examine point machine covers.

M3A Machines Only

3.2 Examine crank handle screw access and lid clamp arrangement.

All Types

3.3 Clean the interior of the machine; remove accumulated moisture and debris.

3.4 Check that all drain holes and ventilators are clear.

The drain hole in the gear wheel compartment is located under the gear wheels, if this gets blocked the compartment can fill with water and freeze in cold conditions causing the machine to fail. See Appendix B.

4. Motor Assembly (See Figure 1.)

4.1 Examine the following:

a) Tail cable, cable entry and gland.

b) Cable cores, wires and ducting.

c) Terminal block, terminals and terminations.

d) Snubbing resistor and fixings (where fitted).

e) Motor assembly and fixings.

f) Clutch assembly and fixings. Including castellated nut and split pin.

g) Centrifugal snubbing switch and contact assembly.

4.2 Where fitted, check the heater is working.

Machines Fitted with a Friction Clutch

4.3 Check the clutch housing and clutch shaft seal retaining plate for any sign of oil leakage from the gear wheel compartment.

5. Drive Assembly (See Figure 1.)

5.1 Examine the lid gasket. Check it provides a good seal, if the seal requires replacing this shall be reported to your SM(S).

5.2 Clean and examine:

a) Gear train.

b) Worm drive and worm wheel.

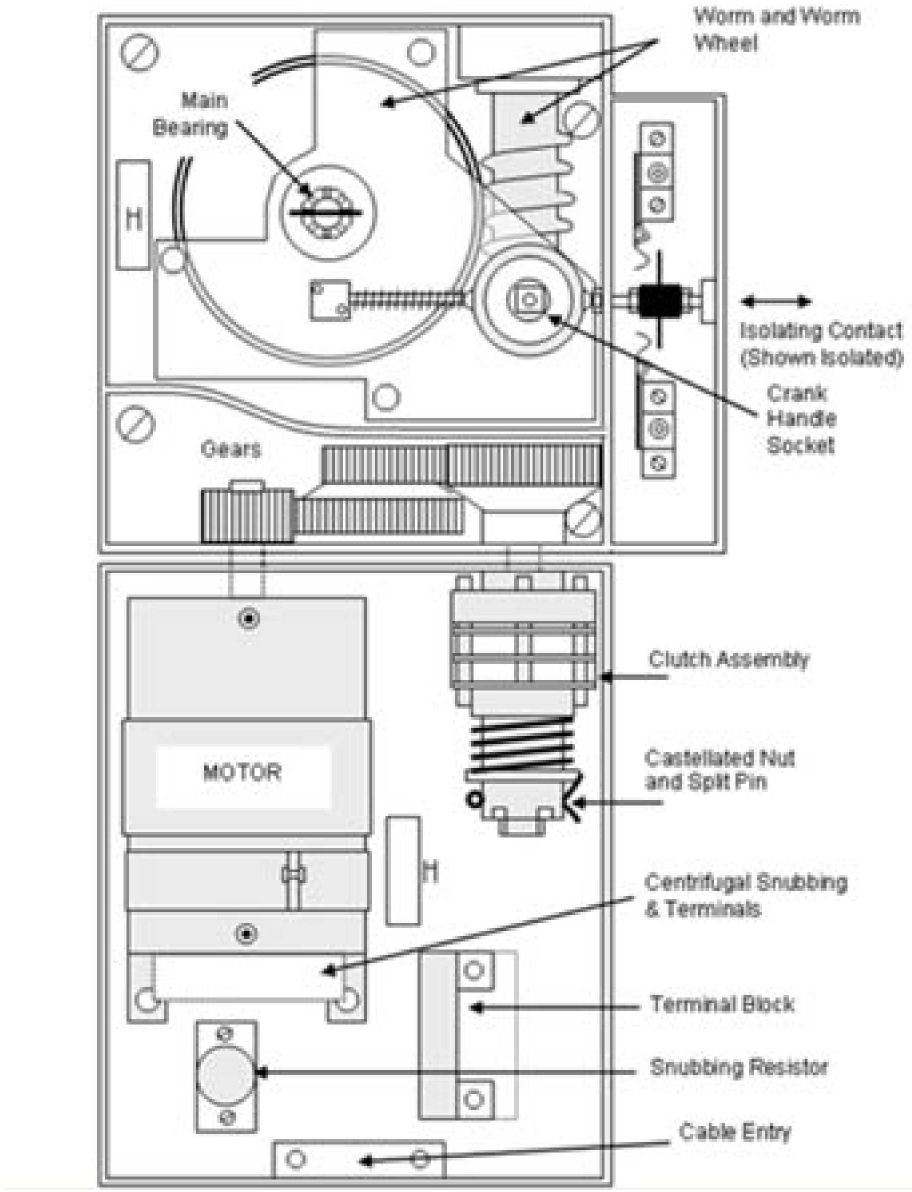


Figure 1 – Motor and Drive Assemblies

5.3 Manually operate the machine to examine all parts, including.

a) Examine the main bearing, castellated nut and split pin.

b) Examine all fixing bolts and set screws.

c) Examine crank handle assembly, spring stop and fixings.

d) Isolating mechanism, insulation and lock nuts.

5.4 Check the open contact gap is a minimum of 2mm.

5.5 Check the contact bridging piece forms a proper contact with the springs, when closed.

5.6 Check the cut-out contacts. Clean contact faces as necessary using a lint free cloth. Replace as necessary.

5.7 Check the terminal blocks, wiring & terminations are clean, and any protection required has been applied.

5.8 Check heater is working.

6. Detector & Lock Assembly (See Figure 2)

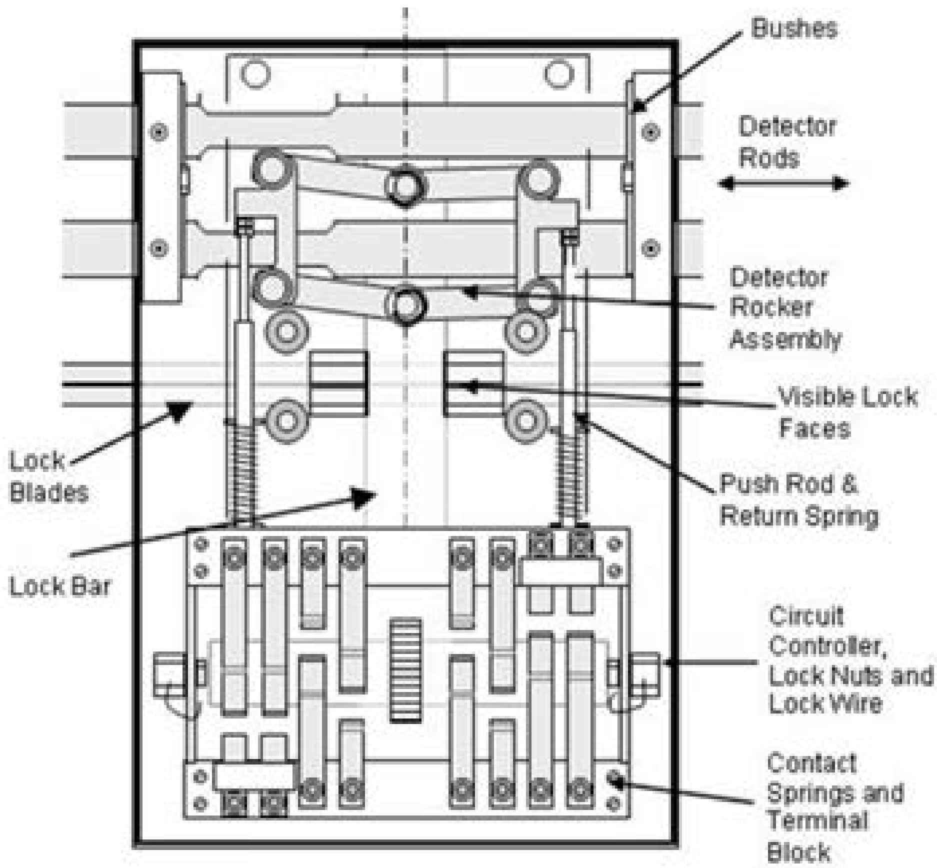


Figure 2 - Lock and Detection Assembly

Detector Assembly

6.1 Examine internal chassis and check all fixing bolts.

6.2 Clean and examine detector rods, bushes and fixing bolts.

6.3 Clean and examine detector rockers, rollers, and pins.

A small-insulated mirror is useful.

6.4 Check the connections to the push rods are secure (when not under tension) and the lock nuts are tight.

6.5 Check the rollers fully engage in the detector rod depressions and freely rotate.

6.6 Check the 'E' Clips are fitted to the rocker pivots and hold the rockers securely.

6.7 Clean and examine push rods, springs and stops.

6.8 Check the heater is working.

Lock Assembly

Operate the machine by hand and examine the visible parts of the lock blades, lock faces, & lock bar. Look particularly for shiny corners and swarf.

6.9 Check the lock blade rollers. The rollers shall freely rotate with movement of the blades.

Circuit Controller

6.10 Examine securing screws, lock nuts and locking wires.

The circuit controller shall be held securely.

If the circuit controller shaft has not been lock wired to the chassis, it shall be secured using a steel shim (or block of wood) between the end of the shaft and the machine casting (See figure 3).

Report any machine found with these items fitted to your SM(S).

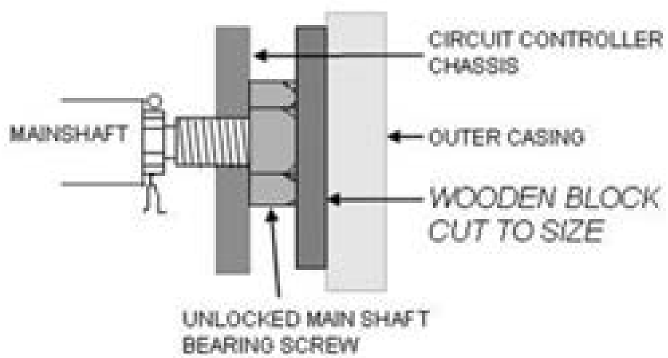


Figure 3 - Circuit Controller: Shaft Security

6.11 Clean and examine the circuit controller assembly including:

a) Gear drive

b) Contact faces and segments. Each open detection contact shall permit a 2.5mm non-metallic gauge to be inserted when the lock bar is withdrawn just clear of the lock notch. The contacts shall remain broken during travel until detection is achieved.

c) Contact springs and contact faces. Clean contact surfaces using a lint free cloth moistened with switch cleaner.

d) Terminal blocks, terminations and wiring.

6.12 Check that each circuit controller contact is fully engaged with the respective cam.

6.13 Check each bearing in which the circuit controller main shaft rotates. There shall be no significant longitudinal movement.

7. Lubrication

7.1 Lubricate, using adhesive grease:

a) Clutch spring and castellated nut.

b) Main bearing castellated nut.

7.2 Lubricate, using lithium grease:

a) Grease nipples on throw bar.

b) Grease nipples on detector rod bushes.

c) Surfaces of detector rods, and accessible parts of lock blades and lock plunger.

d) Main gear teeth (unless an oil bath is provided).

e) Worm gear and wheel.

f) Crank handle connection.

g) Crank handle cover screw thread.

7.3 Lubricate, using mineral oil:

a) Oil cups (where provided).

b) Detector rocker pivots.

c) Lock and detector rollers.

d) Crank handle plunger mechanism and gear bearing.

e) Push rod springs.

f) Circuit controller operating rack.

g) Fixing bolts.

7.4 Top up the oil bath with gearbox oil, where an oil bath is provided.

8. Tests & Final Checks

8.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine))

8.2 Check for foreign bodies in the machine, replace machine centre cover, and check that a RKB222 padlock is fitted to crank handle latch.

8.3 Reset the crank handle cut-out. Observe correct operation of the machine. There shall not be any excessive ‘kick-back’ on the motor.

8.4 Observe that the snubbing is effective.

8.5 Replace and secure the remaining machine covers. Lubricate the padlocks.

8.6 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

8.7 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

SERVICE B

9. General

9.1 Clean the covers (inside and out) and casting.

9.2 Drain the oil from the gear box, where provided, and refill to the indicated level.

10. Motor

10.1 Examine the motor commutator (it shall be a light brown / coffee colour). Rotate using the crank handle and clean by pressing a clean, lint free cloth moistened with a cleaning agent onto the surface of the commutator.

10.2 Examine the motor brushes. Brushes shall slide freely in the holders and seat fully on the commutator. The end of each brush shall protrude from its holder.

10.3 Lubricate the motor grease nipples with a little lithium grease.

11. Contacts

11.1 Clean using lint free cloth moistened with a cleaning agent:

a) Circuit controller contact segments.

b) Normal and reverse detection contacts.

c) Motor control contacts.

d) Crank handle cut-out contacts.

e) Centrifugal snubbing contacts.

11.2 Examine the circuit controller plug coupler (where fitted). Brush the top; separate the two halves and clean the joint faces. Check that the two halves are screwed tightly back together again.

12. Centrifugal Clutch (where provided)

12.1 Remove centrifugal clutch housing cover plate and underlying circlip. Carefully pull off the clutch housing and remove the plunger cage and plungers.

12.2 Clean and examine all parts using a lint free cloth moistened with a cleaning agent. Replace the leathers where the tip of a plunger has been rubbing on the clutch housing.

12.3 Replace the clutch housing if it has become scored.

12.4 Apply a small amount of lithium-based grease to the ball race and reassemble the unit.

13. **Friction Clutch** (where provided)

Friction Clutches are no-longer a serviceable item and therefore shall not be disturbed, any failure shall be reported to your SM(S).

14. Centrifugal Snubbing

14.1 Examine the centrifugal snubbing switch, adjust as necessary. The ends of the inner springs shall be clear of the clutch housing.

The ends of the plastic striker arm shall be just clear of the backs of the inner springs. The gap between each pair of carbon contacts shall be 3mm.

The clearance between the back of the outer spring and its spring keeper shall be 3mm.

15. Disconnection Boxes (if Provided)

15.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

15.2 Refit the lid and (if provided) padlock, check they are fitted securely.

16. Local Policy Requirement

16.1 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed

17. Tests and Final Checks

17.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Test (Machine)).

17.2 Carry out NR/SMS/PartB/Test/011 (Detector Tests (Electrical Detectors).

17.3 Return the point machine to power operation.

17.4 Clutch test: record the operating current whilst operating the points N-R and R-N (max 10A).

Repeat this test after inserting an obstruction between switch and stock rail. Observe correct operation of the overload cut-out protection (6 - 9s), i.e. WJR.

This test shall be undertaken using a meter or a current clamp meter.

The clutch slip current shall be set to 12A ±2A.

The dry plate clutch is adjusted mechanically by increasing or decreasing the clutch spring pressure by adjusting the castellated nut.

17.5 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests).

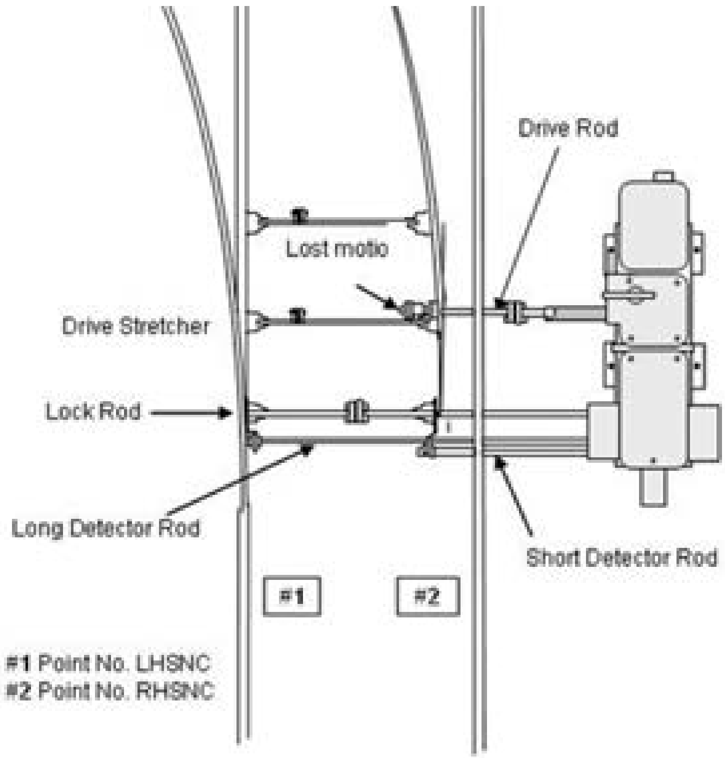
It is recommended that this test be carried out from the location case or equipment room if possible.

17.6 Observe correct operation of the machine. There shall be no ‘’kick-back’ on the motor.

17.7 Check for foreign bodies in the machine, replace cover, and check that RKB222 padlock is fitted to crank handle cover. Lubricate the padlocks.

17.8 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation

APPENDIX A - Typical Drawing: M3 Point Layout – Right Hand Machine
(Not to scale, soleplate & sleepers omitted for clarity)



APPENDIX B - Location of drain hole

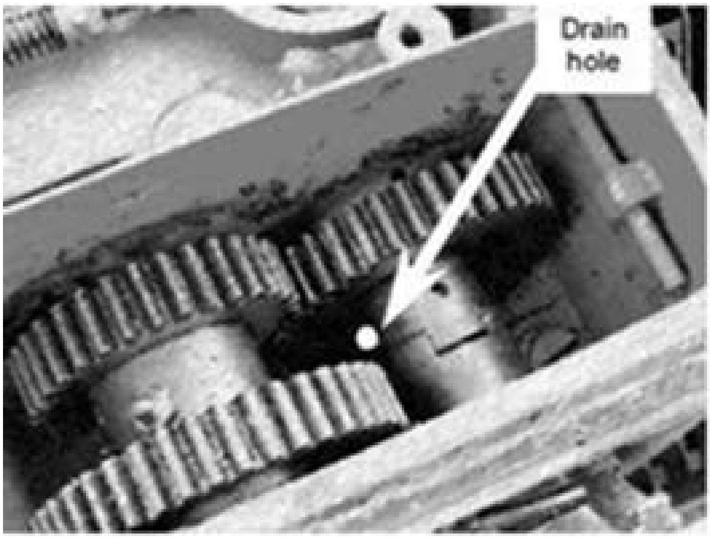


Figure 4 - Location of drain hole in gear wheel compartment

END

General

The WBS AC point controller is a predecessor of the of the modern point contactor relay used to drive point machines.

They are normally found on older installations of WBS point machines

SERVICE A

1. External

1.1 Remove all fire risks from around and near to the controller. Paper, oily waste etc.

1.2 Check the following items:

a) Condition of the casting and cover.

b) Security of the fixing bolts.

c) Cable entry glands.

2. Internal

2.1 Remove the cover and check the general condition of the interior. Clean and wipe as required. Remove any moisture.

2.2 Visually examine all wiring.

2.3 Check the capacitor for any signs of leakage and the resistor(s) for signs of overheating.

2.4 Check that insulating shrouds are fitted to all terminals. Replace any that are damaged or missing.

2.5 Visually examine the motor and cam assembly.

2.6 Lubricate the following with mineral oil:

a) All oil cups/dash pots.

b) Pivots and cam roller.

One drop from a can with a 150mm thin non-conductive tube is required for this item.

2.7 Check the condition and security of the contact fingers, springs, and terminals. Clean (if required) the contacts using a lint free cloth and cleaner.

Take care not to bend or distort the contacts.

Do not attempt to adjust or change the contacts, if any are found to be defective, the complete mechanism shall be changed.

2.8 Check that when the points are normal the reverse contacts are broken, and when the points are reverse the normal contacts are broken.

Measure the gap on the open contacts in both positions, check that it at least 5/16" (7mm).

3. Final

3.1 Check that the plug coupler, flexible hose, and tail cable to the point machine are secure and undamaged.

3.2 Check for correct operation of the points before and after securing the cover.

3.3 Check that a RKB221 padlock is fitted to the unit locking device. Lubricate with mineral oil the hinges and securing device threads.

3.4 Check that the point controller is correctly numbered.

END

General

The High Performance Switch System (HPSS) comprises the High Performance Switch Actuator (HPSA) and the PowerLink Supplementary Drive, plus toe and supplementary rail position sensors (LVDTs).

Further information and details can be found in the HPSS handbook (NR/L2/SIG/11400)

Remote Condition Monitoring (RCM)

If the points that you have requested to work on are fitted with RCM check that the asset has been placed into maintenance mode prior to commencing work.

Prior to commencing work it is recommended that the previous current traces are made available from the RCM system and checked for any abnormalities.

On completion of maintenance, it is recommended that new traces are recorded and viewed so they can be compared with the traces produced before the maintenance activity.

When requesting permission from the Signaller to work on a set of points, ask the Signaller to operate points in both directions to verify and prevent any confusion on the set of points you have requested.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/004 (Facing Point Lock Test).

SERVICE B

2. HPSS External Checks

2.1 Check all the lids, gaiters, covers and retaining fasteners are present.

2.2 Examine the base plate / slide chair assembilies and ensure they are clean and free from excessive wear and damage.

2.3 Examine switch rails for hogging/dipping. Report any significant wheel burns, rail defects and poor permanent way.

3. HPSS Set-up Checks

3.1 Remove the end lid of HPSA (2x padlocks RKB221).

3.2 Disconnect the RCM cable (if fitted) from J5 on the ECU and connect the HPSS handset cable.

3.3 Check visually that the cut-out flag in the powered position and prevents accidental insertion of the cranking handle into the winding mechanism.

3.4 Isolate the motor power to the HPSA by operating the crank handle cut-out mechanism.

3.5 Check when operating the cut-out mechanism,that the indicator flag moves fully to the ‘Power-off’ position and is retained by the spring loaded locking pin. Confirm that the power is isolated using the handset, the status screen shall indicate ‘Manual’.

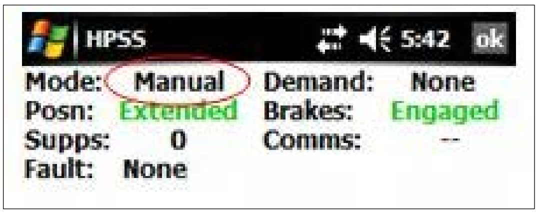


Figure 1

3.6 Remove the remaining covers from:

a) HPSA point machine - centre cover (requires release of 2 rubber gaiters).

b) All centre covers of PowerLink backdrive.

c) Covers (extend and retract side), protecting the toe and supplementary sensors.

NOTE: *Take care when lifting any of the centre covers that are equipped with winter covers.*

4. Switch set up checks

4.1 Check the following measurements for the open switch as stated in NR/SMS/PartZ/Z02 (Point Reference Values):

a) Switch opening at the toe.

b) Minimum Free Wheel Clearance at the Headcut.

4.2 Check the following on the closed switch:

a) That there is 2.5mm to 3mm gap between the switch and stock rail at the end of the switch rail planing (head cut).

NOTE: *If this gap is not achieved, the heel of the switch might close up before the toe, preventing the switch tips closing correctly.*

b) There is a gap of 2mm or less between the stock and switch rail inline with any supplementary sensor, except for CEN54 'C' switches which can be 2mm to 3mm.

c) Check that lost motion is present at all supplementary drive locations. See Figure 2.

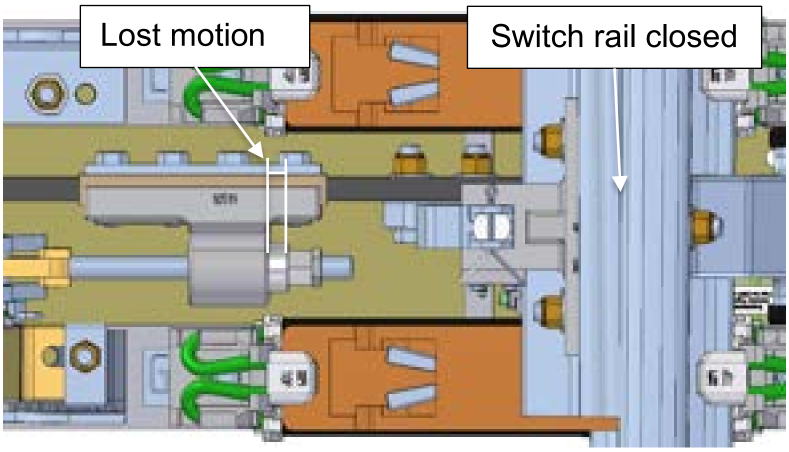


Figure 2

4.3 Return the HPSS to 'Powered' operation and power operate the points to the opposite side.

4.4 Return the HPSS to "Manual" operation.

4.5 Repeat steps 4.1 and 4.2 for the opposite side.

4.6 Return the HPSS to 'Powered' operation.

4.7 Visually check under powered operation that:

a) Operation is smooth and completes within 2.5 – 4 seconds.

b) All fittings are secure.

c) The switch rail rollers are free to rotate and are in contact with the switch rail during operation.

5. Checks within HPSA hollow bearer

5.1 Operate the points under power to the 'retract' position (with the closed switch rail nearest to the gearbox).

5.2 Return the points to "Manual" operation and check that there is a 2mm minimum gap between the white anti-rotation bush and the gearbox casting, See Figure 3. If no gap is visible, add switch rail packer(s) as required on the retract side to obtain a 'set-up' gap of minimum 3.5mm.

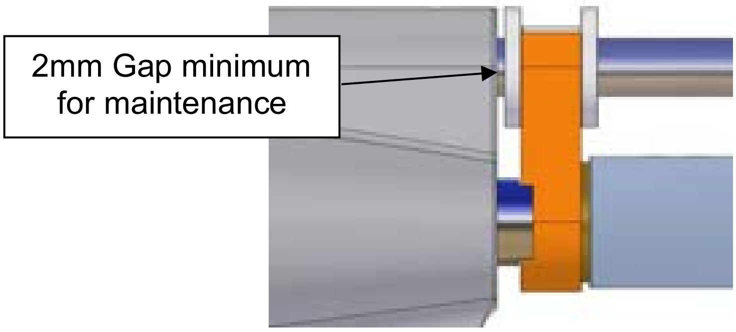


Figure 3

5.3 Remove all debris from around and within the HPSA point machine.

5.4 Check that the HPSA electric motor, brake, power isolation switch, and ECU shock mounts are secure and undamaged.

5.5 Check, that all plug couplers are securely connected to the ECU by attempting to gently rotate the bezel clockwise, use Figure 4 to assist.

a) 4x sensor plug couplers.

b) 2x motor power / sensor, plug couplers.

c) 2x brake plug couplers

d) 2x ECU power and detection plug couplers.

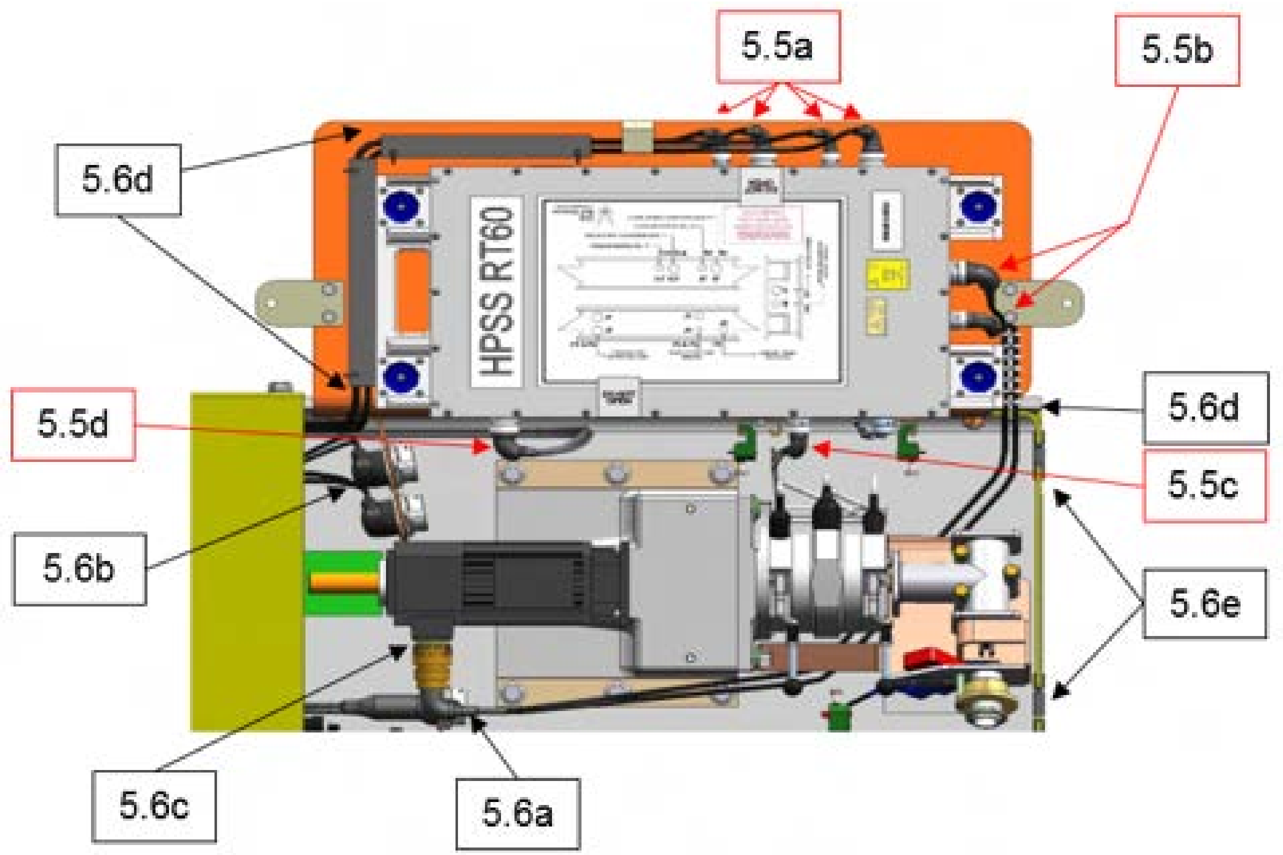


Figure 4

5.6 Check the following within in the HPSA, use Figure 4 to assist.

a) Command (10core), detection (4core) plug couplers.

b) 2x (or 4x) supplementary plug couplers.

c) 2x motor connectors are fully installed and correctly cable tied.

d) Cables are clear of the potential trapping points by the end lid, (3 places).

e) Tail cables are free from damage at cable entry points.

5.7 Check all cables are secured away from the HPSA bearer heater element and any moving parts.

5.8 Using a 'Check torque' (refer to NR/SMS/PartZ/Z02 - Point Reference Values) check all self-locking nuts and bolts are present and secure. Use Figure 5 to assist.

a) 2x (per bracket), toe sensor mounting bolts.

b) 6x gearbox mounting bolts.

c) Where a packing plate is installed under gearbox, 4x packing plate bolts.

5.9 Visually check the condition of the HPSA Drive and Lock Mechanism, use Figure 5 to assist.

a) 4x carriage shaft bolts.

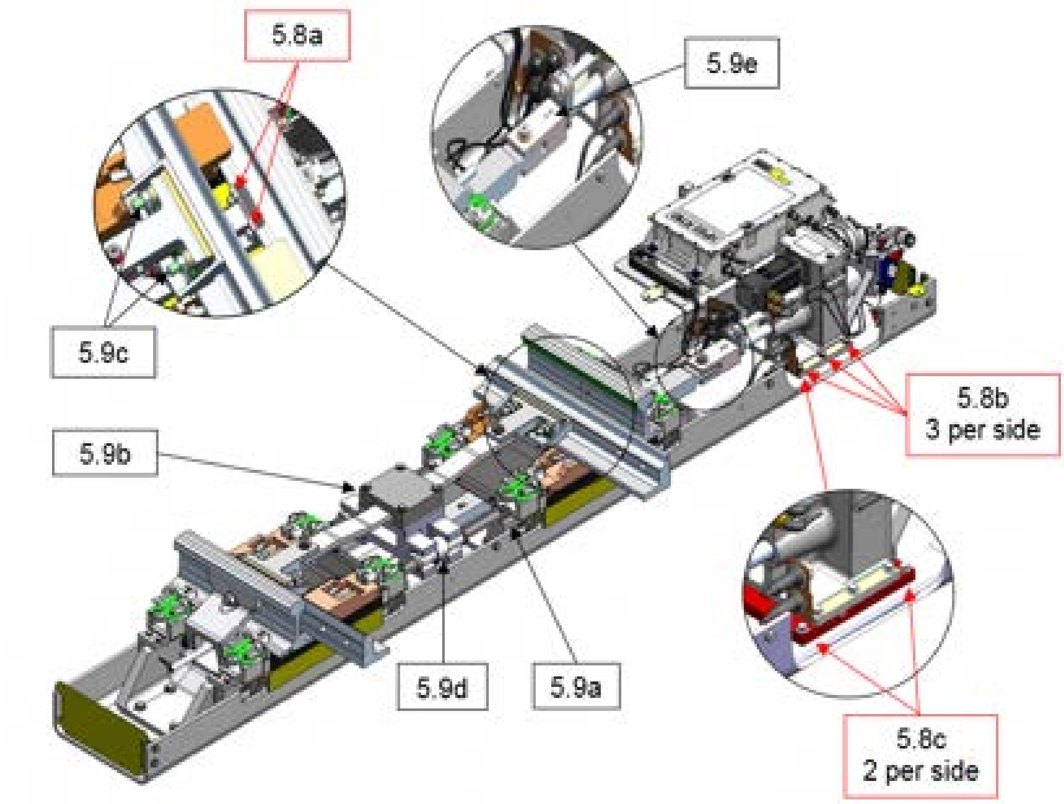
b) 4x carriage top cap bolts.

c) 2x switch rail drive bracket fasteners per bracket.

d) Check the carriage bushes for damage, and clean the carriage shafts using soapy water.

e) Inspect the gearbox to check that the clevis is pinned to the lead-screw.

Any bolts / fasteners / toe sensor brackets that are found to be loose or damaged shall be classed as corrective maintenance and replaced.



6. Manual Cranking Operation

Manually operating the HPSS, check the security of the cranking mechanism and smooth operation.

7. PowerLink Supplementary Hollow Bearers

7.1 Remove any debris/ballast from around and in the supplementary hollow bearers.

7.2 Check the following, at each Backdrive hollow bearer, using a ‘check torque’ (NR/SMS/PartZ/Z02 Point Reference Values), use Figure 6 to assist:

a) 2x bearing blocks mounting fasteners.

b) 4x dropper bracket to stretcher bar fasteners.

c) Supplementary drive bearers only: 2x locknuts are tight against the lost motion thimbles.

d) Supplementary detection bearers only: 2x supplementary sensor drive brackets. If tabbed washers are installed then visually check tabs.

Figure 5

Any bolts / fasteners / supplementary sensor brackets that are loose or damaged shall be classed as corrective maintenance and replaced.

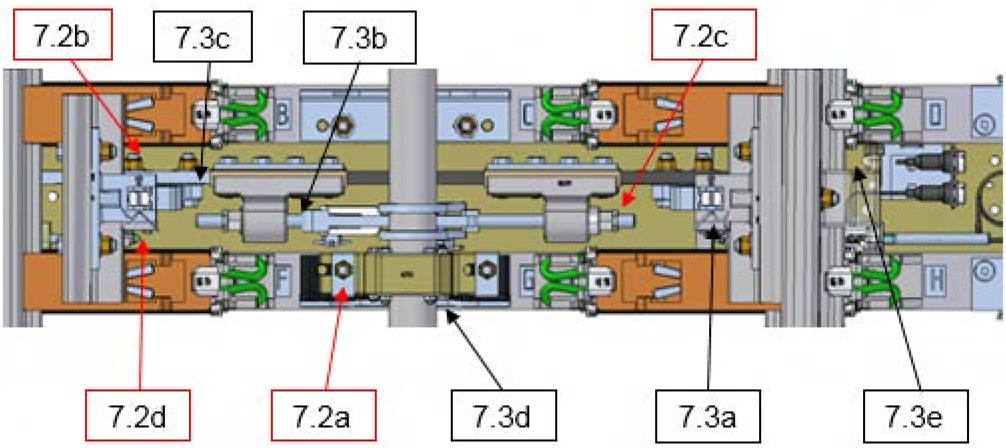


Figure 5

7.3 Visually inspect the following, use Figure 6 to assist:

a) The split pin on the web drive brackets have been correctly formed. One leg should be curled out, the other bent and straight.

b) Check that the 'D' links of the mid (where fitted) and rear supplementary drive stretcher bars are not touching the drive basket when the points are retracted.

c) The serrations between the dropper bracket to stretcher bars are fully engaged.

d) 6x bearing block clamping and bearing journal fasteners.

e) Supplementary detector bearers only: Check all cables are secured away from the bearer heater elements and any moving parts.

8. Torque Tube

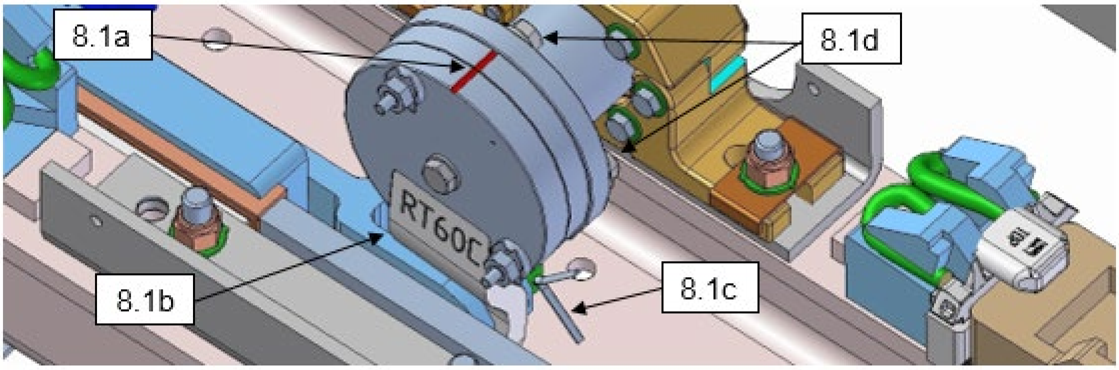


Figure 6

8.1 Check visually the following:

a) That the red lines of the shear pin module align.

b) The shear pin module does not foul on the drive take-off fork (this will be indicated by contact marks on the take-off fork).

c) The retaining split pin legs are present and bent out, at the torque tube drive lug positions.

d) The shear pin module is securely mounted to the torque tube.

e) F and SG torque tubes only: the serrated joint is secure.

f) That no ballast is trapped, or likely to become trapped, between the torque tube and any bearers.

9. Heater check

9.1 With the point end heating system activated (this might require manual activation of the points heating supply), check that the HPSA, supplementary detector(s) and rail heaters are operational.

10. Disconnection Boxes (If provided)

10.1 Remove the lid and Check the following:

a) Disconnection boxes are stable, securely fixed.

b) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

c) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

d) Cable glands are fitted and effective.

10.2 Refit the lid.

10.3 Check the condition and lubricate the RKB221 padlock.

11. Final Checks

11.1 Check the following before returning the HPSS to service:

a) there are no physical obstructions to prevent movement.

b) that the correct number of supplementary detector pairs are recognised by the ECU (via the HPSS Handset).

c) the crank handle is correctly stored.

11.2 Replace all covers and gaiters, except for the ECU end lid. Torque tighten as stated in NR/SMS/PartZ/Z02 (Point Reference Values).

11.3 Return the HPSS to ‘Powered’ operation.

11.4 Carry out NR/SMS/PartB/Test/008 (HPSS Tests).

11.5 Carry out NR/SMS/PartB/Test/004 (Facing Point Lock Tests - HPSS).

11.6 Remove the HPSS handset and reconnect the RCM communication cable. Check that comms is achieved. If RCM is not installed, re-connect the bayonet blanking cap to the handset port of the ECU (J5).

11.7 Replace the ECU end lid.

11.8 Check and lubricate the RKB221 and RKB222 padlocks and re-secure.

11.9 Check that the HPSS operates correctly under power to both normal & reverse positions, (twice if possible).

11.10 If fitted with remote condition monitoring, contact the local RCM team to review the asset trace and to confirm whether the asset can be taken out of maintenance mode.

APPENDIX A - Datum Reset

If any components are changed, any adjustments made to the HPSA point machine, PowerLink supplementary back drive, or tamping has taken place through the points then a Facing Point Lock Test (NR/SMS/PartB/Test/004) should be undertaken which includes the datum reset procedure, after which, a facing point lock and detection test should be carried out and completed successfully prior to a return to service.

The HPSA handset is used to carry out the HPSS datum reset procedure. This updates the fully open and fully closed 'reference positions' of all rail position sensors (LVDTs) that are stored within the ECU (but does not change detection limits.)

Before commencing with the datum reset procedure, check the following:

a) HPSS handset is connected to the ECU and comms is established between the two.

b) check that the HPSS is able to operate correctly to the extend and retract positions.

Each switch rail must be fully closed against the stock rail in line with the first slide chair bolt, before confirming a good extend or a good retract position during the Datum Reset procedure. Failure to do so (e.g. due to switch rail lipping) can result in the points being set up with a gap at the toe between the stock and switch rails.

Using the touch screen of the HPSS handset carry out the following steps:

1. Select Main Menu then Set HPSS Datums.
2. Do You Wish To Proceed? Enter Yes.
3. Are You Able To Complete The Entire Process? Enter Yes.
4. Select number of sensors installed on the layout.
5. HPSS Handset prompts to confirm the number of sensors selected, enter Yes or No, to return to the previous screen.
6. Following the erasure of existing data in ECU, handset prompts Position Rail For Good Extend.
7. Operate HPSA to move to Extend position. Wait for brakes to re-engage.

8. Press Done when switch rail is in the fully extended position and is hard up to stock rail at the toe of the points (i.e. zero gap exists).
9. Writing Extend References data appears on the screen and then prompts Position Rail For Good Retract.

10. Operate HPSA to move to Retract position. Wait for brakes to re-engage.

11. Press Done when switch rail is in the fully retracted position and is hard up to stock rail at the toe of the points (i.e. zero gap exists).

12. Writing Retract References data appears on the screen and then prompts Handset Process Complete.

13. Press OK.

APPENDIX B - Run-Through

The gearbox shall be replaced following a run-through.

All components listed below shall also be replaced before the HPSA is returned to service, together with their associated fasteners, pins, and bearings. Guidance on HPSA component replacement is found in the HPSS Manual (NR/L2/SIG/11400).
The shear pin module (which is a run-through detection feature that forms part of the PowerLink supplementary drive torque tube) shall be replaced following a run-through.

All other supplementary drive components shall be inspected for damage and replaced as necessary. An assessment of any other components shall be made then escalated to the SM(S)

Guidance on component replacement is found in the PowerLink supplementary drive manual.

Ordering the ‘run through kit’ will provide you with all the components for each rail type detailed in Table 1:

Description	Part Number			Qty
	CEN54	RT60	NR60	
Run-Through Kit	4080	4079	4108	1
Gearbox Kit	4001	4001	4001	1
Switch Rail Drive Brkt Kit	4009	4009	4109	2
Switch Rail Drive Arm Kit	4012	4012	4110	2
Drive Shaft Assembly	6035	6026	6225	1
Shear Pin Module CEN54	4052	-	-	1
Shear Pin Module RT60C	-	4047	-	1
Shear Pin Module RT60D	-	4048	-	1
Shear Pin Module RT60E	-	4049	-	1
Shear Pin Module RT60F	-	4050	-	1
Shear Pin Module RT60SG	-	4051	-	1
Shear Pin Module NR60	-	-	4111	1

Table 1 – Run-through: Component Replacement List

1. The above kits contain all the relevant fasteners, pins etc. to enable all HPSA components to be replaced.

2. This list is limited to HPSA components and the shear pin module only. Other PowerLink supplementary drive components shall be inspected and replaced if damaged.

3. CEN54 and NR60 shear pin module: Each design is common to all switch sizes.

4. The gearbox and drive shaft assemblies are extremely heavy and require more than one person to lift them.

APPENDIX C - Basic terminology and information

Extend & Retract

The HPSA uses the above terms to refer to the movement and position of the leadscrew in relation to the gearbox:

a) ‘Extend’ = leadscrew protrudes from the gearbox.

b) ‘Retract’= leadscrew is withdrawn into the gearbox.

These terms do not relate to the Normal or Reverse positions of the points, since the HPSA can be installed with the gearbox at either side of the rails.

HPSA Adjustment

If any adjustment is made to the HPSA such as:

a) Toe opening adjusted.

b) A component within the drive chain replaced (gearbox, drive arm etc).

c) Toe / supplementary sensor replacement

Then a Datum Reset procedure shall be completed (Appendix A) and a facing point lock test shall be carried out.

Electronic Control Unit (ECU)

There are 2 types of ECU, for the following rail types:

- NR60/RT60 rail.
- CEN54 rail (previously known as UIC 54).

Different plug connector keyways are provided for command cable (J1) and detection cable (J2) to prevent the wrong ECU being installed.

The NR60/RT60 and CEN54 ECUs differ due to the 15mm and 12mm obstruction detection requirements respectively.

Toe Sensors Overview

A pair of toe sensors (Extend and Retract) are always fitted at the toe of each switch rail.

Toe sensors are clamped to the foot of each stock rail and are driven to position by the motion of the switch rail drive brackets.

Toe sensor detection windows

The toe sensors are used to detect that the closed switch rail is within 3.5mm of the stock rail, in order for the ECU to give detection.

Supplementary sensor overview

Supplementary sensors are mounted within the backdrive hollow bearers and are driven via a supplementary sensor drive bracket via the switch rail interface bracket.

Pairs of supplementary sensors are fitted along the length of the switch to meet obstruction detection requirements (the quantity of supplementary sensors is determined by switch size length).

Supplementary sensor detection window

Supplementary sensor detection requirements are as follows:

a) CEN54, each supplementary sensor detects that the closed switch rail is less than 8mm from the stock rail, for the ECU to give detection.

b) NR60/RT60, each supplementary sensor detects that the closed switch rail is less than 10mm from the stock rail, for the ECU to give detection.

Insulated and non-insulated sensors

There are two types of drive pegs fitted to the toe and supplementary Sensor(s), insulated and non-insulated.

Do not install a non-insulated sensor (toe or supplementary) with an ‘insulated’ drive bracket.

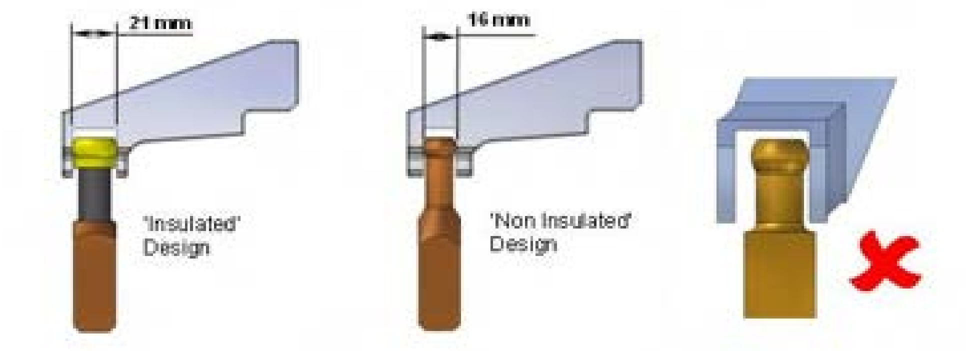


Figure 7

Supplementary Sensor Mounting Bracket

There are three types of bracket:

1. Standard non-handed, (See Figure 9) secured using 4no. M12 screws to bearer wall, made from 5mm thick steel plate. Installed at all RT60 layouts and specific locations on UIC54B layouts. See table Table 2.

Figure 8 – Standard mounting bracket

2. Non-handed, (See Figure 10) secured using 2no. M12 bolts to bearer wall, made from 3mm think steel plate. Installed on RT60 layouts and specific locations on UIC54B layouts. **This style has been superseded and should not be installed.** If this type of bracket is being replaced due to failure, inspect the other supplementary sensor mounting bracket and, if of the same 3mm type, replace with a 5mm thick bracket when possible.

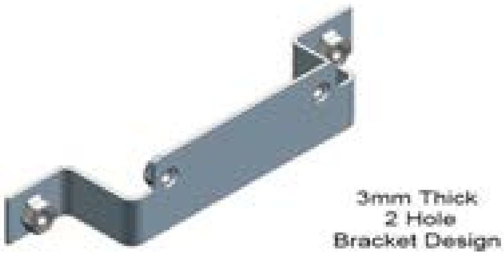


Figure 9 – Superseded mounting bracket

3. Offset mounting bracket (L/H or R/H), (See Figure 11) secured using 4no. M12 screws to bearer wall, made from 5mm thick steel plate. Situated at specific locations on UIC54B layouts only, see Table 2.

Figure 10 – Offset (handed) mounting brackets

Table showing location of offset and standard supplementary sensor mounting brackets UIC54B only.

Switch Size	Supplementary 1 Bracket type (Bearer No.)	Supplementary 2 Bracket type (Bearer No.)
BVs	Not present	Not present
CVs	Offset Brackets (Bearer No 7)	Not present
DVs	Standard Brackets (Bearer No. 5)	Not present
EVs	Standard Brackets (Bearer No. 6)	Not present
FVs	Standard Brackets (Bearer No. 4)	Offset Brackets (Bearer No. 10)
SGVs	Standard Brackets (Bearer No. 5)	Offset Brackets (Bearer No. 11)

Table 2 - Bracket Type / Supplementary Bearer No. (UIC54B only)

HPSA Handset

The HPSA Handset is a pre-programmed portable computer that is used to set up the HPSS system (setting ECU Datum's / Datum Reset) and for faulting and maintenance (LogDump).

It is permissible to have the HPSA Handset connected to the ECU whilst attended, during the passage of rail traffic for on-site points monitoring.

The Datum Reset procedure shall only be carried out when the points (all ends) are in your possession.

Self-Locking Nuts & Bolts

If a self-locking fastener is removed it shall be replaced. Regular re-use will reduce the locking effectiveness. Any self-locking fastener that is found to be loose shall be immediately replaced.

PowerLink Supplementary Drive Adjustment

If any adjustment to the PowerLink Supplementary Drive is made, a Datum Reset procedure shall be completed (Appendix A) and a facing point lock test shall be carried out.

Lubrication

Do not apply mineral oil to the low friction bushes (fitted to the carriage shaft), chair slides or any of the spherical bearings.

The use of Interflon is permitted on the sliding surfaces of the baseplates, carriage shafts and the guide shafts of the toe and supplementary sensors.

END

Includes:	T72 Point Machines
Excludes:	All other Point Machines.

General

The machine shall not be operated electrically until all adjustments have been verified by crank handle operation.

Check that the point identification number corresponds with that shown on the lid and/or machine body.

Nuts that are tight should not move by the application of a short handled spanner.

More information about these machines along with set up and adjustment details is contained in NR/SMS/Appendix/02.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/005 (Facing Point Lock Tests T72 with VCC Lock).

SERVICE A

2. Exterior (T72)

2.1 Check point machine fixings and tighten (if required). Operate machine under power and observe that there is no movement relative to the bearers. If movement is observed, tighten fixing bolts to 100 – 120 Nm and arrange a re-check at the next visit.

Isolate the machine by moving the selector lever from 'MOTOR' to 'HAND'

2.2 Examine crank handle access mechanism MOTOR/HAND selector lever for damage and or wear.

2.3 With 'MOTOR' selected, check that the crank handle cannot be inserted.

2.4 Liaise with the Signaller and with 'HAND' selected, check that the points are isolated and cannot be moved under power, it might not be possible to carry out this task in all circumstances.

2.5 Remove fire risks and potential obstructions.

2.6 Check machine case, cover, fixing clips, hasp(s) and padlock(s) for damage and or wear.

2.7 Clean the drive arm and drive rod and examine for damage and or wear.

2.8 Examine the insulation bush and washers on drive rod.

2.9 Examine the drive arm screws and tab washers; confirm the tab is bent firmly against the side of each screw head. If drive arm clamp screws are found to be loose advise your SM(S).

2.10 Check and adjust the travel of drive rod and drive arm.

2.11 Examine the plug coupler for damage and or wear.

2.12 Check the cable from machine to junction box for damage and or signs of wear.

2.13 Check that the spiral sheath is intact and clamped securely.

2.14 Check that cables are not trapped or covered by P-Way materials.

3. Interior Mechanism (T72)

3.1 Examine plug coupler connections for damage and or wear.

3.2 Check the cable ties are secure.

3.3 Check wires are secured clear of moving parts.

3.4 Examine the following items for damage and or wear.

a) Wires and terminations.

b) All exposed gear wheels.

c) Lock cam and roller.

3.5 Check that the heater assembly mounting plate/gear cover is secure.

3.6 Check the heater and thermostat for damage and or wear, then carry out NR/SMS/PartB/Test/170 (Point Machine T72 Heater and Thermostat Test).

3.7 Examine the manual operation shaft, gear wheel, and return spring. If the spring is defective arrange corrective action.

3.8 Open the water drain device and examine the interior. Remove any debris and any moisture from inner face of cover and case. Close water drain device.

4. Motor Assembly

4.1 Check the motor and fixings for damage and wear.

4.2 Examine the commutator at each end of motor. It should be a light brown/coffee colour.

4.3 Clean the commutator by rotating it slowly and pressing a clean, lint free cloth moistened with an approved cleaner onto the surface.

4.4 Examine the motor brushes and holders.

Brushes shall to be renewed if any has worn down to the minimum permitted length (8 mm).

The brushes shall slide freely in their holders and seat fully on the commutator

5. Junction Box

5.1 Check the following items for damage or wear:

a) Case.

b) Door.

c) Lock.

d) Weather seal.

5.2 Examine the following items for damage or wear:

a) Interior.

b) Terminal blocks.

c) Cable glands.

d) Ties.

e) Wires and terminations.

5.3 Lubricate with mineral oil the door hinges and lock.

6. VCC Lock and Detector Assembly

6.1 Check the balance of the lock arm stroke. Details are in NR/SMS/Appendix/02. If incorrect, report this to your SM(S). Remedial action shall be instigated.

6.2 Check the tail cables, padlock, and the padlock bracket for damage or wear. Confirm that the cables are not trapped or covered by track materials.

6.3 Check the cover and spring retaining clips. If the cover is damaged or spring retaining clips are missing or faulty report it as a corrective maintenance.

6.4 Check the body and fixings, and the internal detector cover for damage or wear.

6.5 Check VCC Lock for signs of run through. If suspected, report it as a corrective maintenance.

6.6 Examine the cam (detector drum) for damage or wear.

6.7 Check the cable clamps and that the cables are secure. Check that any wires cannot be damaged and/or trapped or any terminations touch the cover when it is replaced.

6.8 Examine and clean the wires and terminations and contacts. Pay particular attention for bent contacts, light contacts or contacts with Verdigris on them.

6.9 Examine both ends of brass plunger (switch blade open). If damaged or deformed, report it as a corrective maintenance.

6.10 Check the brass plunger for freedom of operation (switch blade open).

6.11 Gauge the clearance between the cam shaft hexagonal nut and rear of the detector frame (switch blade closed and locked). The 6 mm slotted gauge should be a sliding fit. Adjust the tappet screw as necessary.

6.12 Measure the overall length of the tappet lock nut/tappet screw assembly. If the overall length exceeds 17 mm the brass plunger shall be replaced. See NR/SMS/Appendix/02 for details of these.

6.13 Examine the operating finger, nut and split pin. The finger should be free within the notches of the frame and crank head, If the finger is not free action shall be taken to rectify the issue.

6.14 Check the crank lock casting and the coupling rod insulation for damage or wear. Clean the insulation upper surface as necessary.

6.15 Check the coupling rod and the control arm connections and confirm that the coupling rod is not binding the lock-arms in the transfer channel.

6.16 Check the split pins securing the crank lock bracket nuts for damage or wear.

6.17 Measure (at the edge of their outer diameter) the gap between the spring washers on the hammer head bolts securing the lock crank bracket assembly to the switch blade. (0.5mm – 1mm).

If the gap is less than 0.5 mm the nuts have been over-tightened. Rail creep might result in misalignment and mal-operation. Inform your SM(S). See NR/SMS/Appendix/02 for details

6.18 Check that the lock crank bracket assembly is in contact with plastic sleeve on sliding plane.

6.19 Examine the plastic sleeve on sliding plane. If wear exceeds 1 mm, report it as corrective maintenance.

6.20 Check the plastic pad on crank head. If the pad projects less than 0.5 mm from the crank head, or the chamfered edge of support pad is no longer visible report it as a corrective maintenance.

If the crank head pad requires renewal, remove the lock crank bracket assembly and examine the plastic support pad.

6.21 Examine the crank arm and arm pivot for wear as follows:

a) Move and hold the switch in the mid stroke position.

b) Push the ‘C’ heel against the blade and measure the gap between the heel and the first adjusting shim.

c) Pull the ‘C’ heel away from the blade and measure the gap between the heel and the first adjusting shim.

If the difference between the two readings is more than 2 mm, the lock crank bracket assembly shall be renewed.

With the VCC locked:

6.22 Check that the crank head fully engages the locking piece. Record the amount of engagement / position of the crank head See NR/SMS/Appendix/02 for details.

6.23 Test the stabiliser by trying to push the roller into its housing. If the device is inoperative (spring broken), report it as corrective maintenance.

6.24 Examine the control arm insulating bush. If wear exceeds 1 mm, report it as corrective maintenance.

6.25 Repeat clauses 6.1 to 6.24 for the other VCC lock and detector assembly.

7. Lubrication

NOTE: *The lubricants named in this section are recommended by the equipment manufacturer. Equivalent type lubricants may be used.*

T72 Point Machine

7.1 Lubricate with 'SHELL' Retinax HD Grade 2 grease - Multipurpose grease (blue) the following:

a) Lubricators (1 x internal, 1 x external).

b) grease gun with hexagonal fitting required.

c) Roller assembly.

d) Inside of output shaft cam.

e) Bevel gears (if applicable).

f) Clutch fork and shaft (if applicable).

g) Manual lever pivot (if applicable).

h) Drive arm pivot.

i) Drive rod pivots.

7.2 Lubricate with 'SHELL' Rimula C oil for diesel engine Viscosity SAE 20W-40 via an oil can the following:

a) Gears.

b) Lower shafts.

7.3 Lubricate with adhesive type grease the driving rod thread.

7.4 Lubricate with mineral oil the following:

a) Pivots of crank handle access mechanism.

b) Pivot of manual operation lever housing.

c) Pivots of machine cover latches.

d) Padlocks.

e) Hasp pivot.

VCC Lock

7.5 Lubricate with BP Energrease LS EP grease the following:

a) Surfaces between lock arm and lock crank bracket (lock crank pivot).

b) Both sides of crank head.

c) Plastic sleeve.

d) Locking piece.

e) Roller stabilising device.

VCC Detector

7.6 Lubricate with mineral oil the following:

a) Cam shaft, smear exposed portions of shaft (lock blade closed).

b) Cam shaft bearings via hole at either end of support frame.

c) Padlock.

Junction Box

7.7 Clean and protect terminations.

7.8 Lubricate with mineral oil the door hinges and lock.

8. Contacts and Terminals T72

8.1 Remove the contacts protection cover and check the condition of the contacts.

8.2 Replace the contact cover.

VCC

8.3 Check lock detection contact blades are touching the cam plastic cover (switch blade open).

8.4 Check lock detection contact blades are clear of the cam plastic cover (switch blade closed and locked).

If the contacts are touching the cam plastic cover when the switch blade is closed and locked, then the cam is worn. The contacts shall not be bent. The detector shall be replaced.

Or

The locking is out of adjustment. Arrange remedial action.

8.5 Clean contacts using lint free cloth moistened with an approved cleaner. Contacts are easily damaged. If the contacts are bent/damaged then the detector shall be replaced and a detection test carried out.

8.6 Clean the insulation on the contact block.

8.7 Examine and protect contacts and terminals.

9. General

9.1 Clean the cover and case (T72) and body (VCC) inside and out.

10. Tests and Final Checks

10.1 Carry out NR/SMS/PartB/Test/005 (Facing Point Lock Tests (T72 with VCC Lock).

10.2 Carry out NR/SMS/PartB/Test/007 (Detection Test (T72 with VCC Detector).

10.3 Check all labelling is intact, secure and legible.

10.4 Check and remove any foreign bodies found on the sliding plane or within the detector body.

10.5 Replace the VCC cover and secure padlock. A RKB221 shall be fitted.

10.6 Check for foreign bodies in the point machine, re-fit the lid and secure padlock(s). RKB221 padlock(s) shall be fitted.

10.7 Reset the crank handle cut-out and restore the point machine to power operation.

10.8 Observe correct power operation of the machine. There should be no excessive ‘kick back’ on the motor. If excessive kick back is noted this shall be investigated and rectified

10.9 Place an obstruction between the switch and the stock rail. Operate the points under power and check that the motor stops within 6 to 9 seconds. Remove the obstruction and operate the points under power.

10.10 Check that a RKB222 padlock is fitted to the crank handle access lever bracket.

10.11 Check that with power restored, that crank handle access is prevented.

10.12 The final check before completion of the work is to ask the Signaller to operate the points to Normal and Reverse positions (twice if possible). Observe correct operation.

END

Includes:	Unistar HR
Excludes:	Any other type of hydraulic points

GENERAL

Do not use solvent based cleaner to remove grease from the internal components of the DLD (Drive, Locking, Detection) unit. Clean by wiping surfaces clean with a lint free cloth which is disposed of after use.

See NR/SMS/PartA/A04 (Method Statement Summary) for information on safe working on point systems.

See NR/SMS/PartZ/Z02 (Point Reference Values) for all torque values used in this document.

NOTE: *In wet or inclement weather the drying bags are to be removed and stored safely and the DLD body left open for the shortest possible time.*

On completion of the work, any moisture shall be carefully removed, and the drying bags replaced before the lid is replaced.

1. Remote Condition Monitoring

If the points that you have requested to work on are fitted with Remote Condition Monitoring, check that the asset has been placed into maintenance mode prior to commencing work.

Prior to commencing work, previous current traces should be made available from the Remote Condition Monitoring system and checked for any abnormalities.

Also, on completion of the work new traces should be recorded and viewed so they can be compared with the traces produced before the maintenance activity.

When requesting permission from the Signaller to work on a set of points, ask the Signaller to operate points in both directions to verify and prevent any confusion on the set of points you have requested to work on.

REGULAR TESTS

2. Facing Point Lock

2.1 Carry out NR/SMS/PartB/Test/270 (Facing Point Lock Tests – Unistar HR).

ANNUAL SERVICE

3. Check For External Damage

3.1 Check for any damage, wear, or corrosion.

4. Power Pack

4.1 Check the concrete base, power unit mountings and fixings for damage and that all fasteners are secure.

NOTE: *The pump unit should be reasonably level and secure.*

4.2 Check the plug coupler cable and route for damage, signs of wear and chafing, remove any objects that might cause damage.

4.3 Remove the power pack lid (unlocking the lid automatically cuts power to the machine).

4.4 Remove the drying bags and place aside for disposal.

4.5 Check the lid latches are adjusted to give a secure fit, adjust as necessary.

4.6 Check the protective vents on the side of the case are clean and undamaged.

4.7 Check the safety paint marks on the overpressure valves – See Figure 1.

If the paint is damaged, then the unit is potentially operating above its recommended value.

If damage is seen, raise a work arising form to replace the power-pack as corrective maintenance within 6 weeks as a precautionary measure.

Check paint safety indicators of overpressure valves

Figure 1 – safety paint marks (highlighted) on overpressure valves

4.8 Check the advisory LEDs are illuminated.

4.9 Examine internal wiring.

NOTE: *Hydraulic fluid can cause degradation of insulation.*

4.10 Replace (with an approved product) the 3.6v battery that powers the LEDs – see Figure 2.

Figure 2 - Location of local indication battery within Unistar HR power pack

4.11 Clean and examine the pump unit, motor assembly and all fixings. Check for leaks, particularly around the base of the hand pump mechanism, the cover plate gasket and at the base of the motor.

4.12 Turn the pump control to the intended direction of operation.

4.13 Manually operate the points to both normal and reverse, checking the LED's illuminate in correspondence.

4.14 Check the hydraulic fluid level. If a top up greater than 0.5 litres is required check for leaks in the hydraulic system, rectify as required. If a leak cannot be found, report as corrective maintenance before the end of the shift. If more than 1 litre is required, or notching is felt during manual operation then bleed the system.

The maximum fluid level is indicated by the fluid being halfway up the sight glass as shown in Figure 3. Fluid level beyond this point may leak out of the vent cap during hot weather. This is normal and will not impact the operation. Surplus fluid may accumulate in the base of the unit and should be removed.

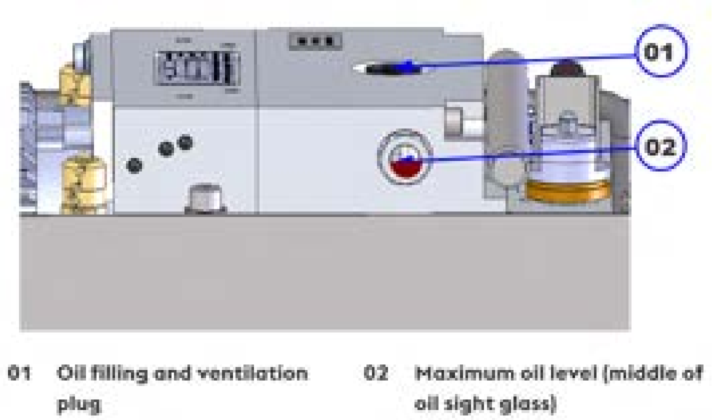


Figure 3 – Maximum fluid level reached when oil is half-way up sight glass

4.15 Install new drying bags and close the main lid and fit the padlocks. The position of the drying bags is shown in Figure 4.

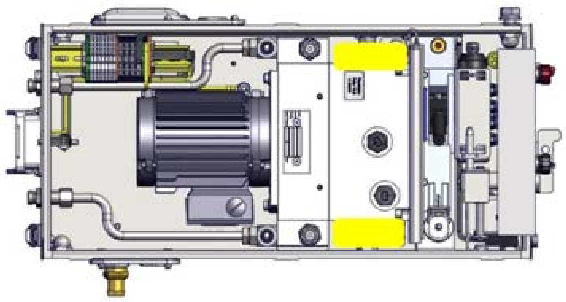


Figure 4 – Position of drying bags in Power-pack (shown in yellow)

5. Switch Rail Bracket and Rod Ends Assembly

5.1 Examine switch rail bracket assembly and fixing bolts. Check that the bolts are torqued in line with NR/SMS/PartZ/Z02 (Point Reference Values) and that the bolts protrude through the lock nuts. Philidas 4 threads, Hardlock 6 threads.

5.2 Schedule any corroded components for replacement.

5.3 Check that the Drive and Detector rod end threads are greased.

5.4 Check the Residual Switch Opening (RSO), if not within specification, check for an obstruction in the switch.

If there is no obstruction present, the lock rod end needs to be adjusted and the detection checked and adjusted as necessary. If the RSO cannot be brought into specification, then this indicates that the integrated pressure heads might be worn.

NOTE: *On switch diamonds, it may not be possible to achieve compliant RSO at the rear of the switch. This is due to the geometry of the switch diamond. Non-compliances shall be reported to the Section Manager for review.*

5.5 Check the integrated pressure heads visually for wear and correct function. If the pressure head does not automatically return to its uncompressed state when the switch is in the open position, then it shall be replaced.

This is indicated by the witness line (shown in Figure 5) failing to be seen when the switch is in the open position, and no resistance being felt when tightening the pressure head setting nut.

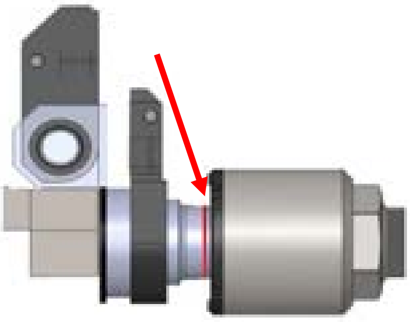


Figure 5 - Indicator mark on integrated pressure head highlighted in RED

5.6 Check the lock and detector bracket retaining plates. Schedule any lock and detector bracket retaining plates that show signs of wear or damage for renewal.

6. Drive Lock Detector Unit - DLD

6.1 Remove the DLD lid. Remove the drying bags and place aside for disposal.

6.2 Check the lid latches are adjusted to give a secure fit, adjust as necessary.

6.3 Check the protective vents (shown in Figure 6) on the side of the case are clean and undamaged.

Figure 6 - Protective vent indicated by arrow one on each side of the DLD

6.4 Check the plug coupler cables, hoods and route.

6.5 Check the hydraulic connections on the DLD(s) are tight and there are no leaks. Installation torques and check torques are given in NR/SMS/PartZ/Z02 (Point Reference Values).

6.6 Check the DLD securing bolts, or the DLD to Buttress Plate fasteners for security and tighten to specification if movement is observed under manual operation. Locking plate bolts shall be tightened to specification.

6.7 Check the safety marked elements in the housing of the DLD unit (see Figure 7), if the paint marks show movement has occurred, tighten to specification and paint new marks.

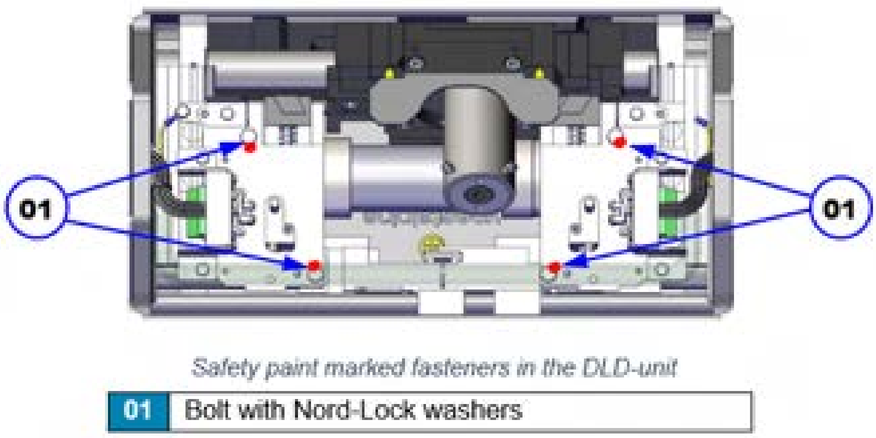


Figure 7 – Security pain marked fastenings within DLD unit

6.8 Manually operate to both normal and reverse positions, observe and verify the Lock Prism indicators overlap and align correctly and that Lock has been made.

6.9 Manually operate to both normal and reverse positions, when visual verification of the lock is made at the prisms, check the Detector Plate detection markings are visible and that Detection has been made (this will be verified by seeing the detection assembly engage).

6.10 Manually operate to both normal and reverse positions, observe the operation of the detector bar head and springs during manual operation. Check that the bolt head returns automatically.

6.11 Clean and lubricate the internal parts of the DLD as shown in Figure 8 with a manufacturer-approved grease (e.g. Renolit HT2).

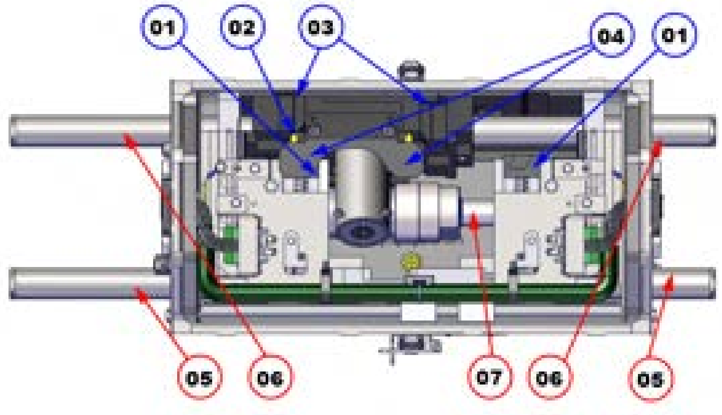


Figure 18: Greasing points DLD-unit

01	Head of the detector bar (Well visible grease film)	05	Detector rod **external**: no lubrication Detector rod **internal**: thin grease film
02	Locking plate (thin grease film)	06	Drive rod **external**: no lubrication Drive rod **internal**: thin grease film
03	Prisms (thin grease film)	07	Piston rod (**no lubrication**)
04	Guidance Bar (thin grease film)		

Figure 8 – greasing points within the DLD unit

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6.12 Install new drying bags and close the main lid and refit padlock. Position drying bags as shown in Figure 9.

Drying bags should be positioned so that they cannot obstruct moving parts of the mechanism.

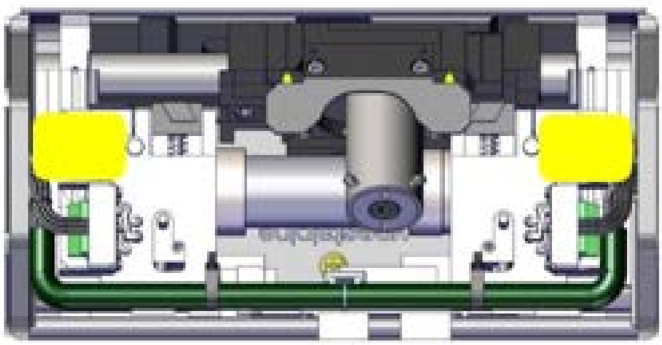


Figure 9 - Position of Drying Bags in DLD (shown in yellow)

7. Disconnection Boxes

7.1 Remove the lid and check:

a) Cables and cores are undamaged, correctly labelled, and free from degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

7.2 Refit the lid and (if provided) padlock.

8. Final Tests and Checks

8.1 Carry out NR/SMS/PartB/Test/270 (Facing Point Lock Tests – Unistar HR).

8.2 Carry out NR/SMS/PartB/Test/271 (Detection Test (Unistar HR).

8.3 Switch the power pack control to “Motor”, stow the manual operating handle and close the lid. Turn down the power cut-off latch to lock the lid and restore power.

8.4 Refit and lubricate padlocks (RKB 221 and 222 padlocks on the lock body, pump unit cover and local control lids). Check padlocks for condition and replace any showing signs of damage.

8.5 Ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

END

Includes:	WRSL Style CP & D Pneumatic
Excludes:	All other types of Pneumatic Point Machine

General

These machines operate on an air pressure of typically 50-60 psi. Care shall be taken when manipulating or regulating the air supply.

When required, the machine shall be isolated as follows:

- CP: Remove the de-energised N or R magnet valve armature depending on the lie of the points (e.g. points normal – remove the reverse armature).
- D: Disconnect the electrical feed to the magnet valve armature for the opposite lie of the points and maintain the lock valve energized. If you remove the plug coupler, point operation and detection shall be isolated.

Or

- CP or D: Insert a tapered block into the centre drive of the drive and lock movement

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests, Machine).

SERVICE A

2. Exterior

2.1 Examine machine covers, studs and padlocks.

2.2 Check visible tail cables and route.

2.3 Check air pipes and connections for leaks.

2.4 Check base-plate and castings for cracking. Operate machine under power and check the machine is secure. Tighten as necessary.

2.5 Remove fire risks and potential obstructions

2.6 Clean and apply adhesive grease to point drive and lock and detector movements.

2.7 Examine piston cylinder glands.

3. Interior

Before you start any work, isolate the machine.

Piston Assembly

3.1 Examine the following:

a) Piston cylinder; look for signs of swarf or corrosion.

b) Air connections. Break detection and listen for air leaks with the points in both positions. Tighten the piston ring as necessary using a 'C' spanner.

c) Piston connection to drive (mushroom and locknut).

Point Drive Assembly

3.2 Clean and examine base assembly and fixings.

3.3 Clean and examine point drive and lock movement, lock dogs, rollers and rivets.

3.4 Lubricate with lithium grease the following:

a) Point drive and lock movement.

b) Piston shaft.

c) Escapement.

d) Rollers (grease nipples x 9).

e) Lock blades and bearer plates. Chamfering and swarf indicates points are out of adjustment.

f) Lock dogs.

3.5 Check lock plunger connection and nut.

Contact Assembly

3.6 Remove accumulated dirt and moisture. Check for signs of cracking.

3.7 Examine the following:

a) Lock plunger and rollers.

b) Detector blades, slides and bolts.

c) Lock plunger retaining straps and bolts.

3.8 Examine yoke, pivot pin, slide bars, rollers, pins and fixing bolts.

3.9 Clean and lubricate with lithium grease the lock plunger and detector blades.

3.10 Clean and lubricate with oil the yoke slide bars, rollers, and pins.

3.11 Check the tension of yoke spring. The spring shall be tight with no loose motion. If the motion is loose, check the spring, pivot block and pivot pin; tighten or replace as necessary.

3.12 Examine the detector slide bar and centre pivot fastening.

3.13 Where fitted, check the heaters and mountings.

3.14 Examine the following:

a) Cable entries, blanking plates and water seals.

b) Internal wiring and terminations. Wiring on these machines tends to degrade due to contamination by oil and water.

c) Clean and protect as necessary.

3.15 Examine detection contact adjustment. Rollers shall rotate freely and sit in the bottom of notches for both N & R positions.

3.16 Examine terminal blocks, detection ('butterfly') contacts and mounting block. All fixings shall be tight.

3.17 Check contact springs and contact alignment in N & R positions; adjust as necessary.

a) Check fixings are tight.

b) Clean contacts with an approved cleaner.

c) Replace contacts that are worn or damaged.

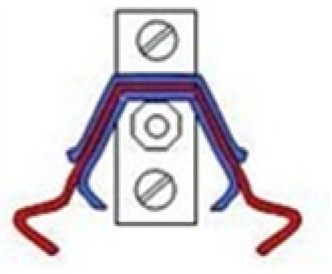


Figure 1 - Contacts

4. Valve Chest – Style CP

4.1 Wipe, clean and examine interior of case, where not treated with anti-condensation paint.

4.2 Examine the following:

a) Cable entry and terminations.

b) Circuit controller contacts. Clean or replace dirty, damaged or worn contacts.

c) Terminations and contact fingers. Clean and protect as necessary (excluding contact faces).

4.3 Examine and clean contact rocker arm. Lubricate with lithium grease.

4.4 Remove and clean both valve armatures using a lint free cloth. Lubricate (lightly oil) the bottom of each armature.

4.5 Check that magnet valve caps are screwed on tight.

4.6 Examine all air connections and joints.

4.7 Replace cover and padlock.

5. Valve Chest – Style D

5.1 Wipe, clean and examine interior of case, where not treated with anti-condensation paint.

5.2 Examine the following:

a) Air regulator lock nut, adjust regulation as necessary. A loose lock nut might cause the regulator to blow out.

b) Plug coupler terminations.

c) Cable entry.

d) Plug coupler fixing clips.

e) Valve seating bolts.

6. Tests & Final Checks

6.1 Carry out NR/SMS/PartB/Test/011 (Detector Tests, Electrical Detectors).

6.2 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests, Machine).

Any adjustments shall be verified manually before operating under power.

6.3 Replace covers and secure using padlocks (Lubricate).

The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

SERVICE B

General

6.4 Thoroughly clean machine and cylinder covers.

6.5 Lubricate with oil or lithium grease the piston cylinder.

7. Valve Chest – Style CP

7.1 Clean the air filter gauze with cleaning fluid.

7.2 Lubricate with oil the valve piston leathers

8. Valve Chest – Style D

8.1 Clean the plug coupler, protect as necessary.

9. Tests & Final Checks

9.1 Carry out NR/SMS/PartB/Test/011 (Detector Tests, Electrical Detectors).

9.2 Carry out, NR/SMS/PartB/Test/019 (Detection Loop Test).

9.3 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests, Machine).

Any adjustments shall be verified manually before operating under power.

9.4 Replace covers and secure using padlocks (Lubricate).

9.5 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests).

9.6 Ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

EP Drive and Lock Mechanism

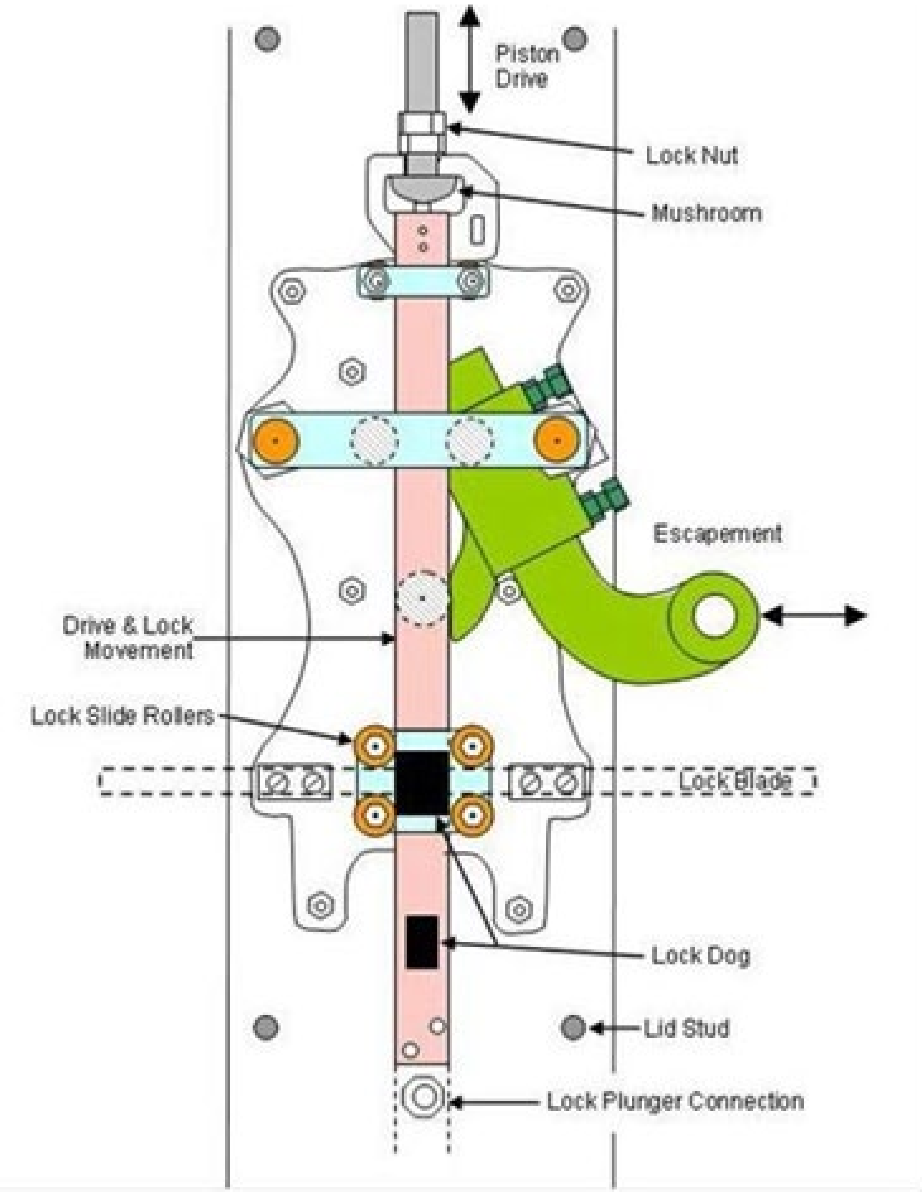


Figure 2 – EP Drive and Lock Mechanism

EP Detection Assembly

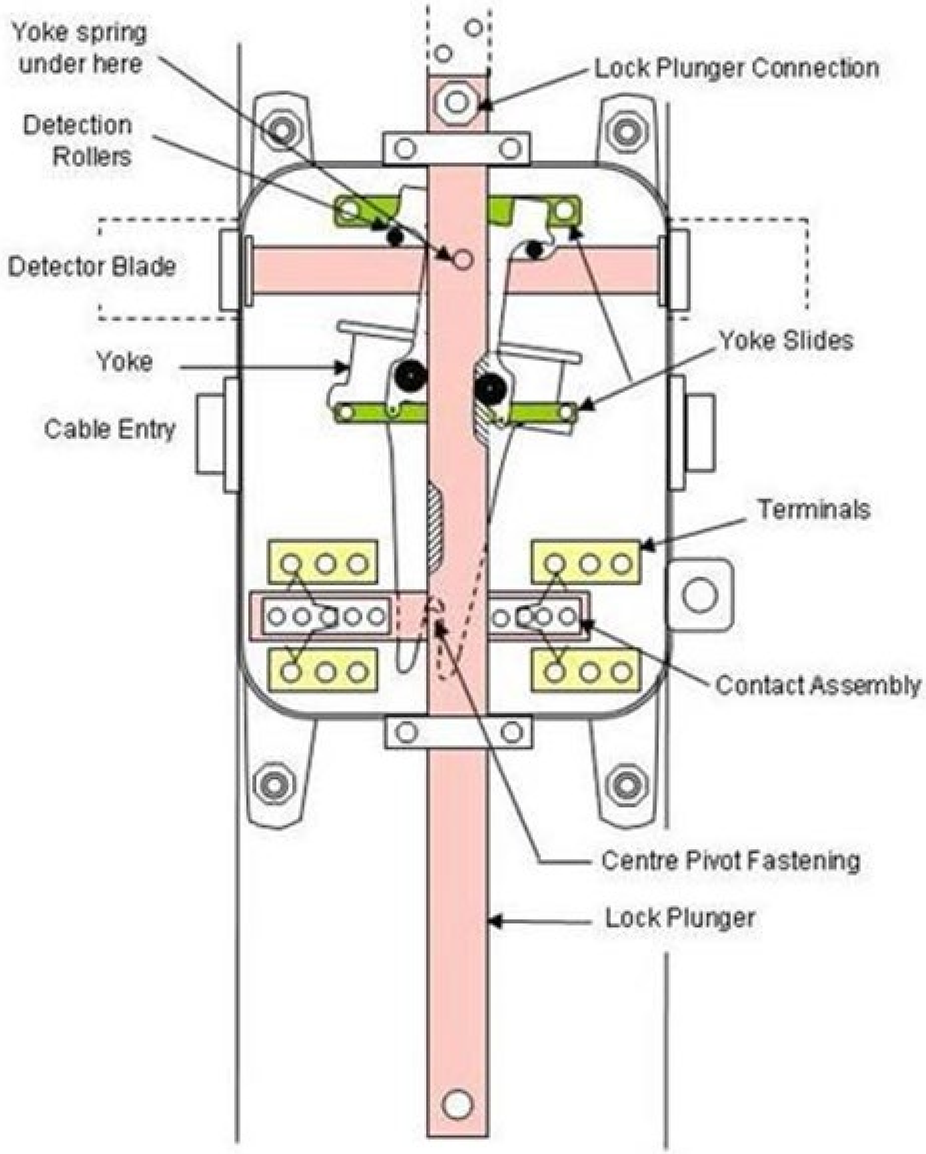


Figure 3 – EP Detection Assembly

END

Includes:	WRSL Hand and Air Points
Excludes:	All other Hand and Air Points

SERVICE A

1.1 Examine all air pipes and connections.

1.2 Examine point operating cylinder.

1.3 Examine point operating ram and seal, check for excessive free play. Where this is found to be unacceptable it shall be reported as corrective maintenance so that the necessary remedial action can be arranged.

1.4 Clean and lubricate the point operating ram with an adhesive type grease.

1.5 Examine and lubricate all point and drive fittings.

1.6 Examine and lubricate (P-Way) hand point mechanism, spring, and fittings.

1.7 Remove all fire risks and potential obstructions from or near point equipment e.g. oily waste, paper and ballast.

1.8 Wipe all external housing parts and fittings.

1.9 Examine wiring, termination's and cable entry - Check the cable is not chaffing.

1.10 Remove any moisture from bottom of housing and case.

1.11 With the co-operation of the Signaller/Panel Operator:

a) Operate the points locally by depressing button on top of the valve, observe correct movement and that the points are fitting up correctly.

b) Repeat for opposite lie of points.

c) Depress isolation plunger in valve chest and by use of the P-Way hand lever (where fitted) or by barring the points off, check that the force exerted by the hand point spring is enough to return and hold the switch rails in position against the stock rails.

d) Repeat this operation for opposite lie of points.

NOTE: *Any discrepancies shall be immediately reported as corrective maintenance so that the necessary remedial action(s) can be arranged.*

1.12 Carry out NR/SMS/PartC/PD01 (BR998 Detector) - Service A and any associated tests called by the SMS.

1.13 Arrange for points to be operated from the control point and observe apparatus functions correctly.

SERVICE B

2. Detector Test

2.1 Carry out NR/SMS/PartC/PD01 (BR998 Detector) - Service B and any associated tests called by the SMS.

END

Includes:	SGE Style VB Pneumatic
Excludes:	All other types of Pneumatic Point Machine

General

These machines operate on an air pressure of typically 50-60 psi. Care shall be taken when manipulating or regulating the air supply.

When required, the machine shall be isolated as follows:

a) Remove the plug coupler: point operation and detection shall be isolated.

Or

b) Insert a block into the point switch to prevent the points from operating.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests, Machine).

SERVICE A

2. Exterior

2.1 Examine machine covers, studs and padlocks.

2.2 Check visible tail cables and route.

2.3 Check air pipes and connections for leaks.

2.4 Check base-plate and castings for cracking. Operate machine under power and check the machine is secure. Tighten as necessary.

2.5 Remove fire risks and potential obstructions

2.6 Clean and apply adhesive grease to point drive and lock and detector movements.

3. Interior

Before you start any work, isolate the machine.

3.1 Examine the following:

a) Piston cylinder; look for signs of swarf or corrosion.

b) Air connections. Break detection and listen for air leaks with the points in both positions. Arrange for ‘O’ ring seals on end of cylinder to be replaced as necessary.

c) Piston connection to drive (lug, split pin and locknut).

3.2 Clean and examine base assembly and fixings.

3.3 Clean and examine point drive, escapement and lock assembly:

a) Baseplate, castings, rivets and fixings.

b) Point drive bar and slider plates.

c) Escapement, pivots and bolts.

d) Throwbar, drive lug and split pin.

e) Rollers and grease nipples.

f) Lock blade, lock dogs, and notches.

g) Chamfering and swarf indicates points are out of adjustment.

3.4 Clean and examine connection to detector box (Lug, bolt and split pin).

3.5 Lubricate with lithium grease the following:

a) Point drive and lock movement grease nipples.

b) Piston cylinder grease nipple.

3.6 Lubricate with oil the following:

a) Piston surface.

b) Wearing surfaces of drive mechanism.

4. Contact Assembly (Style HV)

4.1 Remove the cover, check the seal and castings.

4.2 Check the drain holes and ventilators. Remove any accumulated moisture and debris.

4.3 Clean and examine the following:

a) Locking bar and dogs.

b) Lock slides and notches.

c) Look particularly for wear (swarf) and chamfering (bright corners).

d) Detector slides and notches.

e) Guides, rollers, and fixings.

f) Cover plate and fixings.

4.4 Lubricate the slides with lithium grease.

4.5 Fill the oil cups with mineral oil.

4.6 Examine the following:

a) Detector actuators.

b) Rollers, pivots and split pins, lubricate with mineral oil. Rollers shall fully engage in notches and rotate freely.

4.7 Examine ‘shuttle mechanism’:

a) Moving contact and return spring assemblies.

b) Terminal blocks & fixings tighten / protect as necessary.

c) Contacts and springs, clean and protect as necessary.

d) Protection shall not be applied to contact faces.

e) Cables, cable entries, wiring and terminations.

4.8 Check heaters, where fitted.

5. Valve Unit – Style VG

5.1 Check exterior of case, pedestal and fixings

5.2 Wipe, clean and examine interior of case, where not treated with anti-condensation paint.

5.3 Examine the following:

a) Air regulator lock nut adjust regulation as necessary. A loose lock nut might cause the regulator to blow out.

b) Cable entry.

c) Plug coupler fixing screws.

d) Valve seating bolts.

5.4 Clean and check the exhaust ports.

6. Tests & Final Checks

6.1 Carry out NR/SMS/PartB/Test/011 (Detector Tests, Electrical Detectors).

6.2 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests, Machine).

Any adjustments shall be verified manually before operating under power.

6.3 Replace covers and secure using padlocks. An RKB222 shall be fitted.

6.4 Ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

SERVICE B

7. General

7.1 Thoroughly clean machine and cylinder covers.

7.2 Lubricate with lithium grease the piston cylinder grease plugs.

Only remove these plugs after the air has been isolated. Check they are properly refitted afterwards.

8. Valve Unit – Style VG

8.1 Clean air filter gauze with cleaning fluid.

8.2 Clean plug coupler, protect as necessary.

9. Final Checks and Tests

9.1 Carry out NR/SMS/PartB/Test/011 (Detector Tests, Electrical Detectors).

9.2 Carry out NR/SMS/PartB/Test/019 (Detection Loop Test).

9.3 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests, Machine).

9.4 Check that any adjustments are verified manually before operating under power.

9.5 Replace covers and secure using padlocks. An RKB222 shall be fitted.

9.6 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests).

9.7 Ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

EP Drive and Lock Mechanism

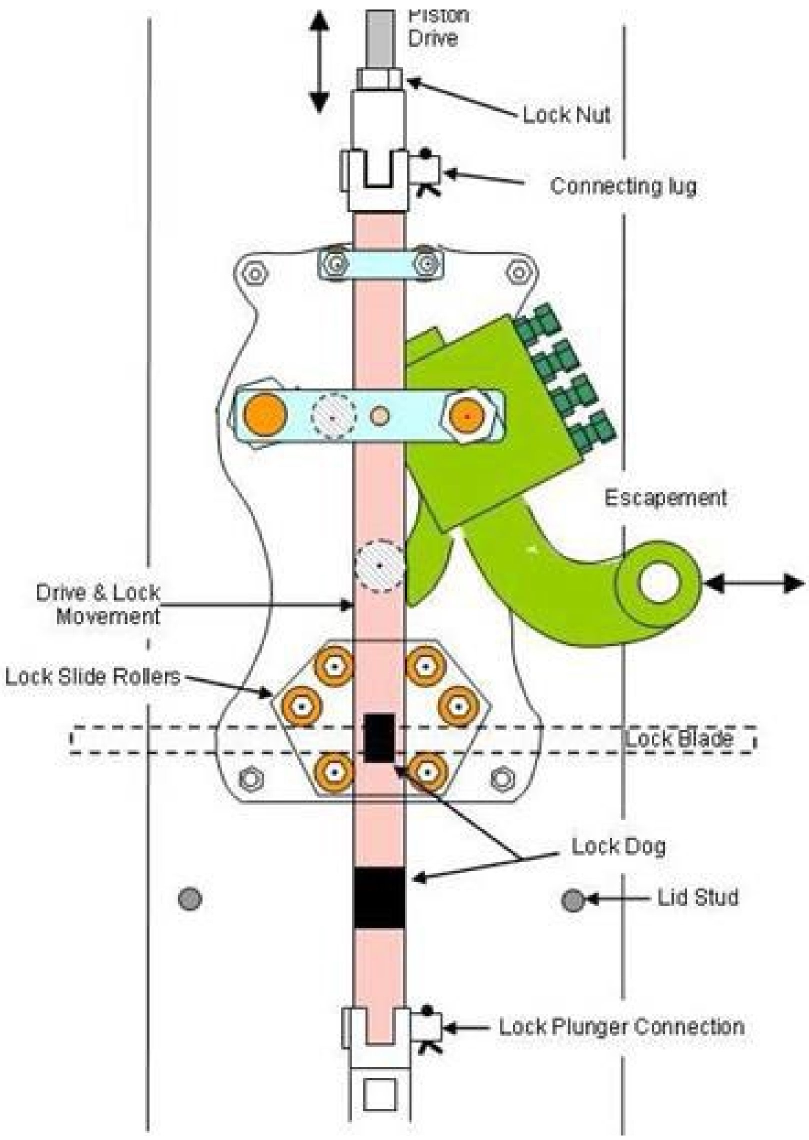


Figure 1 – EP Drive and Lock Mechanism

EP Detection Assembly

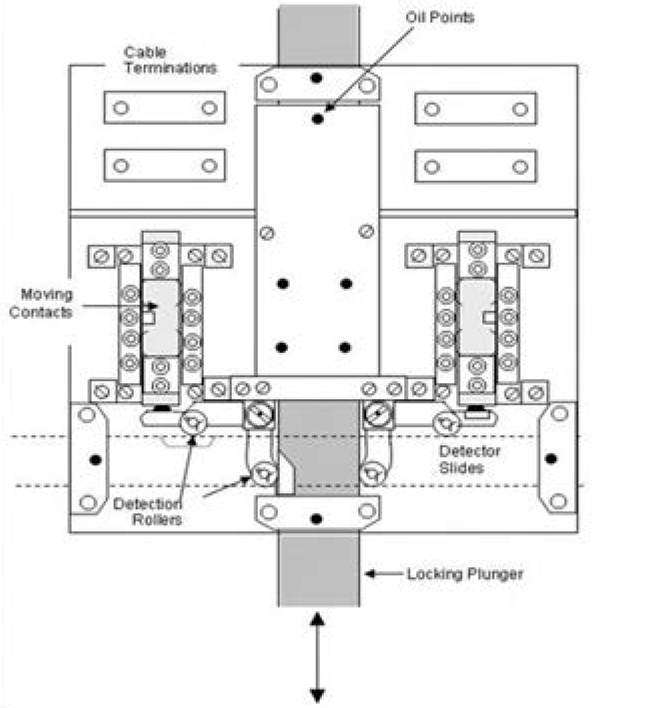


Figure 2 – EP Detection Assembly

END

Includes:	BR998 detectors used for main or supplementary point detection
Excludes:	Other detector types, internal detectors in point machines

General

Liaise with the Signaller before carrying out work on detectors.

If any adjustments are made, the correct detection tests shall be carried out before the equipment is handed back to the Signaller.

Main point detectors are usually situated at the points toe, supplementary detectors towards the heel. At some installations (e.g. double slips) the supplementary detector can be located at the toe. If you are in any doubt, ask your SM(S).

SERVICE A

1. Exterior

1.1 Remove all fire risks and potential obstructions.

1.2 Check the security of the detector casting fixings and the condition of the lid. The detector assembly shall not move when the points are operated. The lid shall provide an effective weather seal.

1.3 Open the lid, remove and examine detector cover. Report damaged covers as corrective maintenance. Track vibration can cause terminal assembly bolts to gradually puncture through the cover.

1.4 Wipe and examine the detector rods, adjusters, connections, and fixings. Protect screw threads with adhesive grease. The detector rod shall not be able to short against the rail.

2. Detector Assembly

2.1 Clean, check and examine the detector assembly, particularly:

a) Base plate and fixings.

b) Detector base casting and fixings

c) Check the circlips are fitted in the correct position

d) Detector slides, notches, holding clamps, and fixings. The tappet slides shall be securely held and not bent or damaged.

e) Check the locknut on the adjustable tappet for tightness.

f) Rocker arm, pivot, return springs, and stops. The pivot shall be rigid, and the springs correctly return the rocker.

g) Rollers, pivots, and fixings. The rollers shall be fully engaged into the notches and freely rotate.

h) Microswitch assemblies and fixing bolts. The adjustable tappet screws and rocker interfaces shall not be clogged.

2.2 The rubber ‘gaiters’ shall be in good condition and undamaged. No part of the O-ring seal between the switch body and the box casting shall be visible

Any problems found with micro switches shall be reported as corrective maintenance.

3. Terminal Assembly

3.1 Remove the terminal box cover. Check that the water seal is undamaged and effective.

3.2 Remove accumulated moisture and debris. Excessive moisture or water ingress shall be reported as corrective maintenance immediately.

3.3 Examine cable entry, glands, visible tail cable and route. The glands shall form a tight seal around the cables, if not tighten or replace as necessary.

3.4 Clean and examine terminal block and set screws.

3.5 Examine cable cores, internal wiring, and terminations to micro-switches and terminal block. Protect terminations as necessary. Check that the terminations are tight, and that wire insulation is not degraded.

3.6 Replace the terminal box cover. Check that the securing nuts are tight

4. Lubrication & Final Checks

4.1 Lubricate, using lithium grease the following:

a) Rocker arm grease nipple.

b) Detector slide grease nipples.

c) Rocker springs.

4.2 Apply a minimum of mineral oil to roller spindles, tappets, and microswitch contact surfaces.

4.3 Smear a film of oil onto the surface of detector slides.

4.4 Observe the apparatus for correct operation. Lubricate padlock, replace and secure detector lid.

5. Local Policy Requirement

5.1 Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.

5.2 Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.

5.3 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.

For Detectors fitted to Train Operated Points Systems

5.4 If any adjustments are made, then carry out NR/SMS/PartB/Test/018 (Train Operated Points Detection Test).

SERVICE B

6. Detection Tests

6.1 Where the detector is used for main point detection, carry out NR/SMS/PartB/Test/011 (Detector Test Electrical Detectors).

6.2 Where the detector is used for supplementary point detection, carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test).

6.3 Carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests).

APPENDIX A - BR 998 Detector

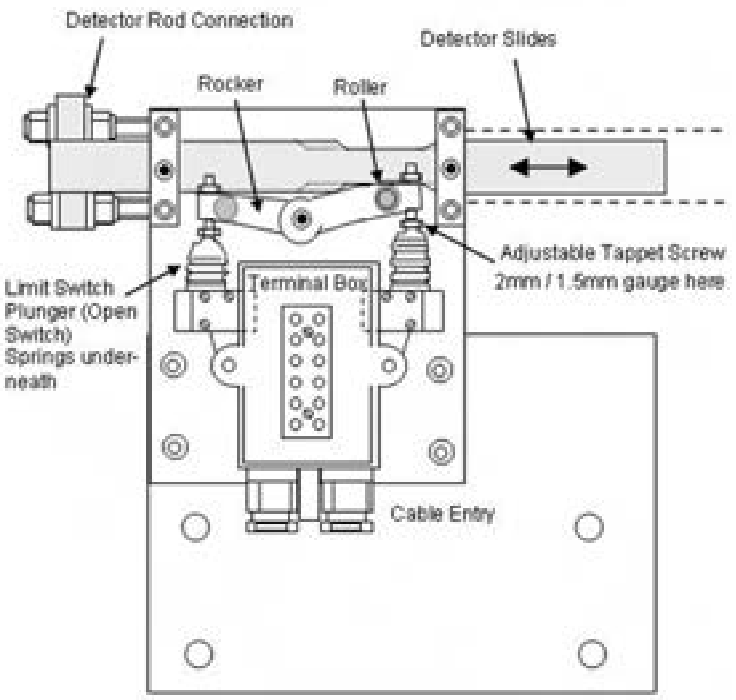


Figure 1 - BR 998 Detector Layout

END

Includes:	Crewe Type, LMS Type, SGE Type detectors used for main or supplementary point detection
Excludes:	BR 998 detectors, internal detectors in point machines

General

Liaise with the Signaller before carrying out work on detectors.

If any adjustments are made, the correct detection tests shall be carried out before the equipment is handed back to the Signaller.

Main point detectors are usually situated at the points toe, supplementary detectors towards the heel. At some installations (e.g. double slips) the supplementary detector can be located at the toe. If you are in any doubt, ask your SM(S).

SERVICE A

1. External

1.1 Remove all fire risks and potential obstructions.

1.2 Check the security of the detector casting fixings and the condition of the lid. The detector assembly shall not move when the points are operated. The lid shall provide an effective weather seal.

1.3 Clean and examine the following:

a) Detector rods, insulations, lug connections, screw threads nuts and lock nuts.

b) Detector slides.

c) Detector fixings.

1.4 Apply adhesive type grease to exposed surfaces of detector slides.

1.5 Examine visible tail cable and cable route. Tail cables shall be protected by cable ducting or orange pipe.

2. Internal – General

2.1 Check the interior of the detector casting, remove moisture and debris. Drain holes shall be unobstructed and effective. Detector slides and cable entries shall be fitted with seals.

2.2 Clean and examine detector slides, bushes and wear plates.

2.3 Lubricate (lithium grease) detector slides, bushes and wear plates (oil).

3. Rocker Assemblies

3.1 Clean and examine the following:

a) Rollers and notches.

b) Rollers shall rotate and fully engage in the notches.

c) Pivots.

d) Spindles.

e) Spring assemblies.

f) Spring-loaded operation shall be smooth and quick.

g) Stops.

h) Split Pins and Fixings.

3.2 Lubricate joints and wearing surfaces, including grease points and oil points, where provided.

4. Tappet & Slider Mechanisms

4.1 Clean and examine the following:

a) Tappets, notches and sliders.

b) Dogs and fixings. Dogs shall fully engage in notches. Shiny corners and swarf indicate an adjustment problem.

c) Packing pieces, guide ways, straps, rivets and fixings.

d) Adjusters. Adjustment facilities shall be secure.

e) Spring and end stop assemblies. Spring-loaded operation shall be smooth and quick.

f) Fixings.

4.2 Lubricate joints and wearing surfaces, including grease points and oil points, where provided.

5. Contact Assemblies

5.1 Clean and examine moving contact assemblies, rockers, pivots, spindles, springs, split pins and fixings.

5.2 Examine contact bands/segments and contact fingers.

a) Clean with a lint free cloth.

b) Apply a protection agent as required (except contact faces).

c) Apply an approved contact lubricant to the contact faces.

5.3 Check spring tension is satisfactory.

5.4 Observe contact movement during manual operation.

6. Wiring and Terminations

6.1 Examine cables and wires. Look particularly for:

a) Degraded or damaged (chafing) insulation.

b) Trapped wires.

c) Unsupported wires.

d) Risk of short circuit (electrical contact with adjacent terminals, casing or metal parts).

e) Fouling by moving parts.

f) Contamination.

6.2 Examine terminations, clean and protect as necessary.

6.3 Where provided, check heaters.

7. Final

7.1 Check for any slackness or maladjustment and that the equipment operates correctly. If any defects are found, the equipment shall be treated as faulty and the Signaller informed.

7.2 Lubricate padlock, secure detector cover, and observe the apparatus for correct operation.

8. Local Policy Requirement

8.1 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.

8.2 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.

SERVICE B

9. Detection Tests

9.1 Where the detector is used for main point detection, carry out NR/SMS/PartB/Test/011 (Detector Test Electrical Detectors).

9.2 Where the detector is used for supplementary point detection, carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test).

END

Includes:	Mechanical Detectors
Excludes:	All other types on Point Detection

General

Signal wires to/from mechanical detectors are covered in NR/SMS/PartC/SG12 (Semaphore Signals).

SERVICE A

1. Mechanical Detectors

1.1 Check that the detector slides are not obstructed and are clear of ballast. Rectify as necessary.

1.2 Check the installation is undamaged and securely fitted, look for:

a) Broken or cracked casting.

b) Loose fixings.

c) Worn slide(s).

d) Seized rollers.

Rectify as corrective maintenance as necessary.

1.3 Check that all shackles, cotter pins, and split pins are undamaged and secure.

1.4 On floating mechanical detectors, check the anchor rod is securely fitted.

1.5 Scrape, wipe, and clean the detector as necessary. Lubricate the slide(s) with adhesive grease.

Check that the cover is correctly fitted after maintenance.

1.6 Carry out NR/SMS/PartB/Test/012 (Detection Test (Mechanical)).

END

Includes:	Fixed Stretcher Bars; Adjustable Stretcher Bars; Tubular Stretcher Bars; Lock Stretcher Bars; Bracket Fasteners; Extension Pieces; Drive Rods; Lock Rods; Detector Rods; Connections; Lugs and Insulations
Excludes:	Nuts/ bolts not associated with point fittings; Adjustable tie bars fitted to some Clamplocks; and Hand Points

GENERAL

The safe running of trains is the top priority; actions taken shall reflect this at all times, if you are unsure block the line.

An FPL test shall be carried out and recorded on the relevant NR/SMS record card after any adjustments or nut tightening.

Security of Fastenings

The tightness and positioning of nuts and locking nuts on point fittings shall be checked by using a calibrated torque wrench as relative to the nuts in use.

Heads of bolts (if a bolt head retaining plate is not fitted) shall be prevented from turning by use of an approved spanner or other approved retaining device whilst torque is applied to its associated nut(s).

The tightness of nuts and locking nuts on **all** point fittings, **including TSB motion unit fastenings**, shall be checked by using a torque wrench, refer to NR/SMS/PartZ/Z02 (Point – Reference Values).

Bolts shall be of a length to accommodate the relative locking function (at least two visible threads showing once the fastening is installed in its 'service' configuration).

A thread is defined as a continuous raised line which goes around the outside of the bolt.

Types of Fastenings

On fixed stretcher bar assemblies, various types of fastenings can be found depending on the age of the installation. If fastenings are replaced Hardlock nuts and grade 8.8 M20 bolts shall be used.

In some positions (e.g. the goose neck) it might not be possible to fit these fastenings, the process detailed in NR/L2/TRK/6100/Mod05 (Fixed Stretcher Bars) shall be followed in these circumstances.

On 35mm adjustable stretcher bar assemblies fitted to point systems, Hardlock nuts and full/half nut locking nuts can be found on the adjustable bar. Depending on the age of the installation along with torque prevailing nuts on the bracket fastenings. The process detailed in NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars) shall be followed for any replacements or adjustments.

For HPSS point systems adjustable stretcher bar preventative or corrective maintenance items can be found in NR/L2/SIG/11400.

Table 1 details the different types of fastenings that are associated with tubular stretcher bar assemblies.

Motion Unit Colour	Locking Technology	Bolt Type	Grade
Yellow (Full Depth)	Locking Helicoil fitted in Motion Unit	M20 x 80mm	8.8
White (Full Depth front Position Clamp Lock Only)	Locking Helicoil fitted in Motion Unit	M20 x 90mm	8.8
Red (Shallow Depth Web Mounted AND all positions for RT60)	Locking Helicoil fitted in Motion Unit	M20 x 110mm	8.8
Orange (Shallow Depth Foot Mounted)	Shakeproof Bolt & Nut retaining clip	M20 x 80mm Shak epro	8.8
Motion Unit to Tube Connection	Locking Helicoil fitted in End Post	M20 x 80mm	8.8

Table 1 – Fastenings

The process detailed in NR/L2/TRK/6100/Mod04 (Tubular Stretcher Bars) shall be followed for any replacement of any component or if there is an adjustment to the length of the tube assembly required.

The fastenings for the tubular stretcher bar shall only be used once.

Installation of Point Fittings

Details on the installation of fixed stretcher bar assemblies can be found in NR/L2/TRK/6100/Mod05 (Fixed Stretcher Bars).

Details on the installation of adjustable stretcher bar on non HPSS Point Systems assemblies can be found in NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars).

For HPSS Point Systems assemblies can be found in NR/L2/SIG/11400.

Details of before/after checks for fixed and adjustable stretcher bar assemblies can be found in NR/SMTH/Part04/PA02 (Replace or Adjust a Point Stretcher Bar).

Details on the installation of tubular stretcher bar assemblies can be found in NR/L2/TRK/6100/Mod04 (Tubular Stretcher Bars).
For Tubular Stretcher Bar assemblies, the before/after checks can be found in NR/SMTH/Part04/PA04 (Replace or Adjust a Tubular Stretcher Bar).

For other point system equipment in NR/SMTH/Part04/PA01 (Replace Rodding, Drives, Lock and Detector Equipment).

Root cause of deficiencies

If any component is found to be loose, broken or requires adjustment; the cause for it shall be investigated. Incorrect set-up of fittings and defects with the P Way can set up vibrations and stresses as trains pass over causing fractures and nuts to loosen on the point fittings. If you are in any doubt, ask your SM(S).

Hardlock Nuts

Hardlock nuts are an alternative vibration resistant nut to the conventional main nut/locking nut configuration (see Appendix D). They can be used on stretcher bars and drive rods.

On adjustable stretcher bars that have a metric M30 thread the nuts are finished in a bright zinc plate with a yellow finish.

On fixed stretcher bars that have a metric M20 thread the nuts are finished in a bright zinc plate.

On drive rods that have a one and a quarter inch imperial Whitworth thread they are finished in a bright zinc plate only.

These different thread types are not compatible, nuts and bolts of the same thread type shall only be used together. If you are in any doubt, ask your SM(S).

Torque Prevailing Nuts (self-locking)

Philidas turret nuts are no longer generally available. SNEP DAH class 8 double slotted self-locking nuts can be used as a direct equivalent. Further details on these nuts can be found in Appendix C.

Corrective Maintenance

Where corrective action is required as part of the maintenance activity due to component faults, these shall be classed as corrective maintenance and reported as detailed in NR/SMS/PartA/A02 (Preventative and Corrective Maintenance) and to your SM(S). This includes any adjustment or tightening of nuts, lock nuts, and bracket fasteners or replacement of complete stretcher bar assemblies.

Imperial/Metric

Older point system may use imperial nuts and bolts on certain fittings, newer or replaced fittings may use metric. Imperial bolts and metric nuts (or vice-versa) shall never be mixed as this can lead to damage and failure of the fastening.

Track Gauge (TG), Free Wheel Passage (FWP), Free Wheel Clearance (FWC), and Residual Switch Opening (RSO)

It is the responsibility of the Section Manager (Track) (SM(T))to measure and record the TG, FWP, FWC, & RSO on point systems during supervisory inspections. Additionally, it is also the responsibility of the Signal Technician to measure and record the FWP, FWC, and RSO on point systems during preventative maintenance.

To enable the installation of any fixed or adjustable stretcher bars, The SM(S) shall arrange for competent personnel to measure track gauge prior to the replacement of the stretcher bar assembly.

Reference Values

Refer to NR/SMS/PartZ/Z02 (Point – Reference Values) for reference values on point systems.

SERVICE A

1. Point Fittings (All types)

Not all the tasks in this section are applicable to all point installations (e.g. Clamp Lock & HPSS). If you are in doubt, ask your SM(S).

For point fittings that are part of a SO Hydraulic Supplementary Point Drive System refer also to NR/SMS/PartC/PF04 (SO Hydraulic Supplementary Point Drive System).

1.1 Check that the point number is correctly fitted and clearly visible.

Numbers are on the first bearer in front of the soleplate to the left or right of the centre line depending on the normal lie of the points.

1.2 Where power operated points have the number on the machine, power pack or other operating mechanism, check it is correct and legible.

1.3 Remove fire risks and potential obstructions. Orange pipes (etc) shall not cause any obstructions. Icy weather can cause ballast to expand.

1.4 Clear any excessive ballast which is within 30mm of point operating equipment or likely to obstruct slide chairs.

1.5 Check the insulations; remove any possible conductive material.

1.6 Scrape, wash, and wipe all components to allow examination for defects or cracks/breakages. Where necessary use a wire brush and a detergent based cleaner to remove dirt and grease.

1.7 Check stretcher bar kicking strap clearances. Refer to NR/SMS/PartZ/Z02 (Point – Reference Values).

1.8 Check there is the required clearance between the bottom of the rail and drive/lock/detection rods. Rods shall not bind on rails during operation. Plastic rail clips may be fitted as a temporary solution to protect from track circuit failure.

1.9 Check that when the points are in the normal or reverse position there is no excessive distortion of the stretcher bars or brackets.

Distortion of the stretcher bar or brackets when the switch rail fits up to the stock rail, indicates incorrect drive set up or incorrect installation of the stretcher bar or brackets. The cause shall be identified before rectification is undertaken. If you are in doubt, ask your SM(S).

1.10 If provided, check any point heating equipment for security and position.

NOTE: *During this check, be aware the point heating might be active.*

Report any defects to your SM(S).

2. Nuts and Bolts (All Types)

On fixed stretcher bar assemblies where loose nuts are found on bracket to rail fastenings that are not Hardlock nuts, they shall be replaced with Hardlock nuts and M20 bolts. See full details in NR/L2/TRK/6100/Mod05 (Fixed Stretcher Bars).

Both Torque Prevailing nuts and Hardlock nuts and M20 bolts can be used on Lock Stretcher assemblies.

Details on the tightening of different types of nuts can be found in Appendix B.

Further tasks on nuts and bolts relative to the type of stretcher bar used are in sections 3 & 4.

2.1 Where torque prevailing nuts (such as Philidas or SNEP DEH) are used:

Check that the nut is tight by the application of a calibrated torque wrench set to 200Nm (the nut shall not move).
If the nut is loose, both the nut and bolt shall be replaced with new components and torqued to the values detailed in NR/SMS/PartZ/Z02 (Point – Reference Values).

See the note in the preamble of this section for fastenings on fixed stretcher bars.

Details of these nut types are shown in Appendix B. These nuts and bolts can be imperial or metric.

2.2 Where Hardlock nuts are used on fixed stretcher bars/Lock Stretcher Bars:

Check that the female nut is tight by the application of a torque spanner set to 200Nm.

If the female nut is loose, both female nuts associated with the connection shall be backed off and the process detailed in Appendix B (Hardlock Nuts on fixed stretcher bars) shall be followed.

Details of these nut types are shown in Appendix C. Hardlock nuts on adjustable stretcher bars fitted to non HPSS Point systems are covered in section 4 and NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars). These nuts and bolts are metric.

2.3 Where square nuts (and occasionally hex nuts) are used on fixed stretcher bars:

Check that the nut is tight by the application of a calibrated torque wrench set to 200Nm (the nut shall not move).

If the nut is loose, it shall be replaced as detailed in NR/L2/TRK/6100/Mod05 (Fixed Stretcher Bars).

See the note in the preamble of this section for fastenings on fixed stretcher bars. Historical fastenings are normally imperial.

Fastenings associated with Philidas / SNEP / Hardlock components are normally metric.

Details of these types of nuts on adjustable stretcher bars fitted to non HPSS Point Systems are in NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars).

2.4 Check all nuts and lock nuts on detector and lock rods are secure and tight.

The nuts shall not move by application of a short spanner. See the details in NR/SMS/PartC/PA00 (Point Equipment General).

2.5 Check the drive rod is securely fitted to the throw bar of the point machine.

2.6 Following any adjustments (nut tightening or nut and bolt replacements) carry out NR/SMS/PartB/Index - FACING POINT LOCK TEST (001-055).

3. Fixed Stretcher Bars (Only)

The stretcher bar assembly (including all of the stretcher bar, the brackets, insulations, and nuts/bolts/washers) shall be considered as a line replacement unit which shall be replaced as a whole.

New line replacement units shall use Hardlock nuts and grade 8.8 M20 bolts only. Details can be found in drawing number RE/PW/721.

If any defects are found, other than a single loose nut and bolt, the whole assembly shall be replaced.

Where individual fastenings require replacement, the fastening may be replaced alone but the fastenings shall be replaced as a pair (see detail in NR/L2/TRK/6100/Mod08 (Action Tables).

Where corrective maintenance activities are required in this section, see NR/L2/TRK/6100/Mod05 (Fixed Stretcher Bars).

NOTE: *Detailed information on these items is contained in NR/L2/TRK/6100/Mod05 (Fixed Stretcher Bars). For explanation of terminology see Appendix A.*

<u>General</u>

3.1 Examine the components of the Stretcher Bar.

a) Brackets - check for cracking.

b) Stretcher Bars - check for bent bars and cracking/breakages.

<u>Brackets</u>

3.2 Check that the Bracket Fasteners are in place and secure. Check there is no movement relative to the rail. Rectify as necessary.

<u>Stretcher Bar</u>

Tasks 3.3 to 3.13 shall be undertaken for both the Normal and Reverse position of the points.

3.3 Examine the back of the switch blades visually for flange back contact. If flange back contact is found or suspected, it shall be reported as corrective maintenance.

3.4 Check for theoretical flange back contact using the wheel profiles part of the S&C gauge.

If the gauge does not fit freely the defect shall be reported as corrective maintenance and dealt with according to NR/L2/TRK/6100/Mod08 (Action Tables).

3.5 Check that the toe opening is correct, record the measurements. Refer to NR/SMS/PartZ/Z02 (Point – Reference Values).

If the switch openings are compromised by track gauge, the defect shall be reported as corrective maintenance.

3.6 Examine the following on stretcher bars.

a) Insulations.

b) Nuts and bolts.

c) Lock nuts (if fitted) and screw thread.

With the exception of defective nuts and bolts, which may be replaced in isolation (as a pair), any other replacement shall require the whole stretcher bar assembly to be replaced.

3.7 Examine the Lock Stretcher Bar. Check for cracks around the bolt holes and damage/corrosion to the Lock Stretcher Bar.

Any defects found shall require the replacement of the Lock Stretcher Bar and fastenings. Both Torque Prevailing nuts and Hardlock nuts and M20 bolts can be used on Lock Stretcher assemblies.

3.8 Measure by use of the S&C gauge the Free Wheel Passage (FWP). Refer to NR/SMS/PartZ/Z02 (Point – Reference Values).

Insert the S&C gauge at the rear stretcher bar and move towards the heel of the switch. Identify the maximum FWP.

On slips measure the FWP one metre either side of the end of the switch planning.

3.9 Measure by use of the S&C gauge the Free Wheel Clearance (FWC). Refer to NR/SMS/PartZ/Z02 (Point – Reference Values).

Insert the S&C FWC gauge at the rear stretcher bar and move towards the heel of the switch. Identify the minimum FWC.

3.10 Measure that the Residual Switch Openings (RSO) are correct throughout the planed length, Record the measurements. Refer to NR/SMS/PartZ/Z02 (Point – Reference Values).

3.11 Record the FWP, FWC, & RSO values on record card NR/SMS/PartR/PF01/RC01 (Point Fittings).

3.12 If the FWP, FWC or RSO is incorrect it shall be classed as corrective maintenance and dealt with according to NR/L2/TRK/6100/Mod08 (Action Tables).

If the recorded value increased by more than 3mm on the previous two measurements but remains compliant to the values in NR/SMS/PartZ/Z02 (Point – Reference Values) it shall be reported as a trend requiring corrective maintenance to the Section Manager (Track).

3.13 Any defects or deficiencies that are found and are recorded as corrective maintenance shall be dealt with according to NR/L2/TRK/6100/Mod08 (Action Tables).

4. Adjustable Stretcher Bars (Only)

The Stretcher Bar Assembly (including the stretcher bar complete with bushes, lock nuts, and brackets) shall be considered as a line replacement unit, if any defects are found the whole assembly shall be replaced. Where individual nuts and bolts require replacement, the nut and bolt may be replaced alone.

Where corrective maintenance activities are required to these items on non HPSS Point systems see NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars) and Appendix B for details.

Detailed information on these items fitted to Non HPSS Point Systems are contained in NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars).

Detailed information on these items fitted to HPSS Point systems are contained in NR/L2/SIG/11400 (HPSS Handbook). Where preventative and corrective Maintenance activities are required to these items on HPSS Point systems see NR/L2/SIG/11400.

For details of terminology see Appendix A.

4.1 Examine the components of the Stretcher Bar Assemblies

a) Brackets: Check for cracking particularly around drilled holes or at weld of the strengthening web.

b) Stretcher Bars: Check for bent bars and damaged threads.

c) Bushes: Check for distortion and deterioration.

Any defects found shall require the replacement of the Stretcher Bar Assembly.

4.2 Examine the Lock Stretcher Bar. Check for cracks around the bolt holes and damage/corrosion to the Lock Stretcher Bar.

Any defects found require the replacement of the Lock Stretcher Bar.

Both Torque Prevailing nuts and Hardlock nuts and M20 bolts can be used on Lock Stretcher assemblies.

<u>Brackets</u>

4.3 Check that the Bracket Fasteners are in place, secure and tight. Check there is no movement relative to the rail. Rectify as necessary.

<u>Stretcher Bars</u>

Tasks 4.4 to 4.14 shall be undertaken for both the Normal and Reverse position of the points.

4.4 Examine the back of the switch blades visually for flange back contact. If flange back contact is found or suspected, it shall be reported as corrective maintenance.

4.5 Check for theoretical flange back contact using the wheel profiles part of the S&C gauge.

If the gauge does not fit freely:

On 35mm square section adjustable stretcher bars the defect shall be recorded as corrective maintenance and dealt with according to NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars).

On HPSS point systems the defect shall be recorded as corrective maintenance and dealt with according to ER/R/1/0224 (via NR/L2/SIG/11400).

4.6 Check that the toe opening is correct, Record the measurements. Refer to NR/SMS/PartZ/Z02 (Point – Reference Values). Id the switch openings are compromised by track gauge, the defect shall be reported as corrective maintenance.

4.7 Check that the adjustable stretcher bars are securely attached. Check that the lock nuts are in place with at least four threads (2 threads if Staytite Hardlock nuts are used) showing beyond the end of each locking nut.

The amount of exposed thread is normally symmetrical. Report any problems as corrective maintenance.

4.8 Check that the locknuts are properly adjusted to provide the locking function.

For 35mm adjustable stretcher bar assemblies on point systems details on this can be found in NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars).

On HPSS Point Systems details on this can be found in ER/R/1/0224 (via NR/L2/SIG/11400).

4.9 If any of the following defects are found, then the Signaller shall be informed immediately, a 20-mph emergency speed restriction imposed, and the defect repaired within 36 hours:

a) A missing, broken, or detached stretcher bar, or

b) A cracked stretcher bar, or bracket that significantly reduces the integrity of the stretcher bar assembly or

c) Less than 4 threads (2 for Staytite Hardlock nuts) showing beyond the locking nut. All other point fitting components shall in place, secure, and all nuts are tight.

If these conditions cannot be met or if any other components in any of the other stretcher bar assemblies are missing, defective, broken, or detached, the line shall be blocked pending repair.

This action applies to both facing and trailing switches.

4.10 Measure by use of the S&C gauge the Free Wheel Passage (FWP). Refer to NR/SMS/PartZ/Z02 (Point – Reference Values).

Insert the S&C gauge at the rear stretcher bar and move towards the heel of the switch. Identify the maximum FWP.

On slips the maximum FWP is located one metre either side of the end of the switch planning.

4.11 Measure by use of the S&C gauge the Free Wheel Clearance (FWC). Refer to NR/SMS/PartZ/Z02 (Point – Reference Values).

Insert the S&C FWC gauge at the rear stretcher bar and move towards the heel of the switch. Identify the minimum FWC.

On slips the maximum FWC is located one metre either side of the end of the switch planning.

4.12 Measure that the Residual Switch Openings (RSO) are correct throughout the planed length, Record the measurements. Refer to NR/SMS/PartZ/Z02 (Point – Reference Values).

4.13 Record the FWP, FWC, & RSO values on record card NR/SMS/PartR/PF01/RC01 (Point Fittings).

4.14 If the FWP, FWC or RSO are incorrect it shall be classed as corrective maintenance and dealt with as corrective maintenance.

If the recorded value increased by more than 3mm on the previous two measurements but remains compliant to the values in NR/SMS/PartZ/Z02 (Point – Reference Values) it shall be reported to the Section Manager (Track) as a trend requiring corrective maintenance.

Bushes

4.15 Check the bushes for signs of surface deterioration. Bushes require to be replaced when they start to break up.

5. Tubular Stretcher Bar (Only)

The Tubular Stretcher Bar assembly consists of three main parts, a Tube Assembly and two 'Motion Units'.

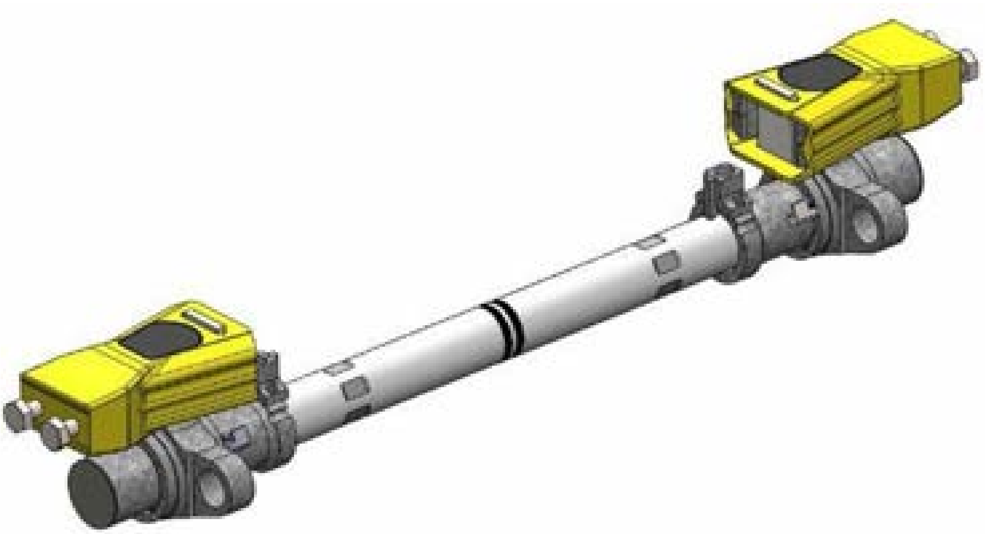


Figure 1 – A Tubular Stretcher Bar Assembly

Detailed information on these items is contained in NR/L2/TRK/6100/Mod04 - Tubular Stretcher Bars.

For explanation of terminology see Appendix A.

5.1 Examine the components of the tubular stretcher bar assembly

a) Drive Connections check condition.

b) Tube Assembly check for bent bars.

5.2 Check that the secondary locking washers are compressed.

5.3 Check the motion unit bolt head covers are fitted and are not damaged; remove any conductive material.

5.4 Check that nut retaining clips are fitted (foot mounted motion units only).

Switch Diamond Layouts

5.5 Check the security of each of the fastenings that secure the motion units to the switch rail through the application of a check torque to the fastening. Refer to NR/SMS/Part/Z02 (Point – Reference Values) for check torque values.

S&C Checks

Tasks 5.6 to 5.14 shall be undertaken for both the Normal and Reverse position of the points.

5.6 Examine the back of the switch blades visually for Flange Back Contact. If Flange Back Contact is found or suspected, it shall be reported as corrective maintenance.

If flange back contact is evident check the retaining plate in the motion unit for damage.

If there is any damage to the retaining plate, then this shall be reported as corrective maintenance and dealt with according to NR/L2/TRK/6100/Mod08 Action Tables.

5.7 Check for theoretical flange back contact using the wheel profiles part of the S&C gauge.

If the gauge does not fit freely, the defect shall be reported as corrective maintenance and dealt with according to NR/L2/TRK/6100/Mod08 Action Tables.

5.8 Check that the toe opening is correct, record the measurements. Refer to NR/SMS/Part/Z02 (Point – Reference Values) for values. Should the switch openings be compromised by track gauge, the defect shall be reported as corrective maintenance.

5.9 Measure by use of the S&C gauge the Free Wheel Passage (FWP). Refer to NR/SMS/Part/Z02 (Point – Reference Values) for values.

Insert the S&C gauge at the rear stretcher bar and move towards the heel of the switch. Identify the maximum FWP.

5.10 Measure by use of the S&C gauge the Free Wheel Clearance (FWC). Refer to NR/SMS/Part/Z02 (Point – Reference Values) for values.

Insert the S&C FWC gauge at the rear stretcher bar and move towards the heel of the switch. Identify the minimum FWC.

5.11 Measure that the Residual Switch Openings (RSO) are correct throughout the planed length, record the measurements. Refer to NR/SMS/Part/Z02 (Point – Reference Values) for values.

5.12 Record the FWP, FWC, & RSO values on record card NR/SMS/PF01/RC/01.

5.13 Should the FWP, FWC or RSO be incorrect it shall be classed as corrective maintenance and dealt with according to NR/L2/TRK/6100/Mod08 Action Tables.

If the recorded value has increased by more than 3mm on the previous two measurements but remains compliant to the values in NR/SMS/Part/Z02 (Point – Reference Values), it shall be reported as a trend requiring corrective maintenance to the Section Manager (Track).

5.14 Any defects or deficiencies that are found and are recorded as corrective maintenance shall be dealt with according to NR/L2/TRK/6100/Mod08 Action Tables.

APPENDIX A - Illustration of terminology used for maintenance of point fittings (not to scale).

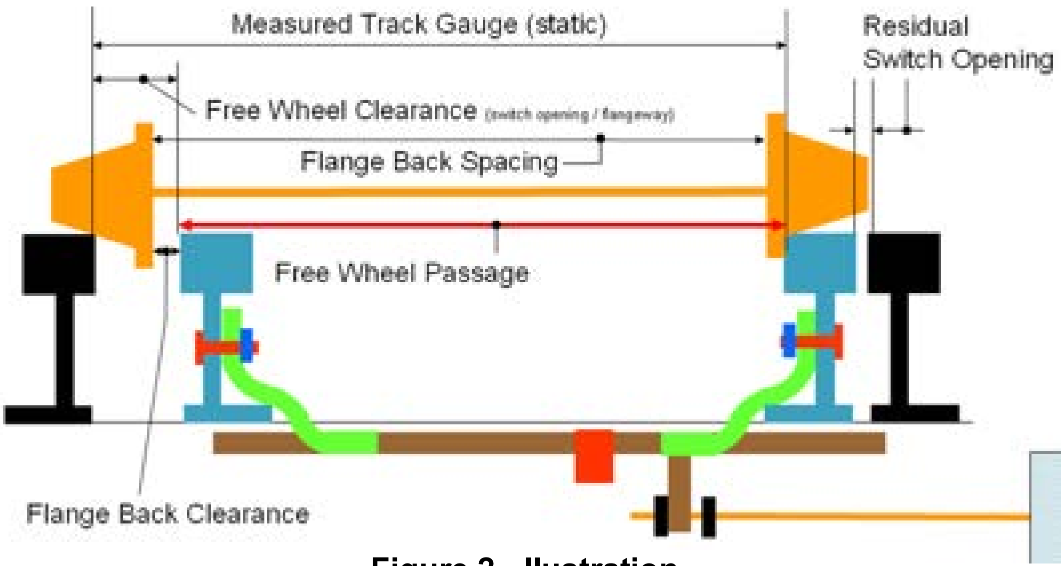


Figure 2 - Ilustration

APPENDIX B - Torque Prevailing Nuts

These can be used on adjustable stretcher bar assembles on non HPSS point systems to fit Mk.1 and Mk.2 brackets to the web of the rail (other type fastenings can also be used). For full details of components and assembly see NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars).

Screw the torque prevailing nuts on the bolts until resistance against the nut locking action is felt. Using an approved spanner to hold the bolt head against rotation, tighten the torque prevailing nut against the Vibrolock washer (if used, see NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars) using an approved ratchet with a 20mm deep socket.

When the prevailing torque nuts are ‘tight’, place the 20mm deep socket on an approved torque wrench (capable of applying 250Nm of torque) and using an approved spanner to hold each bolt head against rotation apply the torque detailed in NR/SMS/PartZ/Z02 (Point – Reference Values) to the nut.

Hardlock Nuts

On Adjustable Stretcher Bars on Non HPSS Point Systems:

The processes detailed in NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars) shall be followed for installation and adjustment of Hardlock nuts.

On Fixed Stretcher Bars:

These are used with grade 8.8 M20 bolts on all fixings.

The male nut shall be sequentially tightened to 250Nm as detailed in NR/SMS/PartZ/Z02 (Point – Reference Values).

The female nuts shall then be finger tightened to engage the interlocking cones. Check there is a visible gap between the surfaces of the nuts - then tightened to 250Nm torque as detailed in NR/SMS/PartZ/Z02 (Point – Reference Values).

Check when applying torque to the female nut that it rotates at least half a turn between finger tightness (engagement of interlocking cones) and achievement of the torque detailed in NR/SMS/PartZ/Z02 (Point – Reference Values).

If a visible gap between the surfaces of the male and female nut does not exist when finger tightening the female nut to engage the interlocking cones or the female nut does not rotates at least half a turn between finger tightness and achievement of the torque detailed in NR/SMS/PartZ/Z02 (Point – Reference Values) the nut combination shall be scrapped and a new set of nut components installed in accordance with the process above.

Plain Square and Hexagonal Nuts

For adjustable stretcher bars on non HPSS point systems see the details in NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars), for HPSS point systems see the details in NR/L2/SIG/11400.

On fixed stretcher bar assemblies these are usually found on older installations and mechanical point systems. They have no integral locking action.

They shall not be used on any new fixed stretcher bar installations. Any loose nuts shall be replaced with Hardlock nuts and M20 bolts as detailed in NR/L2/TRK/6100/Mod05 (Fixed Stretcher Bars).

APPENDIX C - Nut Types

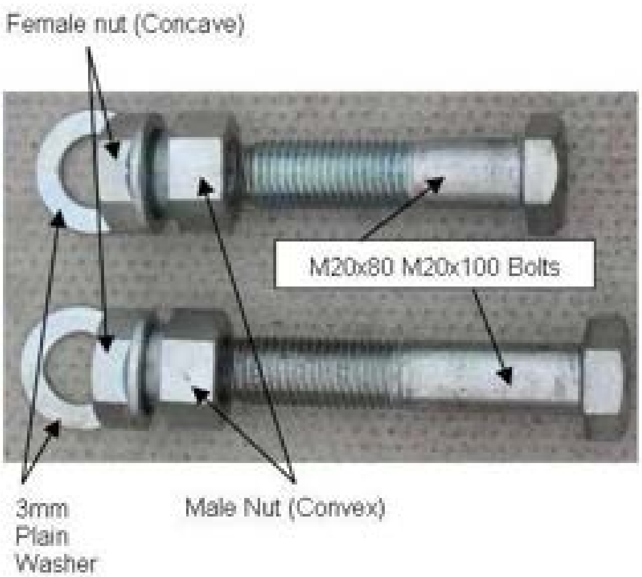
Figure 3 – Philidas Turret Nut

Identifiable by the 'Б' and '8' marking stamped on the flat.

Figure 4 – SNEP DAH Nut

Identifiable by the 'SN' and '8' marking on the top ring.

APPENDIX D - Hardlock Nuts & M20 Bolts



The male nut provides the fastening action; the female nut provides the locking action.

Figure 5 – Hardlock Nuts & M20 Bolts

APPENDIX E - Examples of Fixed Stretcher Bars

Figure 6 – Yellow fixed stretcher bar with hardlock fastenings

Figure 7 – Yellow stretcher bar bracket with hardlock fastenings

Figure 8 – Black stretcher bar bracket with square nut fastenings

Black stretcher bars and non-hardlock fastenings shall not be used on any new or replacement installations.

APPENDIX F - Examples of Adjustable Stretcher Bars

Figure 9 – Adjustable stretcher bar using hardlock nuts fixed to Shallow Depth Rail

Figure 10 – Adjustable stretchers bar using hardlock nuts fixed to Full Depth Rail.

Figure 11 - Adjustable stretcher bar Mk. 1 bracket using half/full nuts (supplementary drive also shown).

Figure 12 - Mk.2 bracket using Philidas type Turret Nut.

Figure 13 - Example of visible thread showing after installation of hardlock nuts. 11 threads showing.

Minimum of 2 threads visible for hardlock nuts and 4 threads visible for full/half nuts required.

APPENDIX G - Examples of HPSS Stretcher Bars

Figure 14 – HPSS Stretcher Bar

END

Includes:	Crank operated supplementary drive
Excludes:	Hydraulic operated supplementary drive and Torsion operated supplementary drive

Any adjustments, tightening, or replacement of components shall be classed as corrective maintenance and reported as detailed in NR/SMS/PartA/A02 (Preventative & Corrective Maintenance) and to your SM(S).

Incorrectly set up or adjusted supplementary drives can affect the operation of the points. If you are in any doubt about the set up or adjustment of a supplementary drive ask your SM(S).

On certain Hydro-Pneumatic points the escapement for the supplementary drive is on the front stretcher bar where the drive is taken off, not the rear stretcher bar where the drive is given. This system shall be set up according to the original design drawing. If in any doubt, ask your SM(S).

General

More information on supplementary drives can be found in NR/GN/SIG/11772.

SERVICE A

1. Crank Operated Supplementary Drive

Details on the set up and adjustment of crank operated supplementary drives can be found in NR/WI/SIG/00111.

1.1 Check that all moving parts are not obstructed and are clear of ballast. Rectify as necessary.

1.2 Check the installation is securely fitted, look for:

- Loose crank bases.
- Worn cranks.
- Seized cranks.
- Loose adjustable sleeve on cranks.
- Worn cotter pins.
- Bent rodding.
- Broken roller assemblies.

Rectify as necessary. Loose or worn fittings can impair the operation of the back drive. Tightening/replacement of any item of equipment requires the supplementary drive to be set up, see NR/WI/SIG/00111 for details.

1.3 Scrape, wipe, and clean the cranks as necessary. Lubricate bearings and cotter pins.

New grease should be pumped in at the grease nipple to expel the existing grease in the bearing/pin. Automatic lubrication can also be used in asssociation with Teflon based grease, see NR/SMS/PartA/A09 (Lubrication). Excess grease shall be wiped away.

1.4 Check the supplementary drive is correctly set up and operating correctly. Details are in NR/WI/SIG/00111.

1.5 Where fitted, carry out SUPPLEMENTARY DETECTION TEST (016).

1.6 Where any adjustments have been made, carry out FACING POINT LOCK TEST (001 or 003) as required.

END

Includes:	Austro-roll, Schwihag and Vossloh types
Excludes:	All other types of roller

Switch rollers shall not be greased. Any such contamination shall be removed with the use of an approved metal cleaner.

SERVICE A

This service is a visual check of the switch rollers will require each roller to be checked in both the open and closed switch position.

On Hy-Drive mk2 installations, the rear rollers might need to be lowered to allow manual pumping of the points due to the back of the switch starting to move before the toe leading to the lock arm jamming.

1. Inspection

1.1 Remove all fire risks and potential obstructions.

1.2 Austro-rolls only: Check support brackets and spring plates for security and damage.

1.3 Check to make sure the switch is fitting up correctly, if not then the backdrive may need adjusting.

2 For the switch in the closed position:

2.1 Check that the roller barrel has a metallic silver band (see figure 1).

This will indicate the roller barrel is performing satisfactory.

Figure 1 – Metallic silver band check

2.2 Check that the sliding surface of the base plate does not show any wear (see figure 2).

This will indicate that the rollers are not lifting the rail.

Figure 2 – Check for wear

2.3 Check that the rollers can move freely and that no flat spots are present on the roller barrels (see figure 3).

Figure 3 – Check for movement and flat spots

2.4 Check that there is a sufficient gap between the roller assembly and the closed switch rail to accommodate dynamic loading (see figure 4).

The clearence should be 1mm + the gap between the base of the switch and the slide chair to take in to account dynamic loading.

Figure 4 – Gap check

2.5 Check that the fixing bolts are in place.

2.6 Check for contamination (see figure 5). If required removed the roller package to clean underneath.

If it is not possible to do this at the time of inspection then it is importantant to report this to your supervisor for corrective maintenace.

Figure 5 – Contamination check

2.7 Check the roller height settings (see figure 6). If they are approacing their maximum height setting, this should be reported to your supervisor as corrective maintenance such as lifting and packing might be required.

Grey roller packages provide a lift upto 6mm whereas blue packages provide a lift upto 4mm.

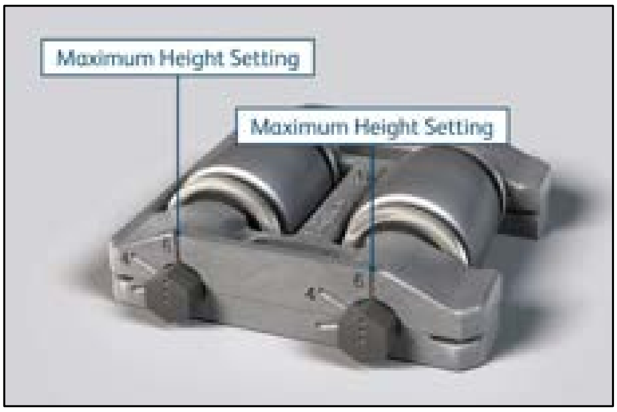


Figure 6 – Height setting

2.8 Check that the kicking strap has a clearence of 6-9mm from the stock rail.

3 For the switch in the open position:

3.1 Check that the open switch rail is resting on the roller and not on the sliding surface.

3.2 Check that the clearence between the switch rail and the sliding surface is 1-3mm.

3.3 Check the kicking strap for signs of binding.

Any issues identified during the inspection that could not be rectified should be reported to a supervisor.

Details of how to set up the rollers can be found in NR/SMS/Appendix/04.

End

Includes:	Alstom SO hydraulic supplementary drive system
Exclude:	Any other type of hydraulic supplementary drive

Disconnect the point detection from the KR lines or apply an alternative safe system of work (See NR/SMS/Part/ A04).

Isolate the mechanism by turning to the 'Manual' position on the hydraulic pack.

Nuts that are tight should not move by the application of a short handled spanner.

General
SO hydraulic supplementary drive systems are used in conjunction with an in-bearer clamp lock (IBCL) and NR60 layouts.
In this configuration the whole installation is called a Hy-Drive Point System.
Maintenance tasks & tests for the IBCL are contained in NR/SMS/PB11

SERVICE A

1. SO supplementary Drive Break-Out Device (BOD)

1.1 Check the Break-Out Devices have not been operated. See appendix A for further guidance.

Original Mk1 Design

The break-out device covers shall be 60mm-65mm from the end of the gauge adjusting lug when not operated.

Original Mk1 Design with modified cover

The modified cover shall align with the edge of the bracket when the device has not operated as per NR/L3/SIG/19808.

Mk2 Design

The red line on the side of the bracket is to be used to provide an indication of whether the device has operated.

1.2 Examine the BOD covers and insulations for damage.

1.3 Check that the BOD bolts are secure. Rectify as necessary.
If tightening is required, the torque shall be 250Nm.

1.4 Check that the gauge adjusting lug locking screws and associated tab washers are secure.

1.5 Check that the horizontal drive pins are secure and that the insulations and split pins are correctly in place and undamaged.

2. Pump Unit

2.1 Restore the points to power.

2.2 Disconnect one of the two motors at the plug connector.

2.3 Ask the Signaller to operate the points and Check that the remaining connected motor is operational.

Due to the requirement of the system for two motors, the points may not complete their movement within 6-9 seconds, this is not a failure. This test is only to check that each individual motor is operational.

2.4 Reconnect the first motor and disconnect the second motor to repeat step 2.3.

2.5 Reconnect the second motor.

3. Front Stretcher and Kicking Strap Brakets

3.1 Check that the stretcher bar bolts (4) are secure. Rectify as necessary.
If tightening is required, reffer to NR/SMS/Part/Z02.

3.2 Examine the front stretcher pivot pins, tabs and split pins and ensure that they are secure and undamaged.

3.3 Check that the M30 stretcher adjustment locking nut is secure. Rectify as necessary.

If tightening is required, the torque shall be 300Nm.

3.4 Check that the kicking strap brackets are secure. Rectify as necessary.
If tightening is required, refer to NR/SMS/Part/Z02.

4. Final Tests and Check

4.1 Carry out DETECTION TEST (HY-DRIVE POINTS) (009).

4.2 Ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

SERVICE B

5. SO Supplementary Drive Units

<u>REMOVE the SO unit covers</u>

5.1 Check that the SO unit plug couplers are properly secure and undamaged.

5.2 Check that the SO unit detector box lead seals are properly secure and undamaged.

5.3 Examine hydraulic hoses for security and signs of leakage or damage.

5.4 Examine the by-pass valve for signs of leakage or damage and check that it is closed and locked.

<u>REPLACE the SO unit covers</u>

5.5 Ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

APPENDIX A – Checking BOD's for Damage or Operation

It is important to check break-out for damage and/or operation. Mk1 break out devices are susceptible to damage and fracture around neck of the winged bracket (see figure 1 below). This was in part due to the screws that held the bracket cover in place being struck by the flange of train wheels. Subsequently a modified cover was then provided to prevent this failure mode (implemented via SIN118).

Following this a re-design of the BoD took place resulting in the Mk 2 BoD

Check for cracking on maintenance inspections.

Figure 1 – Mk1 Break Out Device (BOD) fractures

Checking BOD's for Operation

Checking the BoD for operation depends on the cover installed (Mk1) or if it is a Mk2 BOD.

For the Mk1 BoD with the original cover the break out covers shall be 60mm – 65mm from the end of the gauge adjusting lug when not operated. The red line on the gauge adjusting lug provides a visual indication (see figures 2 and 3).

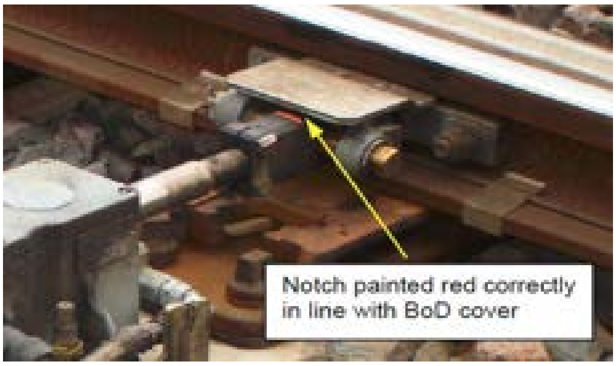


Figure 2 – Mk1 BOD

Figure 3 – Mk1 BOD Indication

For the Mk 1 BoD with the modified cover (NR/SIN/118), check that the cover aligns with the edge of the bracket. If it does not then the device has operated. If in doubt, remove the cover to check further (see figures 4 and 5 below).

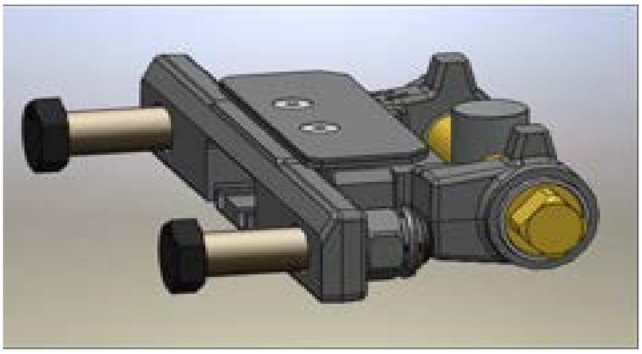


Figure 3 – Mk1 BOD

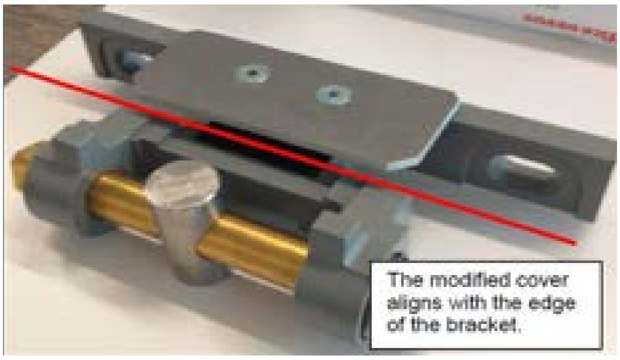


Figure 5 – Mk1 BOD Indication

For the Mk2 Design, run-through indication is provided by a red indication line on the side of the bracket as shown in figure 7.

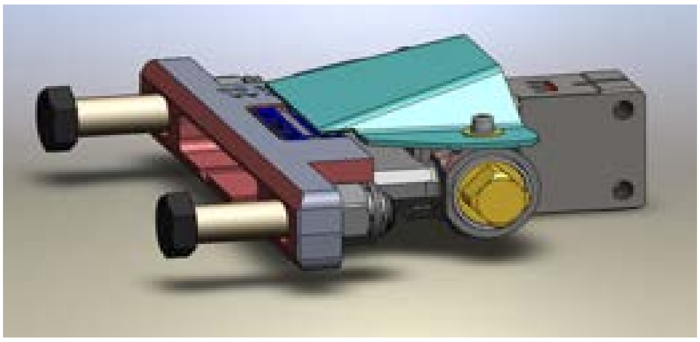


Figure 4 – Mk11 BOD

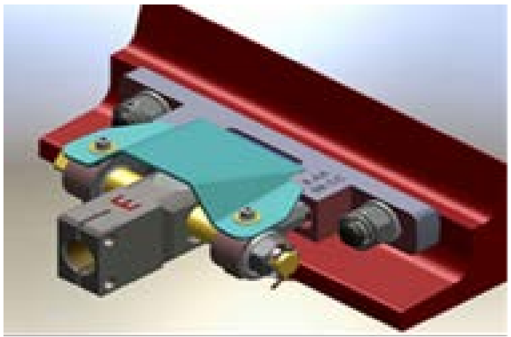


Figure 7 – Indication of BOD Operation

END

Includes:	Clamplock points fitted with Hydraulic Assist Drives
Exclude:	All other assist drives

SERVICE A

1. Maintenance Task

1.1 Check that hoses have no sharp bends and are not unduly raised, as this can allow air to be trapped in the system – Rectify as necessary.

1.2 Check hoses running up the four foot to the assist drive rams are secure and are not chaffing against any stretcher bar.

1.3 Visually inspect hydraulic hoses for signs of deterioration and/or corrosion, and in particular where the pipes run out of normal sight, i.e. in troughing.

1.4 Check the hydraulic fluid level and (where fitted) the level indicator. If the top up is greater than 0.5litres then check for leaks in the hydraulic system, rectify as required.

1.5 If a leak cannot be found, report as corrective maintenance before the end of the shift. If more than 1 litre is required, carry out TEST FOR AIR (015)
NOTE: When topping up the hydraulic fluid, avoid introducing contaminants into the system.

1.6 Check the locking wires on hose connectors are fitted and intact (Figure 1).

1.7 Clean and examine the hydraulic rams for leaks, in both normal and reverse positions. Look particularly at the spigots (where fitted) for any movement/abnormality (Figure 2).

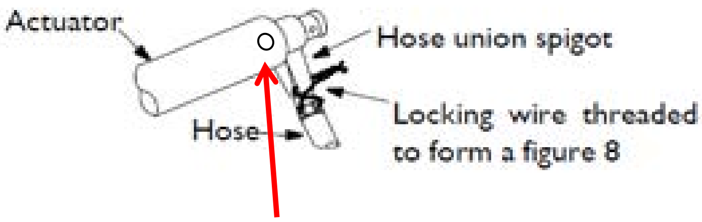
1.8 Clean and examine the assist drive Ram fixing brackets and fixing bolts. Check the assist drive rams are secure to both the rail and the thrust plate at the assist drive position (Figure 3).

1.9 Check that the bolts are of sufficient length to accommodate the lock nut thread.

1.10 Check that there is no distortion of this pin.

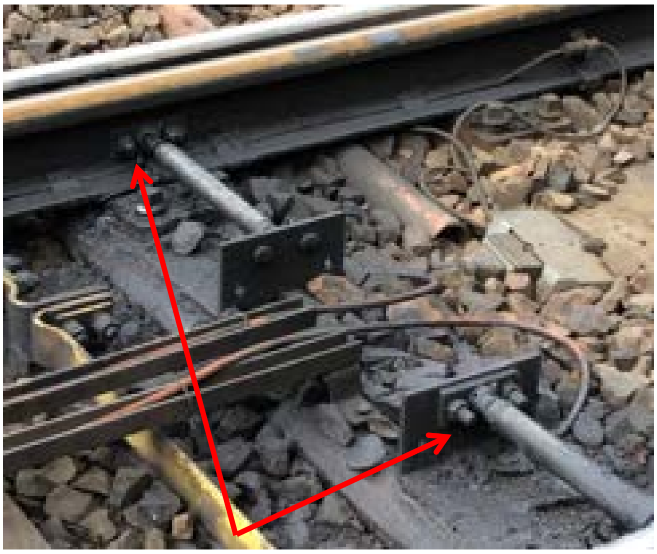
APPENDIX A

Figure 1 – Existing Type



On older versions of Hydraulic Actuators the spigot is joined to the main body and retained by a spirol pin.

Figure 2 – Old ‘spiral’ Type



Check Fastenings are secure on both ‘N’ & ‘R’ actuators at rear

Figure 3 – Fastenings

END

Includes:	Torsion Operated Supplementary Drive.
Excludes:	Hydraulic operated and crank operated supplementary drive

SERVICE B

1. Torsion Operated Supplementary Drive

1.1 Check that all moving parts are not obstructed and are clear of ballast. Rectify as necessary.

1.2 Check the installation is securely fitted.

1.3 Check the supplementary drive is correctly set up, Rectify as necessary. Details are in Appendix A

1.4 Check for wear on the drive pin fitted through the drive take-off arm on the drive take-off stretcher bar.

Arrange for replacement if excessively worn. Excessive wear is indicted by brass filings underneath the take-off arm and a 'squaring' of the round drive pin.

1.5 Check that the toe of the switch rail touches with the stock rail before the back driven portion.

1.6 Check that the lock nuts on the lost motion drive are tight.

APPENDIX A - Torsion Operated Back Drive Adjustment

If the torsion tube is not correctly aligned, excessive wear on components can be experienced and problems can be had driving the switch rails.

Alignment of the torsion tube can be checked by disconnecting the drive pin at the front drive take-off and the back-drive stretcher bars and then removing the top of the pillow block assembly.

The torsion tube can then be rotated in the pillow block assemble whilst observing the rollers within it. Any misalignment is apparent by the way the tube rotates within the rollers.

The front and back drive pillow blocks are mounted on a serrated edge surface, which can allow lateral adjustment to correct any errors.

Because of the design of the torsion back drive the amount of drive at the rear stretcher is the same as at the front therefore two lost motion escapements are provided at the rear stretcher to reduce the amount of drive on this part of the switch rail.

When setting up a torsion back drive the same basic principles in all mechanical signalling apply. With both switch rails equal distance from the stock rail at the toe, check the front stretcher torsion drive lug is vertical.

Connect the drive with drive pin at the front and rear stretchers and adjust via the lost motion escapements to give an equal distant from the stock rail to the switch heel tighten all nuts and locking nuts.

Check the open switch distance at the toe (108/110mm), at the heel check the open switch distance (113A & UIC54B - 50mm / RT60 & NR60 - 60mm) and the closed switch distance (1.5mm) in both the Normal and Reverse positions.

Check that the toe of the switch makes with the stock rail before the backdriven heel.

END

Includes:	Type R Reed FDM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Under no circumstances shall the line amplifier gain straps, gain setting resistors or attenuator resistor values be adjusted. The need for any adjustment of these indicates a fault, inform your SM(S) immediately.

This system is for use on vital signalling functions. Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement. The R series of reed filters was manufactured by MV-GRS (later AEI-GS) in the late 1950's.

The plug boards used are of American GRS design and are unique to this equipment.

The system was also manufactured by GEC-GS (formally AEI-GS) for SGE and used their own style of plug board.

The type R system went out of production in 1964 therefore new build units are unavailable.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 As provided, check the fault logging system for any outstanding faults. Rectify or report.

1.2 As provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 As provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 As provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, Rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Power Supplies (Tx and Rx)

7.1 Using an electronic meter measure the following voltages on all power supply units, see Table 1.

Type	Voltage	Limits	AC Ripple
Individual (Low Current)	AC input	105V to 120V	NA
	DC Output	12V to 13.5V	<75mV
Group (High Current)	AC input	105V to 120V	NA
	DC Output	12V to 13.5V	<75mV

Table 1 - Power supply limits

8. Transmitter (Tx) End

8.1 Using an electronic meter measure the transmitter output voltage across the line resistor, which is mounted between t3E and t1E.

a) Transmitting voltage: 0.7 - 1V AC

b) Not transmitting voltage: <200mV AC

9. Receiver (Rx) End

Using an electronic meter measure the receiver output voltage (across t12&t13) when receiving and not receiving a signal:

a) If receiving the voltage shall be between 10.5 – 15 V DC.

b) If it is not receiving voltage shall be <200 mV DC.

Due to operating conditions, it might not be possible to take receiving voltages on all receivers.

Not receiving voltages shall always be taken.

9.2 Measure using an electronic meter the DC voltage across R1 and R4 of the Reed Follower relay, check it is the same as in 3.1.

10. Line Amplifiers

10.1 Check by touch that the line amplifier transistors are not cold.

The transistors can become very hot in normal use. Cold transistors indicate the line amplifier is not working correctly.

10.2 Using an electronic meter measure the following voltages on the line amplifier, See Table 2.

Terminals	Tappings	Voltage (AC)
Input	NA	105V to 120V
t7 to t8	24V	22V to 26V
	28V	26V to 30V
	No transformer fitted	22V to 30V

Table 2 - Line amplifier voltages

11. Final

11.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

11.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

12. Equipment Cubicles

12.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

13. Control and Interface Equipment

13.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

13.2 As provided, disconnect and clean all keyboards as necessary.

13.3 As provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

13.4 As provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

13.5 As provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

13.6 As provided, check the Althorn (formally Rugby) clock for correct operation.

14. Line Protection and Route Selection

14.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

14.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

15. Spares

15.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

15.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

16. Final

16.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

16.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

Includes:	Type RR Reed FDM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

A vital TX/RX can be used on a non-vital system, but a non-vital TX/RX shall never be used on a vital system.

Under no circumstances shall the line amplifier gain straps, gain setting resistors or attenuator resistor values be adjusted.

In some systems a vital TX/RX can be used with a non-vital TX/RX.

If you are unsure of the configuration of the system (series type or vital/non-vital) ask your SM(S) before carrying out any work.

General

This RR series of reed filters were first manufactured by AEI-GS. With mergers, the company was then GEC-GS, which was then GEC-Alstom.

All the RR types are compatible with the BR829 spec plug board.

Type RR2000 and RR4000 use double tuned reed filters and are approved for use on vital signalling functions.

Type RR3000 uses a single tuned reed filter and is used only on non-vital functions.

Type RR2000 systems are usually found on non-electrified traction areas.

Type RR4000 is used on electrified traction areas.

Type RR2000 and Type RR4000 series have separate ‘Reed Follower’ relays whilst RR3000 has an internal ‘Follower’ relay.

At PSB’s that have fixed test equipment provided, this can be used to test all the channels in place of individual transmitting and not transmitting tests at signal box/trackside locations.

Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, Rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Sites without Fixed Test Equipment Transmitter (TX) End

7.1 Measure and record the transmitter output voltage across the line resistor, which is mounted directly behind the transmitter filter plug board (See Table 1).

RR Series	State	Voltage (AC)
RR1000	Transmitting	590mV to 750mV
	Not Transmitting	<100mV
RR3000	Transmitting	590mV to 750mV
	Not Transmitting	<200mV
RR4000	Transmitting (Normal O/P)	330mV to 430mV
	Transmitting (High O/P)	590mV to 750mV
	Not Transmitting	<100mV

Table 1 - Transmitter output voltages

Due to operating conditions it might not be possible to take TX/not-TX voltages on each function at every maintenance visit.

On vital systems all signal and point operating and indicating functions shall be measured within a 12 month period.

If you are unable to take TX/not-Tx voltages on functions other than signals and points (e.g. TC or GF indications) within a 12 month period, you shall inform your SM(S) and note it on your work order.

8. Sites without Fixed Test Equipment Receiver (RX) End

8.1 Measure and record the receiver output voltage when receiving and not receiving a signal (See Table 2).

On vital systems the voltage can alternatively be measured across R1 and R4 of the Reed Follower Relay.

RR Series	State	Terminals	Voltage (DC)
RR2000	Receiving	A1/D1	10.5V to 16V
	Not Receiving		<100mV
RR3000	Receiving	A1/D2	9V to 16V
	Not Receiving		<200mV
RR3001	Receiving	D1/D2	9V to 16V
	Not Receiving		<200mV
RR4000	Receiving	A1/D1	11V to 18V
	Not Receiving		<100mV

Table 2 - Receiver voltage

Due to operating conditions it might not be possible to take RX/Not-RX voltages on each function at every maintenance visit.

On vital systems all signal and point operating and indicating functions shall be measured within a 12 month period.

If you are unable to take the RX/not-RX voltages on functions other than signals and points (e.g. TC or GF indications) within a 12 month period, you shall inform your SM(S) and note it on your work order.

9. Sites with Fixed Test Equipment

9.1 Using the fixed test equipment provided, step through all channels in turn (including all unused or spare channels). Measure the system levels for each channel at that point in time:

a) When energised RMS voltage shall be between 100mV and 150mV.

b) When De-energised RMS voltage shall be less than 10mV.

10. Final

10.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

10.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

11. Equipment Cubicles

11.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth

12. Control and Interface Equipment

12.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

12.2 If provided, disconnect and clean all keyboards as necessary.

12.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

12.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

12.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

12.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

13. System

13.1 Check on vital type RR reed filter units that a silver data label is fitted. Any units without this label should be reported to your SM(S) immediately.

14. Power Supplies (Tx and Rx all locations)

14.1 Using an electronic meter measure the following voltages on all power supply units (See Table 3).

Unit	Voltage	Limits	AC Ripple
RR912X	AC input	105V to 120V	NA
	DC Output	11.5V to 13.5V	<75mV
RR913X	AC Input	105V to 120V	NA
	DC Output	11.5V to 13.5V	<175mV
RR9410	DC Input *	50V to 55V	NA
	DC Output	11.5V to 13.5V	NA

Table 3 - Power supply unit voltage limits

* At a line-side transmitter or receiver, the power supply voltage is sometimes fed from the 50V DC supply.

14.2 If an AC supply is being used check the AC ripple voltage by switching the meter to AC when measuring the DC output.

15. Line Amplifiers (All Sites)

15.1 Using an electronic meter measure and record the following voltages on the line amplifier (See Table 4).

Terminals	Tapping's	Voltage (AC)
Input	NA	105V to 120V
T10 to T11	24V	22V to 26V
	28V	26V to 30V
	No transformer fitted	22V to 30V

Table 4 – Line amplifier voltages

16. Line Levels (Vital Systems Only)

These require a possession of the system for all or part of the test.

There are different methods of performing these tests, either by replacement of the Rx amplifier with a dummy, a permanently modified Rx amplifier or by use of a spectrum analyser.

In all cases, the tests shall only be carried out by staff assessed as competent to work on Reed FDM systems and if necessary, holding a current instrumentation engineers' certificate.

16.1 Using the preferred method for the site (if none has been declared, ask your SM(S)), measure the line levels for a low frequency and a high frequency channel. (See Table 5).

16.2 Compare obtained readings with previously recorded readings, investigate any significant variations.

System	Location	Value (rms)
RR2000	Line	270mV to 350mV
	Dummy Amplifier or Receiver	110mV to 150mV
RR4000	Line	270mV to 350mV
	Dummy Amplifier or Receiver	105mV to 150mV

Table 5 - Line levels

Under no circumstances shall the level be greater than 500mV.

17. Line Protection and Route Selection

17.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

17.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

18. Spares

18.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

18.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S) Test the operation of the cards/units in the test rack.

19. Final

19.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

19.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

Includes:	Westone FDM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

The gain of line amplifiers and gain setting resistors shall not be adjusted. The need for adjustment of these indicates a fault, inform your SM(S) immediately.

General

This system was the first FDM system developed by WBS. It uses a tuned circuit for frequency discrimination that has relatively poor selectivity therefore it can only be used on non-vital signalling functions.

There are some systems that are configured in a ‘double cut’ method; these are used to provide a remote emergency signal replacement function.

The transmitters and receivers are not particularly tolerant of varying installation conditions therefore the setting up of the system after equipment replacement can be difficult and time consuming to obtain the optimum performance.

Inform your SM(S) before replacing any transmitter or receiver.

Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided should be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians’ terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Power Supplies

7.1 Measure the following voltages on all power supply units on Klippon block A:

a) Measuring across terminals 5 & 6, there should be an AC voltage between 95V to 120V.

b) Measuring across terminals 1 & 2, there should be a DC voltage between 17.1V to 18.9V with AC ripple of less than 75mV.

8. Transmitter and Receiver (TX & RX) End

8.1 Using a frequency selective meter, connected across the line pair, measure the received voltage at both ends of the system on one sample channel.

a) Voltages should be between 300 mV to 1000mV on both transmitter and receiver.

8.2 Measure the transmitters output and the receiver input:

a) Transmitter voltage should be 2V when transmitting and <10mV when not transmitting.

b) Receiver voltage should be 50mV when receiving and <10mV when not receiving.

Due to operating conditions, it might not be possible to take transmitting and receiving voltages on all functions.

9. Final

9.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

9.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

10. Equipment Cubicles

10.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

11. Control and Interface Equipment

11.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

11.2 If provided, disconnect and clean all keyboards as necessary.

11.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

11.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

11.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

11.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

12. Line Protection and Route Selection

12.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

12.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

13. Spares

13.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

13.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

14. Final

14.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

14.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

Includes:	FDM69-NV, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

The gain of line amplifiers and gain setting resistors should not be adjusted. The need for adjustment of these indicates a fault, inform your SM(S) immediately.

This system was devolved by WBS as the successor to Westone. It used a piezo-electric tuning fork for frequency discrimination that has an inferior bandwidth and poorer selectivity than reed systems therefore it can only be used on non-vital signalling functions. In other aspects, the FDM69-NV system has similar configurations (in principle) to those of the reed system.

Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Power Supplies (TX and RX)

7.1 Measure the following voltages on all power supply units:

Voltage	Limits	AC Ripple
AC Input	105V to 120V	NA
DC Output	11.5V to 13.5V	<75mV

Table 1 – Power Supply Voltages

8. Transmitter (TX) End

8.1 Measure the transmitter output voltage across the line resistor.

State	Voltage (AC)
Transmitting	1V
Not Transmitting	<200mV

Table 2 – TX Output Voltage

Due to operating conditions, it might not be possible to obtain transmitting voltages on all channels.

9. Receiver (RX) End

9.1 Measure the receiver output voltage:

State	Voltage (DC)
Receiving	9V to 16V
Not Receiving	<200mV

Table 3 – RX Output Voltage

Due to operating conditions, it might not be possible to obtain transmitting voltages on all channels.

10. Final

10.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

10.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

11. Equipment Cubicles

11.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

12. Control and Interface Equipment

12.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

12.2 If provided, disconnect and clean all keyboards as necessary.

12.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

12.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

12.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

12.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

13. Line Amplifiers with battery standby power supply

This test shall only be carried out with the co-operation of the Signaller due to the possibility of the standby power equipment failing.

For CEGASA cells refer to NR/SMS/PartC/EL00 (Electrical Equipment – General).

For non CEGASA cells - NR/SMS/PartB/Test/058 (Primary Cell Test).

13.1 Check the system to be tested is working normally before any disconnections.

13.2 Remove the BX110 fuse for the PSU feeding the applicable line amplifier.

13.3 Check there is no failure to the FDM system the PSU feeds.

13.4 Replace BX110 fuse for the PSU and re-check power supply voltage is within limits.

13.5 Check the system is operating normally and re-store the system to the Signaller.

14. Line Protection and Route Selection

14.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

14.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

15. Spares

15.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

15.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

16. Final

16.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

16.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

Includes:	Westplex, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Westplex is a modern equivalent of Vital Reed remote control systems. It has been designed to facilitate pre-wiring and simple change over when replacing an existing Vital Reed system.

The line side cabling used by the Vital Reed can be re-used by this system as can the reed follower relays; however, it uses the two cable pairs as a ring and is thus tolerant of the first cable fault.

It is a digital system having the potential for use on open transmission networks such as FTN and does not share the susceptibility of the Vital Reed to interference in the modern traction environment.

Westplex systems also do not have the same channel number limitations that Vital Reed systems have permitting the future expansion of converted systems.

Westplex has a ring transmission system that connects HD Communicator modules to each other.

It is tolerant to any one single fault in this ring, but the fault will be recorded and some system response times can increase.

An Echelon LAN connects HD/LINK modules to an HD COMMUNICATOR, this LAN is not duplicated. Any fault on the LAN, including its EOL terminators, is likely to cause increased error rates and eventual loss of function.

Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. Ring Test

10.1 Check the status indications of the selected HD communicator module on the Westplex system to be tested using Appendix A.

10.2 Connect a laptop PC to the LAN port and using Microsoft Explorer, access the web pages for Line 1 and Line 2 and note the values for signal to noise and loop attenuation.

10.3 Compare with previous values recorded.

10.4 Download the event log and rectify any repeated ring faults (reductions in the signal to noise ratio or increases in loop attenuation).

11. Communications Test

Only one HD/LINKER download is permitted on one Westplex system at any one time.

11.1 Check the status indications of the selected HD/LINK module on the system to be tested using Appendix A.

11.2 Attach a laptop PC to the DIAGNOSTIC port and using HD/LINKER maintainers' facility (M53291.exe) check the communications statistics for every HD/LINK on the system for zero occurrences of missed messages and lost sessions.

11.3 If there are any missed messages, identify the location of the HD/LINK concerned and check for possible faults on its Echelon LAN.

11.4 If there are any lost sessions, carry out the ring test to look for ring faults.

12. Line Protection and Route Selection

12.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

12.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

13. Spares

13.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

13.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

14. Final

14.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

14.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - Westplex Led Status Tables

HD/LINK (wait at least 90 seconds after power up before observing status).

LED	Correct Status
VRO	Correspond to current output status
VPI	Correspond to current input status
HEALTH	Flashing slowly, approximately once every 2 seconds
LAN TX	Flashing
LAN RX	Flashing
SERVICE	Both OFF
POWER	ON

Table 1 - HS/Link status

HD COMMUNICATOR (wait at least 30 seconds after power up before checking status).

LED	Correct Status
HEALTH	Flashing approximately once per second
LINE 1 & LINE 2	ON and steady *
LAN	ON (OFF or Flashing when computer connected to LAN port)
ALARM	OFF
POWER	ON

Table 2 - HD communicator status

* :- Flashing slowly indicates that the module is polling for a contact, flashing fast indicates that it is ‘training up’ (takes approximately 15 seconds).

END

Includes:	Type RM Systems, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems.

General

GEC Type RM equipment can also be referred to locally as SDT and SIGNET.

This system involves the transmission of data between locations called office and field. An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications.

The system was developed in the late 1970's. It is a synchronous point to point system using simplex or duplex as a transmission mode. The system is based on microprocessor technology.

For older systems see the notes in NR/SMS/PartC/SB00 (Signal Box Control & Operating Systems – General).

Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. Power Supplies

10.1 In the order as listed in the following table, using a suitable meter and/or oscilloscope measure the microcomputer power supply and sub-rack PSU DC output voltages and the AC ripple voltages.

Compare the readings with the previously recorded results.

Card/Test	Terminals		DC Voltage Limits	AC Ripple
	+Ve	-Ve		
Microcomputer JM25XX +5V Supply Check	TP4	TP1 or TP6	+4.95V to +5.25V	<50mV
Single PSU +5v Output Check	TP2	TP1	+5.15V to +5.25V	
Triple PSU +5V Output Check	TP2	TP1	+5.15 to +5.45V	

Table 1 - Microcomputer power supply limits

If any of the voltages are found to be outside the limits, the relevant power unit shall be adjusted or changed and all units subsequently re-tested.

There is a test point located on back of PSU on some systems.

Some of the following tests do not require a possession of the system but it is recommended they are performed within a system possession unless the duration of occupation is limited and the Signaller is in agreement.

10.2 Measure the AC supply voltage to all the power supply units are between 105V and 120V.

11. System Changeover (Dual Systems Only)

The following test shall be conducted under a system possession or during a quiet traffic period in liaison with the Signaller.

11.1 Check that the processor indications are correct (Appendix A).

11.2 Check that SW1 on both Output Change-Over Unit cards are set at AUTO. Identify which Output Change-Over Unit card is in ONLINE by observing which one has LED 2 lit (Com Line Output indication).

11.3 Push SW1 on this card over to the OFF position. Observe that within 3 Seconds control passes over to the OFFLINE Output Change-Over Unit card.

This should be confirmed by LED2 illuminating on the card newly in control and extinguishing on the card previously in control.

11.4 Return SW1 on the OFFLINE card back to the AUTO position.

11.5 Observe the processor indications remain as listed in Appendix A.

12. Line Levels

The following test shall be conducted under a system possession or during a quiet traffic period in liaison with the Signaller.

12.1 At both the Office and Field ends of the system; measure using a meter, the transmitted controls/indications and the received indications/controls at the line connection points.

Function	Level	Limits
Tx	-13dBm	+3dBm to –7dBm
Rx	-13dBm	+3dBm to –20dBm

Table 2 - Line level limits

13. Monitor Card

13.1 Test the operation of the monitor card by checking a convenient signalling function whilst it is being operated.

14. Line Protection and Route Selection

14.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

14.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

15. Spares

15.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

15.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

16. Final

16.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

16.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications

Systems can be made up of a variety of cards.

For older systems using computer cards of the JM10XX variety, the only visual indications are on the TX/RX/PP computer cards, modems, PSUs and the alarm unit. For systems with these cards installed ignore all other indication states listed below:

Card	Indication/Function	State
Alarm Unit	Sys OK Indication	Illuminated
	All other indications	Extinguished
Modem JD1080A (Field)	LED's 1, 2	Flashing
	LED's 3,4	Pulsing
	LED 5	Illuminated
Modem JD1080A(Office)	LED's 1,2 #1	Steady #1
	LED 3	Pulsing
	LED's 4,5	Flashing
PP Computer Card JM1036	LED	Illuminated

Card	Indication/Function	State
TX Computer Card JM1021	LED	Illuminated
RX Computer Card JM1020	LED	Illuminated
Microcomputer JM25XX	LED’s 1-8	Extinguished
Memory Extension	N/A	N/A
Highway Buffer Unit	LED’s A0-A10 #2	Pulsing
	LED’s D0-D7	
	RD LED	
	WR LED	
	Reset LED	Extinguished
	Compare LED	Illuminated
Input Buffer Units (single)	LED1	Pulsing
Input Buffer units (Double)	LED1	Pulsing
	LED2	Pulsing
Transistor Output Buffer Units	LED1	Pulsing
Single PSU (JD1076)	+5v LED	Illuminated
Triple PSU (JD1077)	+12v LED	Illuminated
	+5v LED	
	-12v LED	
Battery Backed Triple PSU (JD1077)	+5v LED	Illuminated
	+12v LED	
	-12v LED	
	Batt OK LED	
Output Changeover Unit (Dual Systems only)	LED 1	Pulsing
	LED 2	Illuminated (online unit only)
	LED’s 3, 4, 7, 8	Extinguished
	LED’s 5, 6	Illuminated
Triac Output Buffer Unit	LED 1	Pulsing

Table 3 - System Indications

#1: LED’s 1 and 2 are Flashing on 4 wire (full duplex) circuits but steady on 2 wire circuits (half duplex).

#2: LED’s A7-A10 might be extinguished for smaller systems of less than 4 sub racks (refer to manufacturers’ manuals).

END

Includes:	WRSL Type TDM69, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

Plugging and un-plugging of cards shall be kept to a minimum and undertaken with great care for the remaining life of the equipment.

Edge connectors in this system cannot be repaired or replaced and the failure of an edge connector can permanently render the card or motherboard involved unusable.

See the notes in NR/SMS/PartC/SB00 (Signal Box Control & Operating Systems General) on older systems.

General

Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement.

This system involves the transmission of data between locations called office and field. An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications (See Appendix A for indications).

This system was developed in the late 1960's. It is an asynchronous point to point system using simplex as a transmission mode. The system is IC based using TTL technology.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. High / Low Voltage Tests

The following checks are to be carried out in close liaison with the Signaller at times when no traffic is signalled at both the field and office ends of the system.

10.1 Operate the power supply unit high / low voltage switches as detailed below.

Each step shall be one-minute duration.

Observe the alarm indications remain normal:

a) 24V - High.

b) 24V - Low.

c) 7V - High.

d) 7V - Low.

e) 24V and 7V - High (simultaneously).

f) 24V and 7V - Low (simultaneously).

g) 24V - High and 7V - Low (simultaneously).

h) 24V - Low and 7V - High (simultaneously).

The following tests are best carried out under a system possession.

They can be carried out in conjunction with a test of the local panel. If so, the local panel shall be switched into use and the operator shall verify that they have control of the signalling functions before any testing is started.

Where there is no local panel, the interlocking involved can be put into override.

Testing can start once confirmation is received that override is operating correctly. Liaise with the Signaller before switching any local panels or putting the system into override.

11. Received Signal Level Test (TDM 69 Non-VF Only)

11.1 Using a meter, measure the signal level at the receiver line connection unit (plus A1 and A2 on the line connection unit plugboard). Compare the reading with those taken at the time of installation.

12. Line Level Test (TDM 69 Non-VF Only)

Using a meter capable of measuring decibels, measure the TX and Rx level at the appropriate transmitter or receiver module/modem/line termination (equipment side of any line connection unit). Compare the readings with the previously recorded results.

13. Voltage Tests

13.1 Using an electronic meter (or oscilloscope for the ripple voltage) measure the following voltages on the monitor card. Compare the readings with the previously recorded results.

Test Point	Limits	Ripple
TX +24V	+23.5V to 24.5V	N/A
TX +12V	+10V to 13V	N/A
TX -12V	-10V to -13V	<100mV P/P
TX +7V	+6.8V to +7.2V	<100mV P/P
TX +5V	+4.75V to +5.25V	N/A

Test Point	Limits	Ripple
Rx +24V	+23.5V to 24.5V	N/A
Rx +12V	+10V to 13V	N/A
Rx -12V	-10V to –13V	<100mV P/P
Rx +7V	+6.8V to +7.2V	<100mV P/P
Rx +5V	+4.75V to +5.25V	N/A

Table 1 - Voltage test limits

14. Insulation / Noise Tests

14.1 Using a meter, measure the insulation resistance between the 0v rail (inner PC card housing) and earth it shall be:

- One Rx/Rx Housing <20MΩ.

Where extension modules are used the readings can be reduced as below:

- One extension Module <10MΩ.
- Two extension Modules <7MΩ.

If the insulation resistances are below these stated in 14.1, connect an oscilloscope to the test points on a DIP or DOP card.

The voltages obtained under worse case conditions (when two or more routes are cancelled simultaneously) shall not exceed 400mV.

If this voltage is exceeded, then TX and RX extension modules shall be examined for faulty suppression capacitors.

15. Final Checks

Before booking the Remote Control system back into use check all the functions are present at the controlling signal box and there are no fault indications.

16. Line Protection and Route Selection

16.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

16.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

17. Spares

17.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

17.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

18. Final

18.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

18.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications

These indications are at both the office and field ends of the system.

System	Indication
Dual Alarm Monitor	Green light
Highway Filter	Illuminated Steady LEDs
Alarm Card	

Table 2 - System Indications

END

Includes:	WRSL Type S2, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement.

The remote-control system involves the transmission of data between locations called office and field. An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications.

At the office end a processor can be part of the S2 remote control system; this is a separate housing to the S2 card housing and will be STD bus or WRSL VME bus based. PLC's (Programmable Logic Controllers) can also be provided.

This system was developed in the late 1970's. It is an asynchronous multi station system using simplex or duplex as a transmission mode. The system is based on Microprocessor technology.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

System Tests

On duplicated systems invasive tests shall be conducted on the off-line system.

To test the current on-line system, a change-over shall be forced to change the on-line systems over.

On non-duplicated systems the tests shall be conducted under a system occupation.

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. Power Supplies (non-Manchester systems)

10.1 Measure the DC voltages of the power supplies associated with the system. On the regulated supplies measure using a Digital voltmeter or an oscilloscope the AC ripple on the DC output.

Check they are within the limits as shown in Table 1:

Type	Supply Voltage	Limits	Ripple
Regulated	12V	11.5V to 12.5V	< 50mV
Regulated	24V	23.5V to 24.5V	< 70mV
Regulated	50V	48V to 51V	< 100mV
PSU	12V	11.5V to 12.5V	NA
PSU	24V	23V to 26V	NA
PSU	50V	49V to 55V	NA

Table 1 - Power Supply Limits (non-Manchester systems)

There is always a 12V supply and usually a 24V and/or 50V. If any of the voltages or ripples are found to be outside the limits the relevant power unit shall be changed and re-tested.

11. Power Supplies (Manchester systems only)

11.1 Processor (STD bus only) (If provided) measure the DC power supplied to the STD bus housing.

Using a Digital voltmeter or an oscilloscope measure the AC ripple on the DC output. Check they are within the limits as shown in table 2.

Between	Supply	Limits	Ripple
Black/Red	+5V	5V to 5.5V	<20mV
Black/Orange	+12V	11.5V to 12.5V	<50mV
Black/Purple	-12V	-11.5V to -12.5V	<50mV

Table 2 – Power Supply Limits (Manchester system)

11.2 Test at the connection between the housing and its associated PSU (no test points exist but the voltage can be measured by carefully inserting the test prods into the Molex connection block).

The +5V is critical to reliable operation of the processor. If any of the power supplies are outside of limits the power supply shall be changed. Adjustment of Style M281 power supplies +5V shall only be done for replacements.

TTL logic should operate between 5.0 and 5.25V, this is the voltage present on the cards. Due to the number of cards and current drawn, the voltage at the power supply can be slightly higher, hence the 5.5V upper limit.

12. Processor PLC Type EX40 (only)

12.1 Measure the internal unregulated 24V DC power supply between the DCO+ and the DCO– terminals.it should be between 12V and 30V DC.

The EX08 is an expansion unit.

13. Processor PLC Type S7-200 (Only)

13.1 Measure the external power supplies (Supplies and limits are as per the Table 2)

14. Duplicated Power Supply Units (PSU) Associated with S2 Housings (all systems)

The following tests shall be conducted under a system occupation or during a quite traffic period in liaison with the Signaller.

14.1 Disconnect the 110V AC feeds to one of the PSU's and check that an alarm is given and the S2 system continues to operate correctly.

14.2 Measure the DC output and using a digital voltmeter or an oscilloscope the AC ripple voltage of the remaining PSU. Check that the ripple voltage does not exceed 50mV.

If this voltage is exceeded the PSU shall be changed.

14.3 Observe that the DC output indicator lamp(s) of the un-powered PSU are extinguished. If any remain illuminated the PSU shall be replaced.

Repeat 14.1 to 14.3 for each PSU.

15. Line Levels (non- Manchester systems only)

15.1 Using the adaptor plug (Appendix A) set the office modem A to continually transmitting. Measure using a suitable meter the modems transmit level at a convenient point, they should be between 11.4dBm and –16dBm.

At the field(s) locations, measure using a suitable meter the received level at a convenient point they should be no lower than –40dBm.

15.2 Remove the adaptor plug from modem A and repeat 4.1 and 4.2 for modem B

Where Line Matching Units (LMU) is fitted the signal shall be measured on the modem side of the LMU.

15.3 Disable the office modems and set one of the fields modem to transmit (Appendix A).

Measure using a meter, the transmitted level at a convenient point, they should be between -11.4dBm and –16dBm.

At the office locations, measure using a suitable meter the received level at a convenient point they should be no lower than –40dBm.

15.4 Repeat 15.3 for each of the field modems.

Where Line Matching Units (LMU) is fitted the signal shall be measured on the modem side of the LMU.

Set all the modems back to normal operation and confirm using the office alarm panel that the system is operating correctly.

16. Line Levels (Manchester systems only)

The following tests shall be conducted under a system possession.

16.1 The modem line levels shall be measured with a constantly transmitting data signal. Use either the adaptor plug shown in Appendix A, modem test set, or the modems own test facilities (check the modem manual).

16.2 Set the office modem A to continually transmitting data. Measure using a suitable meter (VF meter) the modems transmit level at a convenient point; they should be between –11.4dBm and –16dBm.

At the field locations, measure using a suitable meter the received level at a convenient point, they should be no lower than –40dBm.

16.3 Check that the alarm fault indication panel for the processor housing is showing the relevant alarm, e.g. ‘link failure’.

Check the audible/visual LED indication alarms on Signallers desk and also on corresponding processor alarm panel (also ref section 6- System Changeover).

Not all processors are duplicated, check on drawings.

16.4 Set the field modem A to transmit data. Measure using a suitable meter the modems transmit level at a convenient point; they should be between –11.4dBm and –16dBm.

At the office locations, measure using a suitable meter the received level at a convenient point, they should be no lower than –40dBm.

16.5 Repeat 16.2 & 16.4 for modem B.

Where Line Matching Units are fitted the signal shall be measured on the modem side of the LMU.

16.6 Set all the modems back to normal operation and confirm using the office alarm panel that the system is operating correctly.

17. System Change Over (Dual systems and non-Manchester systems only)

The following tests shall be conducted under a system possession.

17.1 Operate the Signaller’s change over control. Observe that the Signaller’s system indications respond correctly and that each system operates correctly.

17.2 Operate (where fitted) the Technicians Auto/Manual change over switch. Switch from ‘Auto’ to system ‘A’ and check the system operates correctly. Return the switch to the ‘Auto’ position and repeat the test switching to system ‘B’.

17.3 Check on completion of this test the switch is left in the ‘Auto’ position. Failure to do so results in the Signaller being unable to change systems in the event of a failure.

18. System Change Over (Manchester systems only)

The following tests shall be conducted under a system possession.

There are two different methods used to change over the systems, depending on the type of equipment present.

18.1 Carry out either Section 19. or Section 20 depending on the type of equipment in your area.

19. STD Bus & VME Bus CM2R systems only (control processors)

STD Bus systems and VME CM2R systems have a change-over switch located remotely from the equipment, on the Signaller’s route setting desk.

19.1 Operate the Technicians Auto/Manual change over switch. Switch from “Auto” to system “A” and check that the system operates correctly.

19.2 Return the switch to the “Auto” position and repeat the test switching to system “B”. Check the system is left in “Auto”

<u>CM2R system only:</u>

19.3 Check that the ‘Auto Latch’ LED is flashing. If the LED is extinguished press the ‘Latch Reset’ button.

20. VME Bus CM2 system only (Indication Processors)

VME CM2 type systems have a rotary switch in the processor housing to enable switching of the system by the Technician.

20.1 Set the rotary switch to the off-line system and observe that the systems switch over.

20.2 Set the rotary switch to the 'Auto' position.

20.3 Check the 'Auto Latch' LED is flashing. If the LED is extinguished press the 'Latch Reset' button.

21. Line Protection and Route Selection

21.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

21.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

22. Spares

22.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

22.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

23. Final

23.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

23.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - Modem Connections for Continuous Transmission

The configuration of the modem 9-way 'D' connector is as follows:

Pin	Signal	Pin	Signal
2	Tx Ready	5	CTS (Clear to Send)
3	Rx Data	6	DTR (Data Terminal Ready)
4	RTS (Ready to Send)	7	Ground (0V)

Table 3 - Modem configuration

A line pair can be tested by disconnecting the 'DTE' D- type connector at the rear of the 'end of the line' modem (this can be the office modem or the furthest away field modem) and replacing it with a D-type male plug with the internal connections configured Pin 4 connected to Pin 6.

This can set the modem to continually transmitting at 1300Hz (mark).

The modem launch level and receive levels along the line can now be measured at a convenient point in the S2 cabinet (refer to the site diagrams).

If there is a miniature switch fitted to the D-type plug (this is between Pin 2 and Pin 6) the modem can be set to transmit either 'mark' (1300Hz) or 'space' (2100Hz) to check the frequency attenuation of the line.

APPENDIX B - System indications

These indications are seen at both the office and field ends of the system.

Alarm Panel		
Location	**Indication**	**Status**
Office	Fault	Extinguished
	Call Technician	
	In Use	Illuminated (if System Selected)
	Available	Illuminated
Field	Fault	Extinguished
	In Use	Illuminated (if System Selected)

Table 4 - System indications

The 'In Use' indication does not appear on single systems

Power Supply	
Indication	**Status**
PSU	Illuminated
Power Failure	Extinguished

Table 5 - Power supply indications

Scanner Cards in the S2 Housings		
LED Position and Colour	**Indicating**	**State**
Top Red	Highway OK	Regular Flashing
Lower Red	Programme OK	On
Top Yellow (x2)	NA	Off (only active if alarms printer connected)
Lower Yellow (x2)	Data Tx or Rx	Continuous Flickering

Table 6 - Scanner Card Indications

Digital Input (DIP) & Digital Output (DOP) Cards in the S2 Housing		
LED Position and Colour	**Indicating**	**State**
DIP Card Top Red	Highway A	Regular Flashing
DIP Card Lower Red	Highway C	
DOP Card Top Red	Highway A	
DOP Card Lower Red	Highway C	

Table 7 - DIP&DOP indications

If the system is not dual only the top LED's flash

Modems		
LED	**Indicating**	**State**
PWR	Power	Illuminated
DTE	Data Terminal Equipment	
RXD	Receive Data	Flashing
TXD	Transmit Data	

Table 8 – Modem Indications

If the system is not dual only the top LED's flash

Processor (Type WRSL VME only) if provided	
LED	**State**
Online	Illuminated (SYS 1 or 2)
Watchdog	Flashing
Available	Illuminated
Autolatch	Flashing
Fault	Extinguished

Table 9 - Processor Indications

Toshiba PLC		
LED	**Status**	
	IP PLC	**CP PLC**
Power	Illuminated	NA
Run	Illuminated	Illuminated
Error	Extinguished	Extinguished
Alarm	Extinguished	Extinguished
PROM	Illuminated	Illuminated

Table 10 - Toshiba PLC indications

Siemens PLC	
LED	**Status**
SF	Extinguished
Run	Illuminated
Stop	Extinguished

Table 11 - Siemens PLC indications

END

Includes:	Westronic F1 TDM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement.

A remote control system involves the transmission of data between locations called office and field. An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications.

This system was developed in the mid 1960's. It is a synchronous multi-station system using half duplex as a transmission mode. The system is built on discrete components (cards).

See the notes in NR/SMS/PartC/SB00 (Signal Box Control & Operating Systems General) on older systems.

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary, locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. Power Supplies (Office & Field)

10.1 Measure using a meter the DC voltage and AC ripple on the ‘A’ & ‘B’ supply lines at the appropriate fuse terminals on the supervisory and monitoring panel.

For 18V the limits are between 17.25 to 18 VDC, with a ripple voltage of <50mV.

10.2 In turn, operate and then return to the normal (up) positions the ‘A’ & ‘B’ marginal voltage switches. Measure using a meter the DC voltage and AC ripple at the same test points as 10.1.

For 16.5 V the limits are between 15. To 16.5 VDC, with a ripple voltage of <50mV.

11. Line Changeover (Office) (If Provided)

This test shall be performed in liaison with the Signaller.

11.1 By use of the line selection switch, change lines and check that the system returns to normal operation within 5 to 7 seconds. Return to the line originally selected and check that the system returns to normal operation within 5 to 7 seconds.

11.2 Observe that the ‘Line Selected’ indication corresponds with the position of the switch and no faults are indicated during the changeover test.

12. Fault Alarm and Alarm Resets (Office & Field)

Because of the disruptive nature of the following tests it is advised they are carried out under a system possession unless the duration of the occupation is limited and the Signaller is in agreement.

12.1 Because of the interaction between office and field, alarm tests shall be performed at one location at a time, with all others set for normal operation.

During these tests a secondary alarm can be given along with the one being tested; these should be ignored for the purposes of these tests.

13. Fuse Alarm

13.1 Turn the alarm reset switch to manual.

The door indication should show manual alarm reset.

13.2 Briefly connect the feed side of a fuse to the centre stud. Check that the red fuse alarm lamp illuminates.

13.3 On the monitoring panel check that after approximately six seconds the 'System Normal' lamp extinguishes and the 'System Failed' lamp illuminates.

13.4 Press the alarm reset button and check the alarms clear.

14. All Cards Present / Card Out (If provided) (Including registry relay cards)

14.1 Turn the alarm reset switch to auto.

14.2 Remove a principal card (e.g. OMT3). Check that the 'All Cards Present' lamp extinguishes and the 'Card Out' lamp illuminates.

14.3 On the monitoring panel check that after approximately six seconds the 'System Normal' lamp extinguishes and the 'System Failed' lamp illuminates.

14.4 Replace the card and check that the 'Card Out' lamp extinguishes and the 'All Cards Present' lamp illuminates on the monitoring panel, check that after approximately six seconds the 'System Normal' lamp illuminates and the 'System Failed' lamp extinguishes.

This test's the auto reset of the 'Card Out' alarm.

14.5 Turn the alarm reset switch to manual.

14.6 Remove a principal card (e.g. OMT3). Check that the 'All Cards Present' lamp extinguishes and the 'Card Out' lamp illuminates.

14.7 On the monitoring panel check that after approximately six seconds the 'System Normal' lamp extinguishes and the 'System Failed' lamp illuminates.

14.8 Replace the card and press the alarm reset button, check the alarms clear.

15. Scan Fail

15.1 Turn the alarm reset switch to auto.

15.2 Connect together the P79 (80 stage stepping chain) or P63 (64 stage stepping chain) and the common sockets on the matrix board (located on the system monitoring panel).

15.3 Check that the ‘Scan Fail’ lamp illuminates. On the monitoring panel, check that after approximately six seconds the ‘System Normal’ lamp extinguishes and the ‘System Failed’ lamp illuminates.

15.4 Remove the strap and check that after approximately five to seven seconds the automatic fault reset operates and the system normalises.

16. Two Delivery Relays Up (Not fitted at single address fields)

16.1 Turn the alarm reset switch to auto.

16.2 Strap together the D2U and 2.2K sockets on the matrix board. Check that the ‘D2U lamp illuminates. On the monitoring panel, check that after approximately six seconds the ‘System Normal’ lamp extinguishes and the ‘System Failed’ lamp illuminates.

16.3 Remove the strap and check that after approximately five to seven seconds the automatic fault reset operates and the system normalises.

17. Two Entry Relays Up (Not fitted at single address fields)

17.1 Turn the alarm reset switch to auto.

Strap together the E2U and 2.2K sockets on the matrix board. Check that the ‘E2U lamp illuminates. On the monitoring panel, check that after approximately six seconds the ‘System Normal’ lamp extinguishes and the ‘System Failed’ lamp illuminates.

17.2 Remove the strap and check that after approximately five to seven seconds the automatic fault reset operates and the system normalises.

18. Delivery Fail

18.1 For each address in turn, remove the relevant RD1 card (refer to the WRSL diagrams for the system). Check that after a few seconds the ‘Delivery Fail’ lamp for that address illuminates.

18.2 Replace the card and check that after a few seconds the ‘Delivery Fail’ lamp extinguishes and all other alarms show normal.

19. Office Location Only

19.1 Remove the RD1 cards for all address. Check that the 'Common Delivery Fail' lamp illuminates.

19.2 Replace all the cards and check that after a few seconds the system normalises and no other alarms are indicated.

20. Final

20.1 At all locations check that all indications show normal, there are no alarms showing and the alarm reset switch is in the auto position.

21. Marginal Voltage Test (Office & Field)

21.1 Select the marginal voltage operation by using the two toggle switches. Check that the 'Marginal Voltage' warning lamp illuminates when either or both switches are operated.

21.2 Leave the switches in this position for at least 30 minutes. If any other alarms are indicated in this period rectify as necessary.

21.3 After the 30 minutes period return the switches to their normal position (Up) and check that the 'Marginal Voltage' warning lamp extinguishes.

22. DC Line Proving (If Provided)

22.1 Check that the Normal line is selected at all locations. Check that the 'Line Proving OK' lamp is illuminated.

22.2 At the terminal field location, disable the DC line proving supply by removing the two small plug-in relays whose coils are used as carrier signal blocking chokes.

22.3 At the office location check that the 'Line Proving OK' lamp extinguishes and the 'Line Fault' lamp illuminates. Replace the relays at the field location and check that the 'line Fault' lamp extinguishes and the 'Line Proving OK' lamp illuminates.

22.4 Switch to the Standby line.

22.5 At the terminal field location, disable the DC line proving supply by removing the two small plug-in relays whose coils are used as carrier signal blocking chokes.

22.6 At the office location check that the 'Line Proving OK' lamp extinguishes and the 'Line Fault' lamp illuminates. Replace the relays at the field location and check that the 'line Fault' lamp extinguishes and the 'Line Proving OK' lamp illuminates.

23. AC Line Proving (If Provided)

23.1 Check that the Normal line is selected at all locations. Check that the 'Line Proving OK' lamp is illuminated.

23.2 At the office location remove the line proving card check that the Normal line is selected at all locations. Check that the 'Line Proving OK' lamp is illuminated. Replace the card and check the indications normalise.

23.3 At the terminal field location remove the line proving card and check at the office location that the 'Line Proving OK' lamp is illuminated. Replace the card and check the indications normalise.

23.4 Switch to the Standby line.

23.5 At the office location remove the line proving card check that the Normal line is selected at all locations. Check that the 'Line Proving OK' lamp is illuminated. Replace the card and check the indications normalise.

23.6 At the terminal field location remove the line proving card and check at the office location that the 'Line Proving OK' lamp is illuminated. Replace the card and check the indications normalise.

24. Line Protection and Route Selection

24.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

24.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

25. Spares

25.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

25.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

26. Final

26.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

26.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Adjustments and Set Up

These procedures require the use of specialised equipment and can affect the operation of the system.

They shall only be carried out by persons competent in using this equipment and with the F1 system. (E.g. Technical Support).

APPENDIX B - System Indications

These indications are at both the office and field ends of the system. Note that not all the indications are present in systems at different locations. Check only the indications present on the system you are maintaining.

Indication	Colour	State
System Normal	Green	Illuminated
All Cards Present		
Door		
Line Proving OK		
Line Fault	Red	Extinguished
System Failed		
Card Out		
Scan Fail		
D2U		
E2U		
2DRU		
2ERU		
Fuse Alarm		
Delivery Fail		

Table 1 - System Indications

END

Includes:	Vaughan Harmon DM11, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement.

The remote control system involves the transmission of data between locations called office and field.

An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

See the notes in NR/SMS/PartC/SB00 (Signal Box Control & Operating Systems General) on older systems.

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary, locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. DC Power Supplies

10.1 Measure using a meter the DC output voltages from all the power supply units on the 'A' and 'B' systems.

10.2 Measure using a digital voltmeter or an oscilloscope the AC ripple on the DC output. Check they are within the stated limits:

PSU	Test Point	Volts	Limits	Ripple
A&B +5VDC Logic	PSU Front Panel Sockets	+5V	+4.9V to +5.25V	< 50mV
A&B +7VDC Logic		+7V	+6.5V to +7.5V	< 50mV
A&B Interface		-12V	-11.5V to -12.5V	< 100mV
A&B Supply to regulated PSU	AP-H Test Points #	+48V	+45V to +52V < 5V	< 5V

Table 1 - Powers Supply Limits

If any of the voltages or ripples are found to be outside the limits the relevant power unit shall be changed and re-tested.

#: On Gresham-Powerdyne PSUs test voltage where accessible.

11. AC Power Supplies

11.1 Measure the AC supply voltage to all the power supply units this should be 105V to 120V.

12. System Change Over

The following tests shall be conducted under a system possession or during a quiet traffic period in liaison with the Signaller.

12.1 Check that the processor indications are as listed in Appendix A.

With the co-operation of the Signaller, force a changeover of the system and observe the processor indications remain as listed in Appendix A (on line and off line are now reversed).

12.2 Return the changeover switch to its original position and observe the processor indications remain as listed in Appendix A.

13. Line Levels

The following tests shall be conducted under a system occupation or during a quite traffic period in liaison with the Signaller.

On Line System

13.1 At the office end of the system measure using a meter, the transmitted level of the controls and the received level of the indications at the line connection points:

a) Tx Control Levels: -13dBm to -16dBm.

b) Rx Indication Levels: No lower than -40dBm.

13.2 At the field end of the system measure using a meter, the received level of the controls and the transmitted level of the indications at the line connection points.

a) Tx Indication Levels: -13dBm to -16dBm.

b) Rx Control Levels: No lower than -40dBm.

Off Line System

13.3 At the office end of the system measure using a meter, the transmitted level of the controls and the received level of the indications at the line connection points:

a) Tx Control Levels: -13dBm to -16dBm.

b) Rx Indication Levels: No lower than -40dBm.

13.4 At the field end of the system measure using a meter, the received level of the controls and the transmitted level of the indications at the line connection points.

a) Tx Indication Levels: -13dBm to -16dBm.

b) Rx Control Levels: No lower than -40dBm.

14. Monitor Card

14.1 Test the operation of the monitor card by checking a convenient signalling function whilst it is being operated for both the ‘A’ and ‘B’ systems.

15. Line Protection and Route Selection

15.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

15.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

16. Spares

16.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

16.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S) Test the operation of the cards/units in the test rack.

17. Final

17.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

17.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications

Signaller's Alarm Panel	
LED	**State**
On Line	On (if system selected)
Fault	Off
Available	On

Table 2 - Alarm Panel Indications

System Cards		
LED	**Card**	**State**
Watchdog	68P Processor (A&B)	Flashing
Available		On
Selected		On (if selected)
Fault		Off
Tx		Flickering
Rx		Flickering
Halt	68P Processor (A&B)	Off
A&B Scan	6SI Input	Both Flickering
	6SO Output	One Flashing

Table 3 - System Cards Indications

END

Includes:	Telecode TDM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

The remote control system involves the transmission of data between locations called office and field. An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications.

If a half system fails, then recovers or is switched out of maintenance there is an automatic two-minute ‘recovery’ period during which the affected half system cannot be brought ‘on line’.

Some systems are non-duplicated, and some are ‘one way’ (simplex) only. If you are unsure ask your SM(S).

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians’ terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. Watchdog Unit

10.1 Check the alarm status displays on the Watchdog card. Investigate any alarms showing then press the Watchdog alarm re-set button.

11. Power Supplies

11.1 Measure the AC supply voltage to all the power supply units and confirm it is between 105V to 120V

11.2 Measure using a meter the DC output voltages from all the power supply units on the 'A' and 'B' systems.

11.3 Measure using a digital voltmeter or an oscilloscope the AC ripple on the DC output. Check they are within the stated limits:

PSU	Test Point	Volts	Limits	Ripple
Logic (without standby battery)	PSU Front Panel Sockets	+12V	+11.4V to +12.6V	< 50mV
Logic (with standby battery)	PSU Front Panel Sockets	+12V	+13.2V to +14.4V	< 50mV
Plant Supply	Melcher PSU 2mm Test Points #	+50V	+48V to +52V	< 100mV
Modem	5V Test Point	+5V	+4.9V to +5.25V	<100mV

If any of the voltages or ripples are found to be outside the limits the relevant power unit shall be changed and re- tested.

#: On this unit multiply the reading by two to obtain the correct voltage.

12. Standby Battery Test (where provided)

The following test shall be conducted in liaison with the Signaller.

12.1 Switch off the ‘A’ 12V logic PSU. Observe that the ‘A’ system continues to operate normally (although it shows as a fault on the maintainer’s panel).

12.2 Measure the output voltage over a period of 5 minutes and check that it does not drop below 11.8V. Switch the unit back on and observe that the voltage increases slightly.

12.3 Switch off the ‘B’ 12V logic PSU. Observe that the ‘B’ system continues to operate normally (although it shows as a fault on the maintainer’s panel).

13. Line Levels (VF Modems only, where fitted)

The following tests shall be conducted under a system possession.

13.1 Confirm which of the systems is currently in use (A or B) and check the correct indications are showing on the monitoring panels and the system cards.

13.2 At the field end of the system set the upper switch on the ‘A’ modem to the ‘Test MK’ position and measure using a meter the transmit level at the ‘SEND’ test points and confirm it is between -11dBm to –13dBm

Do not alter the setting of the ‘LOOPBACK’ switch.

13.3 At the office end of the system measure using a meter the ‘A’ modem received level at the ‘REC’ test points and confirm it is no lower than –30dBm.

13.4 At the field end of the system move the upper switch on the ‘A’ to the ‘TEST BIAS’ position.

13.5 At the office end of the system measure using an oscilloscope on the ‘A’ modem the received signal at the ‘RD’ test points is a square wave with a 1:1 mark/space ratio.

13.6 Replace the switch on the ‘A’ transmitter modem at the field end of the system to the ‘NORMAL’ position and repeat 4.2 to 4.5 for the field and office ‘B’ modems.

14. Line Levels (Fibre Modems only, where fitted)

When handing a disconnected fibre do not look into its end.

The following tests should be conducted under a system possession using a light meter accepted for this system.

14.1 At the office end, ascertain which of the systems is currently in use (A or B), checking that the correct indications are showing on the monitoring panels and the system cards.

On the system not currently in use establish where the Tx and Rx channels are.

On cards with two fibres connected, one is the Tx and the other the Rx. On cards with one fibre connected, the Tx and Rx use the one fibre with one operating at 1310nm and the other at 1550nm.

14.2 Measure using a light meter the Rx light level at the end of the fibre:

- No lower than -20dBm.

14.3 Measure using a light meter the Tx light level at the end of the fibre:

- No lower than -8dBm.

14.4 Reconnect the fibre(s) and repeat section 5 at the field end.

15. Alarms (VF Modems only, where fitted)

The following tests shall be conducted under a system possession.

15.1 At the office end of the system open the ‘transmit’ line pair by using the upper two isolating links fitted in the TBVFA terminal block (at the rear of the Telecode 80 cabinet).

15.2 At the field end of the system observe that the ‘A’ modem indicates a ‘CA’ alarm and that the ‘DCD’ indication extinguishes. Reinstate the links and observe that the alarms cancel.

15.3 Repeat 15.1 using the isolating links on the TBVFB terminal block and alarm indications on the ‘B’ modem.

15.4 At the field end of the system open the ‘transmit’ line pair by using the upper two isolating links fitted in the TBVFA terminal block (at the rear of the Telecode 80 cabinet).

15.5 At the office end of the system observe that the ‘A’ modem indicates a ‘CA’ alarm and that the ‘DCD’ indication extinguishes.

15.6 Reinstate the links and observe that the alarms cancel.

15.7 Repeat 15.3 using the isolating links on the TBVFB terminal block and alarm indications on the ‘B’ modem.

16. Transmission Test

The following tests shall be conducted under a system possession.

16.1 At the office end of the system using the maintainers panel, check that the test bit can be sent on both the ‘A’&’B’ systems.

16.2 Repeat 16.1 at the field end of the system using the test bit pushbuttons on the remote change over panel.

17. System Change Over (duplicated systems only)

The following tests shall be conducted under a system possession.

17.1 On the office Maintainer’s Panel operate the switch on the system that is in use to ‘Maintenance’ and observe that the ‘OK’ light has commenced to flash, its ‘In Use’ indications are extinguished, and the other systems ‘In Use’ indications are illuminated.

17.2 Observe on the Signaller’s TDM Status Panel that the ‘In Use’ indication has changed to the other system and the ‘Semi Urgent Alarm’ shows.

17.3 Switch the system back to ‘Available’ and after the two- minute recovery check that the Semi Urgent Alarm’ has extinguished. Repeat 8.1 & 8.2 for the other system.

17.4 Check that during these tests all system indications display the correct information and that the audible alarm sounds when the system indicates a fault. When the system has recovered from a fault and can be silenced by the acknowledge pushbutton.

18. Line Protection and Route Selection

18.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

18.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

19. Spares

19.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

19.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S) Test the operation of the cards/units in the test rack.

20. Final

20.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

20.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications

Signaller's TDM Status Panel		
LED	**State**	**Meaning**
System OK	Normally Illuminated	At least one half of system available
System Failed	Normally Extinguished	If Illuminated, both systems failed or switched to maintenance
Semi Urgent Alarm	Normally Extinguished	If Illuminated, one half of system failed or one system switched to maintenance
System 1 in use	Illuminated or Extinguished	Only Illuminated if system in use
System 2 in use	Illuminated or Extinguished	Only Illuminated if system in use

Table 1 - Signaller's TDM Status Panel Indications

Maintainer's Panel (office end only)		
LED	**Colour**	**State**
OK (System A&B)	Green	Illuminated
Failed (System A&B)	Red	Extinguished
In Use Send (System A&B)	Green	Illuminated (only if in use)
In Use Receive (System A&B)		
Test (Systems A&B)	Yellow	Extinguished
50v Power Fail - Local	Red	Extinguished
50v Power Fail - Remote		

Table 2 - Maintainer's Panel (office end only) Indications

NOTE: *Not all Telecode 80 systems have a maintainer's panel.*

Remote Change Over Panel (field end only)		
LED	**Colour**	**State**
OK (Systems A&B)	Green	Illuminated
Failed (System A&B)	Red	Extinguished
In Use (Systems A&B)	Green	Illuminated (only if in use)
Test (Systems A&B)	Yellow	Extinguished
50v Power Fail	Red	Extinguished

Table 3 - Remote Change Over Panel (field end only) Indications

Power Supply Modules	
LED	**State**
PSU 1 - OK	Illuminated Green
PSU 1 - Failed	Extinguished
PSU 2 - OK	Illuminated Green
PSU 2 - Failed	Extinguished

Table 4 - Power Supply Modules Indications

System Cabinets		
Card	**Function**	**State**
Transmitter	Wait	Extinguished
	Start	Regular Flashing Yellow
	Parity	Regular Flashing Yellow
	Clear	Regular Flashing Yellow
TX Digital Extender	Scan	Illuminated Yellow
Receiver	Viol	Regular Flashing Yellow
	Parity	Regular Flashing Yellow
	D.Fail	Extinguished
Master Receiver	M.Fail	Extinguished
	C.Fail	Extinguished
	Scan	Regular Flashing Yellow
VF Modem	Test	Extinguished
	RTS	Illuminated Yellow

System Cabinets		
Card	**Function**	**State**
	SD	Flashing Orange
	RD	Flashing Pink/Orange
	DCD	Illuminated Orange
	CA	Extinguished
Fibre Modem	DC	Illuminated Green
	Sync	Illuminated Green
Mains Power Supply & Battery Charger	+12V	Illuminated Green
	+12V Battery	Extinguished

Table 5 - System Cabinet Indications

Assembly, Card, and LED names are as printed on the faceplate. Illuminated means non flashing. Not all the cards are present in all systems.

END

Includes:	AP Datalink TDM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

Before removing or replacing any card or module you shall power down the system cubicle by removing the fuses (AC & DC) on the front panel of the PSU and BSU.

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

This system involves the transmission of data between locations called office and field. An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications.

A list of system abbreviations can be found in Appendix A. This system was developed in the late 1970's.

It is point to point system using simplex as a transmission mode. The system is based on CMOS technology.

If the system is duplicated, the services shall be carried out on each system.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. Power Supplies

The tests in this section shall be conducted under a system occupation or during a quite traffic period in liaison with the Signaller.

They shall be performed for both the controls and indication systems.

10.1 Measure the power supply to the equipment cubicle it should be between 105V and 120V AC.

10.2 Remove the BSU fuse and measure the output of the PSU it should be between14.3V and 14.7V DC.

10.3 Measure the voltage across the BSU test points; this should be between 0.6V and 0.9V less than the PSU reading. Replace the BSU fuse.

10.4 Measure using an oscilloscope the ripple voltage on the DC supply from the PSU it should be < 10mV Peak to Peak.

10.5 Measure (where fitted) the supply for the output buffer relays it should be between 11V and 13V DC (Ripple <100mV PP).

11. Carrier Transmission Levels (spot frequencies)

The following tests shall be conducted under a system possession. The following tests are to be carried out for each Tx(M) card.

Remember to power down the cubicle before removing or replacing any card.

11.1 Remove the Tx(C) cards at both the office and field ends of the system then switch all the LAU's in the system to Tx line operation.

11.2 Connect an oscilloscope and a frequency / power level meter to the output test points on the Tx(M) card. Measure the carrier frequency. In turn strap the common test point to the Mark and Space test points and measure these.

For each of these, check the displayed waveforms are not distorted and the signal level frequency is as below -1dBm to –3dBm

11.3 Repeat 11.2 with the test equipment connected to the Tx line test socket on the LAU card.

11.4 Switch all the LAU's in the system to Rx line operation. Repeat 11.2 and 11.3 using the Rx line test socket on the LAU card.

11.5 When all the measurements have been obtained return the switches on the LAU cards to 'Auto' line selection and replace the Tx(C) cards.

12. Carrier Reception Levels (spot frequencies)

The following tests are to be carried out for each Rx(M) card.

Remember to power down the cubicle before removing or replacing any card.

12.1 Remove the Tx(C) cards at both the office and field ends of the system then switch all the LAU's in the system to Tx line operation.

12.2 Connect an oscilloscope and a frequency / power level meter to the input test points on the Rx(M) card. Measure the carrier frequency. In turn strap the common test point to the Mark and Space test points and measure these.

For each of these, check the displayed waveforms are not distorted and measure the signal level frequency -35dBm.

If this measurement is more than 6dB lower than the last recorded, inform your SM(S).

12.3 Repeat 12.2 with the test equipment connected to the Tx line test socket on the LAU card.

12.4 Switch all the LAU's in the system to Rx line operation. Repeat 3.2 and 3.3 using the input test point on the Rx(M) card and then the Rx line test point on the LAU card.

12.5 When all the measurements have been obtained return the switches on the LAU cards to 'Auto' line selection and replace the Tx(C) cards.

13. Mark-Space Ratio

13.1 With the system in normal operation, measure using an oscilloscope the mark-space ratio and the pulse width at the test points on the Tx(M) card. The Mark-Space Ratio should be equal and the Pulse Width 5ms (±0.2ms).

14. Line Change Over

14.1 Using the switch on the LAU cards, select Rx line operation at both the office and field ends of the system. Observe that the system operates normally and no alarms are indicated.

14.2 Repeat 14.1 for the switch on the LAU cards in the Tx line operation position. Check that the switches are returned to the 'Auto' position at the completion of this test.

15. Alarms

15.1 On each of the alarm tests check that the cabinet door indication changes from green to red.

Power

15.2 Remove in turn the 110V AC and the 12V DC fuses from the PSU. Observe that the power supply alarm (PWR) is indicated on the LAU.

Receiver

Remember to power down the cubicle before removing or replacing any module.

15.3 At the office end of the system, remove in turn the Rx(C), Rx(M) and the last Rx(E) unit. Observe that a local Rx alarm is indicated on the local LAU and a remote Rx alarm is indicated on the LAU at the field location.

15.4 Repeat 15.3 at the field end of the system.

Transmitter

Remember to power down the cubicle before removing or replacing any module.

15.5 At the office end of the system, remove in turn the Tx(C), Tx(M) and the last Tx(E) unit. Observe that a local Tx alarm is indicated on the local LAU and a remote Tx alarm is indicated on the LAU at the field location.

15.6 Repeat 15.5 at the field end of the system.

Line

15.7 At each location in turn disconnect the Tx line and observe that the system automatically switches to operation on the Rx line.

15.8 Check that a Tx line alarm is indicated on the local LAU and a Rx line alarm is indicated at the remote LAU. Re-connect the line.

15.9 At each location in turn disconnect the Rx line and observe that the system automatically switches to operation on the Tx line.

15.10 Check that a Rx line alarm is indicated on the local LAU and a Tx line alarm is indicated at the remote LAU. Re-connect the line.

16. Battery Supply Units

16.1 Remove the 110V AC supply fuse to the PSU and allow the equipment to operate on the internal battery for 30 minutes. At the end of this period measure the battery supply unit voltage it should be 11.5V DC.

If the voltage is less than this the battery might be suspect and a replacement shall be fitted.

17. Line Protection and Route Selection

17.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

17.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

18. Spares

18.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

18.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

19. Final

19.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

19.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - – Abbreviation Meanings

Abbreviation	Meaning
PSU	Power Supply Unit
BSU	Battery Supply Unit
LAU	Line & Alarm Unit
Tx(M)	Transmitter Modem Card
Tx(C)	Transmitter Control Card
Tx(E)	Transmitter Extender Card
Rx(M)	Receiver Modem Card
Rx(C)	Receiver Control Card
Rx(E)	Receiver Extender Card

Table 1 - System Abbreviations

END

Includes:	Transmitton TDM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

This system involves the transmission of data between locations called office and field.

An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. Power Supplies

Some of the following tests do not require a possession of the system but it is recommended they are performed within a system possession unless the duration of occupation is limited, and the Signaller is in agreement.

10.1 Measure the AC supply voltage to the power supply unit - 105V to 120V.

10.2 Measure the DC output voltages from the power supply at the bus bars on the back of the rack.

NOTE: *The bus bars are identifiable as hard wire straps, soldered across the card sockets on the pin positions listed in Table 1 below:*

Plane Position	Pin Position +Ve	Pin Position 0V	Voltage	Limits
Top	1 & 2	31 & 32	+5V	4.8V to 5.2V
Bottom	27	32	+12V	11V to 13V
Bottom	29	32	-12V	-11V to-13V

Table 1 - DC Output Voltages

11. Line Levels

The following tests shall be conducted under a system possession or during a quiet traffic period in liaison with the Signaller.

11.1 At the office end of the system measure the transmitted level of the controls and the received level of the indications at the line connection points:

System	Level	Limits
Tx Controls	-13dBm	+3dBm/-7dBm
Rx Indications	-13dBm	+3dBm/-20dBm

Table 2 - Office Line Levels

11.2 At the field end of the system measure the transmitted level of the indications the received level of the controls at the line connection points:

System	Level	Limits
Tx Indications	-13dBm	+3dBm/-7dBm
Rx Controls	-13dBm	+3dBm/-20dBm

Table 3 - Field Line Levels

12. Line Protection and Route Selection

12.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

12.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

13. Spares

13.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

13.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

14. Final

14.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

14.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications:

Card	LED Function	State
Status Display Panel	System Healthy	Illuminated
	System Fail	Extinguished
	PSU Healthy	Illuminated
	Comms Fail	Extinguished
MT50 System Controller	Watchdog	Illuminated
CPU Board	Watchdog	Extinguished
MT 72 -16 Way Relay Input Board	Input Status	Flickering
MT 85 -16 Way Relay Output Board	Output Status	Flickering

Table 4 - TDM System Indication

Card	LED Function	State
PSU	+5v	Illuminated
	-12v	Illuminated
	+12v	Illuminated
	+24v	Illuminated
Memory Extension	N/A	N/A

Table 5 - Power Supply Unit

END

Includes:	DAM TDM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems.

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

This system involves the transmission of data between locations called office and field.

An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary, locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. Power Supplies

10.1 Measure the power supplies (logic, isolation, relay, transmission etc). Check they are within ±0.25V of their nominal value, if not rectify and/or report as corrective maintenance.

11. Line Levels

11.1 At the office end of the system measure the transmitted level of the controls and the received level of the indications.

Transmission Level	Maximum Permissible Line loss
-13dBm	30dB

Table 1 - Office Line Levels

11.2 At the field end of the system measure the transmitted level of the indications and the received level of the controls.

Transmission Level	Maximum Permissible Line loss
-13dBm	30dB

Table 2 - Field Line Levels

12. Line Protection and Route Selection

12.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

12.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

13. Spares

13.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

13.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

14. Final

14.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

14.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

Includes:	Westronic 1024 TDM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

System Configurations

The Westronic 1024 is provided in one of two configurations.

The field TDM is provided with duplicated processor cards (CPU-2) and a system arbiter card (SA-1) and duplicated power supplies.

The field TDM is equipped with a combination of up to 16 digital input (DIP-64) and Digital Output (DOP-64) cards.

The alarm monitor is fitted with a single processor card, a single power supply, and digital inputs only.

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. Dual Processor Systems Only

This is to check that the off-line systems and the changeover units are serviceable.

10.1 At the System Arbiter module, check the LEDs indicate as follows:

a) Either ‘SYS 1’ or ‘SYS 2’ On-Line LED is illuminated to indicate which system is on-line.

b) Both the on-line and off-line system’s ‘Watchdog’ LEDs are flashing.

c) ‘Power’ LED is illuminated.

d) ‘Fault’ LED is not illuminated.

e) ‘PSU1’ and ‘PSU2’ LEDs are illuminated Green.

NOTE: *If either ‘PSU1’ or ‘PSU2’ LED is red then press the ‘reset’ button to clear. Investigate and rectify any defects as corrective maintenance.*

10.2 Set the rotary switch to manually select the off-line system and observe that the systems switch over.

10.3 Check the LED indications for correct system operation.

10.4 Set the rotary switch to the ‘AUTO’ position.

11. Power Supplies

11.1 For systems fitted with a battery back-up unit, check the 'Battery OK' LEDs are illuminated.

NOTE: *If either of these LEDs is extinguished the battery has failed or is discharged.*

NOTE: *If a mains failure occurred recently, allow time for the battery to re-charge. If the Battery OK LED remains extinguished, replace the battery as per manufacturer's instructions.*

11.2 Where fitted, switch battery back-up output to 'disable'.

11.3 Check the '5V Power' LED is lit on the front of each PSU.

11.4 Using a multi-meter, check the output voltage from each PSU within the limits stated below.

Adjust if necessary, by rotating the trim control on the PSU front panel.

Supply Voltage	Limits	Ripple
PSU 5.0V	4.9 to 5.1V	<50mV

Table 1 - PSU Output Voltages

11.5 Switch the battery back-up output to 'enable'.

12. Battery Back-up Unit

The internal sealed lead acid battery has a quoted typical service life of five years. It is recommended that the battery should be replaced after four years.

12.1 Check the length of time the battery has been in service.

12.2 If the battery has been in service for four years or longer, replace it as detailed in the manufacturer's instructions.

13. Line Protection and Route Selection

13.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

13.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

14. Spares

14.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

14.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

15. Final

15.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary, locked.

15.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

Includes:	Solar systems used with Vamos Crossing Systems
Excludes:	All other types of Solar Powered Systems

General

An agreement with the Signaller shall be reached before any tasks are undertaken that affect the normal operation of the crossing equipment.

SERVICE B

1. Batteries

1.1 Check batteries for signs of damage, rectify if damaged.

1.2 Check all battery terminations are secure and clean.

1.3 Carry out NR/SMS/PartB/Test/055 (Secondary Cell Test) Section 1.

2. Solar Panels

2.1 Check all mounting bolts are secure.

2.2 Examine the solar panels for damage. Advise your SM(S) if the damage is noted.

Never use abrasive detergent, strong alkaline detergent and strong acid detergent

Clean the surface of the solar panel with water and a soft cloth or sponge. A mild detergent can be used on persistent dirt.

2.3 Verify that the Solar Panels have not moved due to vandalism or vibration and are still aligned correctly, by checking the witness marks on the post and lower bracket.

3. TriStar Battery Controller (Solar)

It should be noted that the solar version of this controller is used in both solar and wind turbine systems on the network.

3.1 Check the controller is secure and undamaged.

3.2 Verify that the bottom right of the LED screen indicates one of the following:

a) Absorb - (During daylight) Charging.

b) Float - (During daylight) Trickle Charging.

c) Night - (During darkness or when the solar panel connection is broken) Not Charging.

NOTE: *Any fault or error indications and take corrective action if necessary.*

3.3 Check that the airflow around the controller is not blocked, clear any dirt or debris from the heat sink, clean if required.

4. Metron Unit

4.1 Verify the Metron unit is working by pressing any of the buttons on the front panel. The LED panel illuminates showing the Menu. If the unit fails to respond advise your SM(S).

The LED panel returns to sleep mode after 2 minutes.

5. PowerTector Unit

5.1 Confirm that the green LED is lit and the alarm is not sounding.

PERIODIC TASK

6. Solar Panels

6.1 Replace the Solar Panel(s).

Solar panels degrade slowly and therefore require a routine replacement program.

END

Includes:	Miniature Wind Turbine Generator Systems used with Vamos Crossing Systems
Excludes:	All other types of Wind Turbine Generator Systems

General

An agreement with the Signaller shall be reached before any tasks are undertaken that affect the normal operation of the crossing equipment.

SERVICE B

1. Batteries

1.1 Check batteries for signs of damage, rectify if damaged.

1.2 Check all battery terminations are secure and clean.

1.3 Carry out NR/SMS/PartB/Test/055 (Secondary Cell Test) Section 1.

2. Wind Turbine

2.1 Switch the turbine brake to the on position and wait for the turbine to stop rotating.

If the turbine fails to stop turning within one minute the brake should be released. This shall be reported to your SM(S).

NOTE: *There are two reasons the brake fails to stop the turbine spinning, either the wind is too strong and is overcoming the brake or the brake has failed.*

If the wind is blowing too hard to complete the task this is to be recorded on the record card.

2.2 When the turbine has stopped moving, lower the tower using the approved method.

Under no circumstances shall the turbine be lowered if the blades are still turning.

2.3 Examine the turbine blades and the nacelle for damaged, worn/loose parts or cracks.

Particular attention shall be paid the blades and their leading edges, as damage to these causes an imbalance when the turbine is spinning. This imbalance leads to additional stress and might result in failure of the nacelle.

2.4 Raise the turbine using the approved method and secure it in place.

2.5 Release the turbine brake and confirm that the blades turn.

3. TriStar Battery Controller (Solar)

It should be noted that the solar version of this controller is used in both solar and wind turbine systems on the network.

3.1 Check the controller is secure and undamaged.

3.2 Verify that the bottom right of the LED screen indicates one of the following:

a) Absorb - (During daylight) Charging.

b) Float - (During daylight) Trickle charging.

c) Night - (During darkness or when the solar panel connection is broken) Not Charging.

NOTE: *Any fault or error indications and take corrective action if necessary.*

3.3 Check that the airflow around the controller is not blocked, clear any dirt or debris from the heat sink, clean if required.

4. Metron Unit

4.1 Verify the Metron unit is working by pressing any of the buttons on the front panel. The LED panel illuminates showing the Menu. If the unit fails to respond advise your SM(S)

The LED panel returns to sleep mode after 2 minutes.

5. PowerTector Unit

5.1 Confirm that the green LED is lit and the alarm is not sounding.

PERIODIC TASK

6. Turbine Nacelle

6.1 Remove and send the Turbine Nacelle for servicing.

Turbine Nacelle bearings degrade slowly and therefore require a routine replacement program

END

Includes:	EFOY Fuel Cell Systems
Excludes:	All other types and makes of Fuel Cell

General

Do not smoke in the vicinity of the Pro fuel cell or fuel cartridge.

Protect from heat and ignition sources. Methanol is highly flammable!

Do not touch leaked methanol.

The EFOY Pro fuel cell shall not be opened.

Gloves and eye protection shall be worn during this task.

Leakage of a small quantity of methanol evaporates, leaving no residue.

For further information See NR/SMS/Appendix/26 (General Information on the Direct Methanol Fuel Cell System).

SERVICE B

1. Fuel Cartridge

1.1 Carry out NR/SMTH/Part04/RE21 (Replace a Direct Methanol Fuel Cell Cartridge).

2. General Maintenance

2.1 Switch the device off and disconnect the charge line before cleaning.

2.2 Visually check that there are no signs of water ingress.

2.3 Clean only with a soft cloth dampened with water.

2.4 Reconnect the battery charge line after cleaning.

If the battery charge line is not connected then the automatic antifreeze feature remains inactivated causing premature failure of the system.

PERIODIC TASK

3. Fuel Cell Unit

3.1 Replace the Fuel Cell Unit.

Fuel Cells degrade slowly and therefore require a routine replacement program.

END

PANELS, INTERFACES & ASSOCIATED EQUIPMENT

1. Switch Panels

Switch Panels are for control of a small area and are usually found in signals boxes that have been converted from a mechanical frame.

Operation of the signals, points etc is achieved by the operation of a switch that is adjacent to the item it controls (on some panels the switches may be grouped at the bottom of the panel).

The interlocking is achieved electrically by a free wired system usually in an adjacent equipment room connected to the panel by multi-core cables.

An indication by the switch shows if the requested operation has been allowed by the interlocking. Basically, the operation of these panels is similar to operation of a lever frame (one switch for each controlled item).

2. One Control Switch (OCS) Panels

One Control Switch panels are usually found in signal boxes controlling small interlockings. Each route on the panel is controlled by a switch at the entrance to each route (on some panels the switches may be grouped at the bottom of the panel).

Operation of the route switch sets all required points and signals (if allowed) to the exit of that route (usually another signal) where the next route switch is located.

Where main and shunt routes are provided to the same exit, a separate switch are provided (although some systems do use a three-position switch for this task).

Points have their own individual switches that are normally set in the ‘free to be called’ position (switch in centre position).

They can be called N or R by operation of the switch (providing this is allowed by the interlocking). The switch is left in the centre position for the route setting to work.

A variation of the OCS panel in complex areas is to provide one signal key and a multi-position route key. The Signaller first selects the required route and then operates the signal key to call the required points and signals for the selected route.

3. Entrance-Exit (NX) Panels

Push button entrance-exit (NX) panels are usually found in purpose built power signal boxes. They operate by selecting an entrance followed by an exit that (if allowed) sets a route between the two points.

This is indicated by a series of white lights on the diagram calling signals and points required in the selected route. The basic types of these panels are the entrance key/exit button and the entrance button/exit button

NX panels do not provide safety interlocking, this is carried out in the geographical, route relay, or computer based interlocking.

4. Entrance key/Exit button

This system requires the Signaller to turn a key to select the entrance signal and then press a button at valid exit signal or location (e.g. buffer stops).

5. Entrance button/Exit button

This system requires the Signaller to press a button at the entrance signal and then press a button at the valid exit signal. This system is the most commonly used method and the following notes apply to this system of operation.

Route buttons can be Entrance, Exit or combined Entrance/Exit. They are indicated by Red/Yellow bezel. An arrowhead on the button points in the direction of the route. They are black for entrance and clear for exit.

Combined buttons have two arrowheads to indicate their dual purpose. The set route is cancelled by pulling the entrance button.

Other buttons on the panel are for signal emergency replacement (red bezel with an ‘E’ on the button), controlled signal to automatic working (blue bezel with an ‘A’ on the button, ground frame release (brown bezel with an ‘F’ on the button) and track circuit override (black bezel only).

Points have their own individual switches that are normally set in the ‘free to be called’ position (switch in centre position). They can be called N or R by operation of the switch (providing this is allowed by the interlocking) the switch is left in the centre position for the route setting to work.

6. Push Button Interlocking (PBI)

These based on a NX panel, the non-safety push button interlocking is achieved by relays and allows only certain combination of buttons to set a route. If an entrance button is pressed, a route is set only if a valid exit button is then pressed; if the exit is not valid a route is not set.

If a valid route is set, the PBI sends this instruction to the interlocking. The interlocking then calls the signals and points for the selected route if they are available.

The PBI NX panel is connected to the interlocking either by multi-core cables if it is adjacent or by a TDM control system if the interlocking is remote.

7. Electronic Route Setting Equipment (ERSE)

These are also based on NX panels but the non-safety relay based PBI functions are performed electronically by the ERSE. The system consists of one printed circuit for each route in the interlocking.

These generate route calls to an associated relay interlocking depending on the buttons operated on the NX panel.

In addition to the route cards there are also input cards (to receive the push button and route availability information from the interlocking), output cards (to operate the point and signal NLR/RLR's) and power supplies.

In addition to the ERSE itself, the interlocking requires relays that can be fed from the electronic outputs; these are called Buffer Output Relay Units (BORU).

The ERSE is usually situated in or near the relay room where the interlocking it feeds is situated The NX panel is connected to the ERSE either by multi-core cables if it is adjacent or by a TDM control system if the interlocking is remote.

Later systems of ERSE are computer based, called a button processor. In these the interlocking circuits are fed directly from the computer outputs without the need for buffer output relays.

8. SSI Panel Multiplexers (PMUX)

These form the link between an NX panel and a SSI interlocking. The PMUX consists of a microcomputer system that scans all the buttons and other controls on the panel.

It then generates a serial data stream that it sends to the panel processor modules in serial form. Conversely it receives a data stream from the SSI that it uses to drive the panel lamps and other indications on the panel.

Transmission to and from the panel processor modules is continuous over separate pairs of wires. For high availability, the PMUX might be duplicated with manual or automatic changeover. Both PMUX then receive all inputs, one or the other driving the outputs at any given time.

9. TD Multiplexers (TDMUX)

These are basically the same as a PMUX but in this format they form the link between a relay interlocking and a train describer. The TDMUX reads the state of the relay interlocking via a number of digital inputs.

The data is then sent to the train describer as a serial message where it is used to generate the train movements.

10. Data Logging (Archive) PCs

Some new systems are provided with data logging personal computers (PCs) whilst in some other cases they are being retro fitted to existing systems. They can be fitted to TDM, PMUX or TDMUX equipment.

They record and store on their Hard Drive (HD) all activity of the equipment they are monitoring and provide an instant record of events or enable the information to be downloaded for analysis.

Reference to the manual for the analysis software is recommended to correctly transfer and analyse the data.

Information on the HD is overwritten with new data when it reaches full capacity. The time this takes depends on the capacity of the HD and the amount of activity in the monitored equipment.

Transfer of archive data to disk should be carried out at a frequency advised by your SM(S)

REMOTE CONTROL SYSTEMS

11. General

Remote control systems are a means of operating signalling equipment that is remote from the signal box.

They fall into three basic types:

a) Direct Wire that uses a different wire for each function

b) Frequency Division Multiplex (FDM) that uses a different frequency for each function

c) Time Division Multiplex (TDM) that uses a different time slot for each function.

Direct wire and TDM remote control systems are not fail safe; in these systems, the integrity of the signalling system is provided by the interlocking.

Vital FDM systems are designed to be fail safe as these systems directly operate signalling equipment.

Non vital FDM systems are used for systems that donot directly operate signalling equipment (see notes in the FDM section).

12. Direct Wire

This is the simplest system where the controls out and the indications back are fed over Micro-core or Telecoms paired cables. Due to losses in the cable and interference from traction supplies, these systems cannot be used over long distances.

They can be used for activating over-ride systems at remote interlockings.

Direct wire systems are usually cost effective for control over small distances with a limited number of functions

13. FDM Systems

This is a multiplexing system where more than one function can operate over the communication circuit (a line pair) by means of giving each function a frequency that is independent of any other used. By the use of filters (tuned reed, tuned circuit or tuning fork) at the Tx and Rx end total independent operation of each function is allowed.

In these systems, the interlocking for controlled area is at the signal box. Output from the interlocking drives a transmitter that generates a signal at a particular frequency.

This frequency is transmitted along a line pair and activates a receiver at a trackside location tuned to that particular frequency.

The receiver output drives either a reed follower relay that in turn operates the signalling function or directly drives the signalling function.

Indications from the locations are transmitted back to the signal box in a similar way on another line pair.

Line isolation transformers and line amplifiers are used to split the line pair into sections to minimise induced interference and to boost the line voltage over long distances.

Control and indication systems run on different line pairs (two way simplex). On the control system the transmitters in the PSB are wired in series with the receivers in the trackside locations wired in parallel.

On the indication system the transmitters in the trackside locations are wired in series and the receivers in the PSB wired in parallel The FDM system is limited to the amount of functions it can perform by the number of channels and therefore frequencies available in each system.

Vital Reed systems operate signalling functions from the interlocking, Non-vital Reed systems operate systems not controlled from an interlocking (overide, indication etc).

There are various vital FDM system that can be used for the control of vital signalling circuits, these include Type R, Type RR1000/2000, RR4000, RR5000, RR6000 etc as these use a double tuned reed filter.

Non-vital systems include Westone, FDM69-Nv and Type RR3000 can only be used for non-vital functions.

There are some installations were these non-vital systems have been ‘double cut’ and used for applications such as remote emergency signal replacement, but because of their design they cannot be used to directly operate a vital signal function (e.g. call a proceed aspect in a signal or call points)

Any Type RR system that uses RR3000 units in any part of the system are classed as non-vital. If you are in any doubt, ask your SM(S).

FDM systems are cost effective for distributed system over long distances with a limited number of functions.

If you are in doubt about anything on the system, ask your SM(S).

14. General FDM System

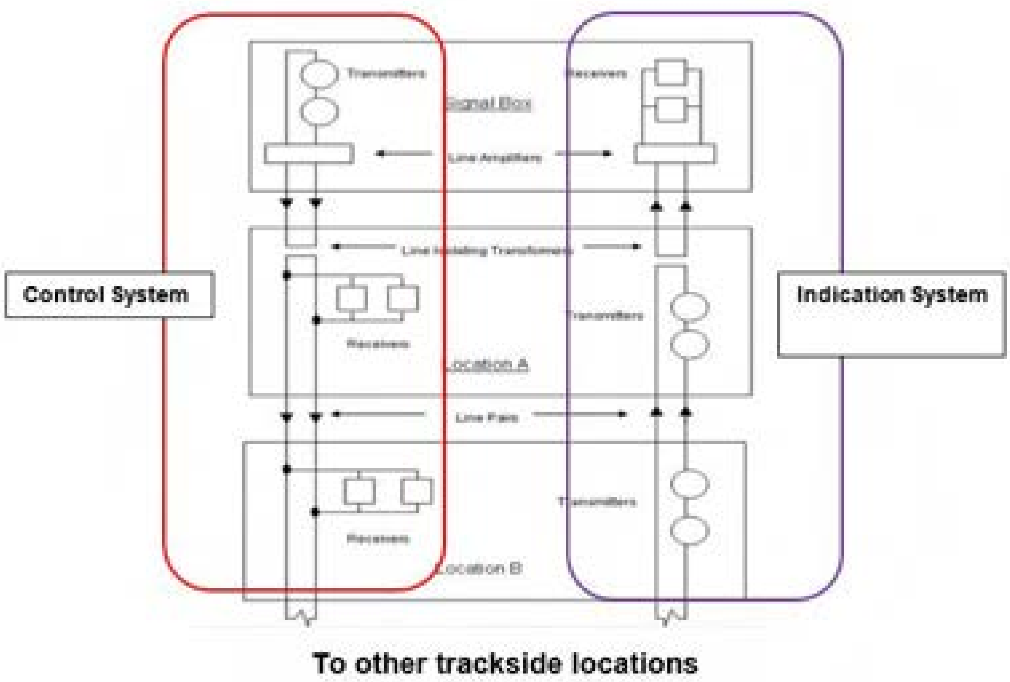


Figure 1 – General FDM System Schematic

TDM Systems

This system works by connecting circuits at each end of the system in turn, each circuit connection is separated by an interval of time.

This principle can be explained by comparing it to two uniselectors (rotary switches), one at each end of the system connected by a cable that rotate in synchronism.

This connects each output with its respective input (because of the synchronism) during one step of each cycle. In the TDM system, this action is carried out electronically.

TDM systems are used to transmit a large number of functions between two fixed points, these usually being a power signal box (office) and a remote interlocking (field).

An office transmits controls and receives indications; field locations transmit indications and receive controls.

TDM systems do not have to be ‘fail safe’ as safety (operation of vital signalling functions) is provided by the interlocking at the field end of the system.

Generally, TDM systems consist of a digital transmitter (multiplexer) that scans information inputted from a NX panel, push button interlocking or ERSE.

This information is then arranged for transmission (the information is put into a digital pulse train (serial) form where a 1 bit could indicate a closed input contact and a 0 bit an open input contact).

This digital information is then fed to a Frequency Shift Carrier Transmitter (modulator) that converts the digital information to a HF frequency modulated signal.

At the other end of the system the HF FM signal is demodulated to reproduce the digital information. This is then fed to a digital receiver (demultiplexer) that converts the digital information to drive the signalling output relays.

Control information from office to field and indication information from field to office can be sent Duplex, Half duplex, Simplex or Two way simplex depending on the system type.

The system can also be point to point (office to one field) or multi-station (office to two or more fields) again depending on the type.

TDM systems are cost effective for point to point working over long distances with a large number of functions

General TDM System

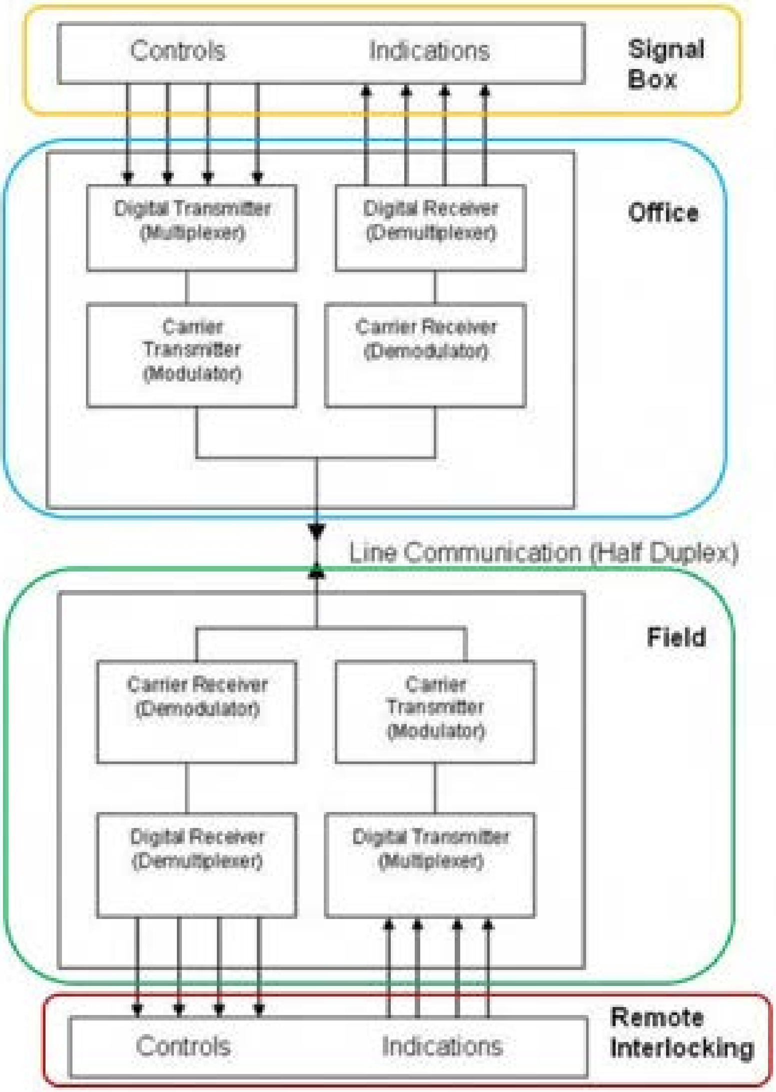


Figure 2 - General TDM System Schematic

The failure of a TDM system disables the remote interlocking, stopping the running of trains.

To avoid this three systems are available to minimise the effects of the failure of a TDM system (FDM systems because of their design and mode of operation do not cause the same problems as the failure of a TDM system)

15. Local Panel

A local panel might be located at the remote interlocking, this allows the interlocking to be worked locally without being linked by the remote system to the signal box.

When switched to the local panel the controls at the signal box are disabled, therefore the system should only be operated by authorised staff.

16. Overide Systems

Overide systems are provided to allow the Signaller limited control of an interlocking in the event of the failure of the TDM system.

The controls might be carried by a direct wire or a FDM system that enables the Signaller to set up a limited number of pre-set routes at the interlocking.

No indications are available to the Signaller from the interlocking whilst it is in overide.

17. Duplicated System

This method duplicates both the control and indication systems along with the line. The Signaller is able to switch individually between both the control and indication systems to provide the maximum system flexibility.

At the transmitting end, data is made available to each system independently using a relay to provide the isolation necessary. At the receiving end, the output is selected.

In some systems/locations, back contacts of the system selection relays are used so that any failure of the selection circuits connects both systems (which normally agree with each other) rather than leave no control at all.

Newer systems usually have automatic changeover facilities that are controlled by the system computers.

Technicians have the facility to force a changeover via the Technicians' terminal for maintenance but the Signaller usually does not. If you are in doubt about anything on the system, ask your SM(S).

18. Typical Applications of Remote-Control Systems

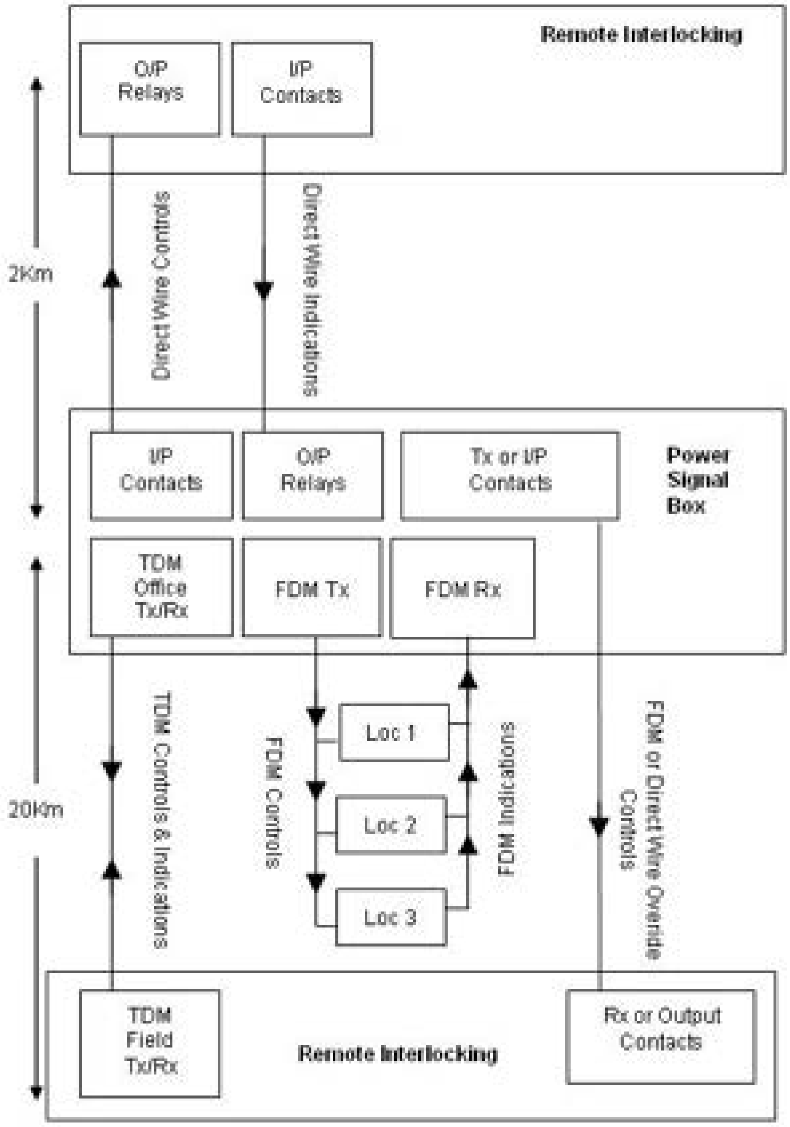


Figure 3 – Remote Control Typical Schematic

19. Older Systems

With the ongoing developments of TDM systems during the 60's & 70's, some systems of the same make installed at different times might not contain the same equipment (cards, indications etc).

Only the relevant sections of any applicable test should be applied to the system. If you are in any doubt ask your SM(S).

The NR/SMS tests for these systems are based on the manufactures manuals that were written when the systems were new.

As components age in older systems, tolerances and levels can vary. If the office and field ends of the system 'drift' together, tolerances and values might be at different levels to that in the test but are working correctly for present system configuration.

This condition might also lead to certain tests and measurements in the NR/SMS to be unobtainable. Local instructions on certain systems might ask for certain tests not to be undertaken for this reason.

If you think a test is likely to severely disrupt the operation or reliability of the TDM system you are testing, ask your SM(S) before proceeding.

20. Newer Systems

Most modern systems are computer based and housed in similar looking cubicles. They can perform multiple tasks PMUX, TDMUX, TDM) depending on the cards and units they contain and the software loaded on them.

Special attention should be taken when exchanging components that the correct item is used for the system you are working on.

Cards might look the same but can perform different functions. If you are in any doubt, ask your supervisor.

Glossary of Terms Used in Remote Controls Systems

Term	Meaning
Address	A coded message in a specific pattern to identify the origin and destination of a package of information
Analogue Signals	Signals that can assume almost an infinite number of values during any specified time (e.g. the human voice)
Asynchronous	Transmission of data that is not in step. Timing signals are derived from special characters in the data stream itself (the opposite of synchronous)
Attenuation	A general term used to denote a decrease in magnitude of transmitted level from one point to another (e.g. line loss)
Bandwidth	The difference expressed in Hertz (Hz) between the highest and lowest frequencies handled by a system
Baud	Unit of transmission speed equal to the number of bits per second and inter-bit pauses
Bit	Unit of information content (contraction of ‘Binary Digit’), either a one (1) or zero (0). It might be equivalent to an ‘On’ or ‘Off’ condition
Carrier Frequency	The frequency of an alternating current used for conveying information along a line circuit (often in excess of 6KHz)
Carrier System	A means of obtaining a number of channels over a single path by modulating each channel on a different carrier frequency and demodulating at the receiver end to restore the signals to their original form. It also avoids the distortion of data over long lengths of copper cables

Term	Meaning
Channel	A unique path for the transmission of a single item of information (FDM systems)
Character	The actual or coded representation of a digit
CMOS	Complementary Metal Oxide Semiconductor (Transistor type device)
Code	A system of symbols or conditions which represent information
Crosstalk	Unwanted insertion of signal(s) from an adjacent communication channel
Data	Any representations such as digital characters or analogue quantities to which meaning is assigned
Decibel (dB)	A unit of power or voltage level difference, used as a measure of amplifier gain or attenuator loss
Demodulation	The process of retrieving an original signal from a modulated carrier wave
Digital Signals	Signals that can assume a limited number of discrete values usually related to some numerical or coded system
Duplex	Simultaneous two-way independent transmission of information over one communication system
Field (TDM Systems)	The end of a system receiving controls and transmitting indications
Frequency Division Multiplex (FDM)	A multiplex system where the available frequency spectrum is shared between channels
Half Duplex	Alternate two-way independent transmission of information over one communication system
Highway	Cables or wires used to carry data between a central control circuit and a number of other points (e.g. backplanes in PCB racks)
IC	Integrated Circuit
Line or Line Pair	A pair of electrical conductors
Modulation	The process by which some characteristic of one wave is varied in accordance with another wave
Multiplex	A means of combining several signals for transmission on a shared medium (e.g. line pair)
Noise	An undesired disturbance on a communication system
Office (TDM Systems)	The end of the system transmitting controls and receiving indications
Parity Checking	A means of checking that the number of logical 1’s received is the same as the number of logical 1’s transmitted, as an aid to error detection
Piezo Electric Effect	The generation of an electric charge when certain crystals are compressed or stretched in certain directions and the converse behavior of distortion when electric charges are applied to the crystals
Reed	A mechanically vibrating element used to provide frequency selectivity

Term	Meaning
Response Time	The time between inception and effective reception of a control or command
Scan	An electronic process of servicing all the inputs and outputs of a TDM system
Sectionalisation	Splitting of the line into isolated lengths connected together only by transformers or amplifiers (this reduces the level of induced voltages)
Sentence	A number of 'Words' joined together
Serviced	Response by a card to a correct address
Simplex	One-way transmission of information on a communication channel
Synchronous	The continuous transmission of data in order. A synchronizing signal is sent at the start of each scan to confirm that the counters at each end of the system are in step (the opposite of asynchronous)
System	All the channels carried on a line pair or all the equipment associated with a line pair
Time Division Multiplex (TDM)	A transmission system whereby unique time slots are assigned to individual inputs/outputs which are then multiplexed together
TTL	Transistor – Transistor Logic
Word	An ordered set of characters that is the normal unit in which information might be stored, transmitted or acted on

Table 1 - Glossary

END

Includes:	Signal Boxes or Signal Control Centres with Switch Panels, NX Panels, VDU Based Control Equipment, or LC Control Units
Excludes:	Telephone Equipment, IECC, Westcad control system and Control & Interface equipment

General

Any intrusive work or tests shall be agreed with and carried out in liaison with the Signaller (e.g. replacing tiles or buttons, cleaning monitors screen, disconnecting keyboards etc).

Not all Signal Boxes or Signal Control Centres have all the equipment detailed in this SMS, therefore the relevant tasks for equipment shall be undertaken where provided. If you are in doubt, ask your SM(S).

It is good practice to ask the Signaller for known problems or faults before starting maintenance.

NR/SMS/PartC/SB00 (Signal Box Control & Operating Systems General) gives you details about the various panel types that can be found, generic details on VDU based control equipment can be found in NR/SMSPartC/IC00 (VDU Based Control Equipment - General).

The tasks in this section is for equipment contained within the Signal Box or Signal Control Centre. For equipment contained in equipment rooms the SMS tasks are included in the equipment specific SMS's

REGULAR SERVICE

1. Alarms

1.1 Check first filament failure alarms, system alarms, power supply alarms etc.

SERVICE A

2. Switch Panels and NX Panels (Exterior)

2.1 Check the panel structure and fixings.

2.2 Check the control/indication panel faceplate. In particular look for:

a) Worn or illegible artwork.

b) Damaged panel sections/tiles.

c) Faulty buttons/switches.

d) Faulty train describer displays.

e) Faulty indications/lamps.

Use the tools when changing Post Office type lamps to avoid damage to the panel. Check that the lamp is seated and operates correctly.

2.3 Dust and wipe the panel faceplate with a cloth moistened with detergent or non-abrasive cleaner.

2.4 Check and wipe associated diagrams (gradients etc).

2.5 Test audible alarms.

2.6 Check that CCTV crossing controls, indications and monitors operate correctly.

2.7 Check AHBC crossing indications and alarms.

2.8 Check HABD indications. Details can be found in the NR/SMS/HO series suite.

3. Switch Panels and NX Panels (Interior)

3.1 Examine the panel interior, look particularly for:

a) Damaged or incorrectly mounted components.

b) Signs of overheating.

c) Metallic debris.

3.2 Check the rear panel doors are correctly fitted.

3.3 Carefully examine internal cables, ducting, wiring, terminations, and insulation.

3.4 Examine switches, button fixings, armature assembles, springs and contacts. The armature shall seat correctly against the retaining screw. Adjust screw if required.

3.5 Examine plug couplers, power supplies, relays and bases.

3.6 As required, dust the interior.

3.7 As required, Lubricate hinges and locks.

4. Panel Block Equipment

NOTE: *Tasks 4.1 to 4.4 apply to panel block bells mounted in cases separate from the panel; the remaining tasks apply to all types of panel block equipment.*

4.1 Dust and examine the exterior.

4.2 Remove the cover and dust the interior.

4.3 Examine the interior; pay particular attention to:

a) The bell tapper/button assembly.

b) Springs and contacts.

c) Terminations, wires and insulation.

d) Fixings.

4.4 Check that wires cannot be trapped or damaged and replace the cover.

4.5 Check the correct operation of panel block bells and switches. This can be undertaken by observing the Signaller offering or accepting a train.

4.6 Check the emergency release seal is intact, correct and cannot be removed.

4.7 Check the emergency release cannot be operated without breaking the seal.

5. VDU Based Control Equipment

5.1 Clean all monitor screens and housings with a proprietary anti-static dry screen cleaner. Use cleaning products in accordance with the manufacturer's instructions.

5.2 Check that all monitors display a satisfactory picture. Rectify or report as required.

5.3 Visually check all leads and connectors are secure and undamaged. Rectify or report as required.

5.4 As necessary; disconnect and clean the keyboard(s). Hold the keyboard upside down when cleaning.

5.5 As necessary (if the operation has become intermittent or jerky) disconnect and clean the tracker ball and mouse. If necessary, remove and clean the ball and rollers.

5.6 Check there is a working spare keyboard and tracker ball or mouse available on site.

5.7 Check that the workstation areas are clean and tidy. Remove any rubbish and debris.

SERVICE B

6. Tests

6.1 Test 'All Signals On' feature. Not SSI Interlockings, see NR/SMS/PartC/IS11 (Solid State Interlocking (SSI) – section 13.1 Function Tests.

7. Emergency Release

7.1 Test for the correct operation of the emergency release.

7.2 If necessary, renew the seal and record the details. The Signaller shall not be able to operate the emergency release without breaking its seal.

END

Includes:	Signal Box Operating Floor & Block Shelf Equipment
Excludes:	Lever Frames (RT/SMS/LVxx), Relay cabinets (NR/SMS/EL21), Lever Locks and Circuit Controllers (RT/SMS/LVxx), and Key Release Instruments (NR/SMS/LV51)

Any intrusive work or tests shall be agreed with and carried out in liaison with the Signaller (e.g. replacing indicators etc).

Not all Signal Boxes or Signal Control Centres will have all the equipment detailed in this SMS therefore the relevant tasks to equipment shall be undertaken where provided. If you are in doubt, ask your SM(S).

It is good practice to ask the signaller for known problems or faults before starting maintenance.

REGULAR CHECKS

1. Alarms

1.1 Check first filament failure alarms, system alarms, power supply alarms etc.

SERVICE A

2. General

2.1 Check signals and points are visible from the signal box. The signaller shall have an unobstructed view of signal arms and points, or is provided with indications.

2.2 Check all block shelf components and fittings are secure and seals are correctly fitted.

2.3 Check labelling. Indications, plungers (etc) should be labelled with the lever / function number to which they apply. The correct covers shall be are refitted after maintenance.

2.4 Check that mechanical locking cover plates and electric lock covers are secure. Padlocks shall be fitted to prevent unauthorised access to electric locks.

3. Signal Box Diagram

3.1 Check diagram is clean, legible, undamaged and securely supported. Clean using damp cloth moistened with dilute detergent.

3.2 Examine wiring, terminations and components.

3.3 Check the indication lamps (ask the signaller). Investigate any low output from the lamps and rectify where practicable.

4. Block Shelf Wiring

4.1 Check wiring and cables are supported and are not at risk of snagging.

4.2 Examine insulation for signs of wire degradation.

5. Block Instruments and Single Stroke Bells

5.1 Dust and Examine exterior.

5.2 Carefully remove cover.

5.3 Carefully Dust interior.

5.4 Examine interior mechanism, pay particular attention to:

a) Springs and contacts.

b) Bell tapper assembly.

c) Needle shaft for correct alignment

Warning: Do not clean or oil

d) Trigger mechanism.

e) Terminations and wires.

5.5 Check the commutator is clean.

5.6 Clean the glass.

5.7 Examine fixings.

5.8 Check wires cannot be trapped or damaged; carefully replace and secure (lock) cover.

5.9 Request signaller to operate each block instrument and Observe correct operation.

With the block 'Normal', the indicator should hang vertically.

You shall report to your supervisor, any bias towards 'Train on Line' or 'Line Clear'.

5.10 Check that an additional line clear cannot be obtained by further movement of the commutator against its physical stop.

6. Southern Railway (SR) Standard 3 Position Block Instrument

These tasks are additional to section 5 for these types of block instruments.

Figure 1 shows the components of the block instrument as detailed in steps 6.1-6.4

6.1 Check that the locking pin and return spring assembly are clean and free from any lubricant or contamination.

6.2 Check that the return spring is not deformed. By use of a small non-metallic probe, (e.g. match stick) gently lift the commutator locking pin until it makes contact with the return spring mounted above the coil assembly.

6.3 When the pin is in its fully raised position (clear of the commutator ratchet teeth) carefully remove the non-metallic probe and Check that the pin drops away sharply.

6.4 If the pin remains in the raised position or is sluggish in dropping away inform your supervisor immediately. This is a sign that residual magnetism could be present that could affect the correct operation of the instrument

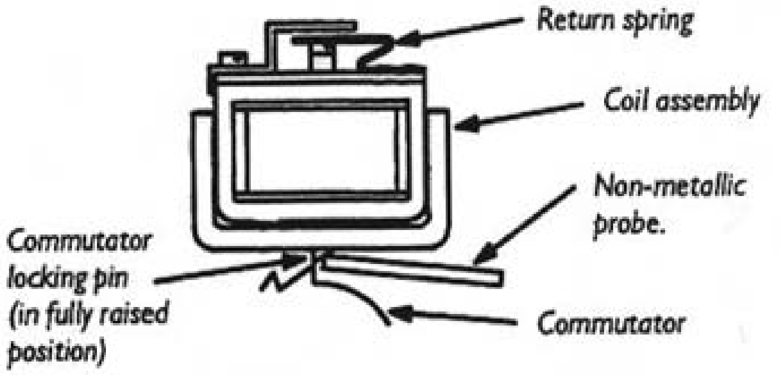


Figure 1 – Standard 3 Position Block Instrument

7. Emergency Release (Paper or Glass)

7.1 Dust and Examine exterior.

7.2 Check seal is intact, correct type and cannot be inadvertently removed.

8. Emergency Release (Welwyn Rotary)

8.1 Dust and Examine exterior.

8.2 Check seal is intact.

8.3 Check unit is correctly labelled.

8.4 Carry out a Function Test (NR/SMTH defined test B17 steps 4 to 14).

9. Plunger, Block Switch

9.1 Dust and Examine plunger/ switch mechanism, linkage, terminations, wires and fixings.

10. Needle Indicator (Spagnoletti)

10.1 Dust and Examine exterior.

10.2 Where provided, Check indication using test facility.

10.3 Check clarity of label/ artwork.

10.4 Examine interior mechanism, particularly for:

a) Any damage or misalignment to needles/ banners.

Warning: Do not attempt to clean or oil.

b) Degraded terminations or wires.

10.5 Clean the glass.

10.6 With no current applied, gently operate the needle by hand. Observe it returns smoothly and rapidly when released.

10.7 Apply current for each position and check the needle does not overdrive.

10.8 Check wires cannot be trapped or damaged; carefully replace and secure cover.

10.9 Request Signaller to operate and Observe correct operation.

11. Lamp Indicators

11.1 Dust and Examine exterior.

11.2 Where provided, Check indication using test facility.

11.3 Carefully remove cover

11.4 Examine interior, pay particular attention to:

a) Terminations and wires.

b) Lenses and lens engravings.

11.5 Check the lamps.

11.6 Clean the glass.

11.7 Examine fixings.

11.8 Carefully replace and secure cover.

11.9 Request signaller to operate and Observe correct operation.

12. Audible Alarms

12.1 Test audible alarms, where practicable to do so. Including: train running away, first filament failure, power supply, level crossing alarms etc.

Certain alarms are only identifiable by investigating the circuit records (e.g. Train Running Away audible alarm).

13. Control & Indication Panels

This includes level crossing pedestals and indicators

13.1 Check control / indication panel faceplate. In particular look for:

a) Worn or illegible artwork.

b) Damaged panel sections.

c) Faulty buttons/ switches.

d) Faulty indications / lamps.

13.2 Dust and Wipe clean with a cloth moistened with detergent or non-abrasive cleaner, as necessary.

14. Systems

14.1 Check and clean keyboards and VDUs. Including stand-alone train describers.

14.2 Check CCTV crossing controls and indications operate correctly.

14.3 Check HABD indications (See NR/SMS/HO** series)

14.4 As provided, Test other electronic systems.

SERVICE B

15. Emergency Release (Paper Type)

15.1 Check that the release cannot be obtained without breaking seal.

15.2 Break the seal and Test for correct operation.

15.3 Renew the seal and Record as appropriate.

16. Earth Test

16.1 If not monitored by ELD, carry out DYNAMIC EARTH TEST (052).

End

Includes:	GraphXMaster CX50-100U Back Projection Unit
Excludes:	All other types of Back Projector Unit

General

High voltages are present in the projector.

Precautions for working on high voltage equipment shall be implemented and observed.

Never look directly into the lens of the projector. The light emitted might cause permanent damage to your eyes.

Never remove the lamp from its housing directly after use. The lamp is under great pressure when hot and might explode causing personal injury and/or property damage. Allow enough time for the lamp to cool completely.

Wear eye protection (UV goggles with side protection) and clean cotton gloves when handling the lamp.

More information on this equipment can be found in NR/SMS/Appendix/02

DAILY SERVICES

1. Projector Ventilation/Cooling

1.1 Check the projector ventilation apertures are clear. Rectify as necessary.

1.2 Check projector cooling fans are operating. Inform your SM(S) of any problems.

REGULAR CHECKS

2. Inspection

2.1 Check and confirm the operation of key pad. Replace the batteries as necessary. Details are in NR/SMS/Appendix/02.

SERVICE A

3. GraphXMaster Projector

3.1 Check that the warning labels and markings are secure and legible.

3.2 Switch off projector and check that the lamp cooling fans have stopped. Automatic fan control.

3.3 Isolate the power supply and unplug the projector AC power cable.

3.4 Dust the projector exterior.

3.5 Check the AC power cable and plug. Replace if damaged or has signs of overheating.

3.6 Carry out NR/SMS/PartB/Test/173 (GraphXMaster Protection AC Leakage Test).

3.7 Plug in projector AC power cable and connect back to the power supply.

3.8 Switch on projector and check that the internal cooling fans operate immediately.

If the cooling fans fail to start, switch off projector immediately and report to your SM(S). Allow enough time for the projector lamp to reach optimum temperature before proceeding.

3.9 Check projector operation and cube screen display. Adjust settings if necessary.

4. Control Room

4.1 Wipe the cube screens and the cube enclosures. More details are in NR/SMS/Appendix/02.

SERVICE B

5. Projector Lens

NOTE: *This task shall only be undertaken if there is degradation of the displayed image*

5.1 Dust the projector lens. More details are in NR/SMS/Appendix/02.

END

General

Liaise with the Signaller so that they are aware of your presence before any maintenance commences.

It is good practice to make an entry in the block / occurrence book on arrival at the signal box.

The back of a signal head shall not be opened when a train is approaching, as this can cause the driver to misread the signal.

Keep the door closed until the train has passed and check that there is no other train approaching.

Signal arms shall not be moved, unless it is certain that there is no possibility of the signal being misread by the driver of an approaching train.

The last function of maintenance is to test and observe that the equipment operates correctly from the controlling point.

SIGNAL LAMPS

1. Illumination of Auxiliary Filament

The preferred method of illuminating the auxiliary filament is by using the filament disconnection link in the signal head.

The link is disconnected by gripping the cover and pulling. Following the test, check that the connector is properly locked on the 'faston' tab by gently pulling the wire.

Where a link is not provided, the wire to the main filament is to be disconnected, you shall need to follow the SMTH.

2. Lamp Holder Spring Contact

To minimise a risk of high resistance or arcing, spring contacts should be adjusted correctly, so that any movement of the lamp in the holder will not cause the lamp to go out. The spring tension can be increased by gently bending the spring upwards.

Any contacts that show signs of burning or which cannot be correctly adjusted should be replaced. A small, insulated mirror can be used to help in the inspection.

The position of the lamp holder relative to the signal lens is factory set and should not be interfered with.

3. 8000 Hour Lamps

The voltage range is higher than a conventional SL35 main filament. See NR/SMS/PartZ/Z01 (Signal – Reference Values) for details.

The auxiliary filament of an 8000hr lamp is not long life and should be set to the voltage range listed for a conventional SL35.

A first filament failure in one of these lamps should be treated in the same manner as a conventional SL35, and the lamp replaced to prevent a ‘lamp out’ (black signal) occurring.

4. Quartz Halogen Lamps

Do not touch the glass of quartz halogen lamps as contamination damages the glass envelope when it gets hot. Always use paper tissue when handling the lamp.

Quartz halogen lamps should be run at their rated voltage otherwise there is a possibility of the glass envelope blackening due to tungsten deposits caused by low temperature.

This can lead to low light output and the signal being misread by a driver.

5. Quartz Halogen Lamps Fitted to ML Heads and Indicators

Some ML signals have been fitted with a 110/10V signal head transformer and should not be adjusted to give a 12V output.

The transformer can become saturated and there is a possibility that sufficient magnetising current will be drawn by the transformer to keep the lamp proving relay energised even when the lamp is removed. This is a wrong side failure. Any signal head found with a 110/10V transformer and a 12V lamp should be reported to your SM(S).

Typical lamp voltages are detailed in NR/SMS/PartZ/Z01 (Signal – Reference Values). All signal lamps should be illuminated during the maintenance visit (if practicable) to check the filaments are operational.

The signal lamp record card should normally be retained in the signal head or adjacent location, where this is not practicable.

If kept in the signal head, the card should be stored in the most restrictive aspect to reduce the risks associated with phantom aspects. They should not be positioned where they could obscure the lamp.

The record card shall be completed at each maintenance visit and whenever a lamp is renewed.

6. Lamp Proving

The GECR relay specification shall be matched to the signal lamp type and circuit provided. An error can result in the lamp proving being ineffective.

COLOUR LIGHT SIGNALS

More information on alignment of colour light signals can be obtained in NR/GN/SIG/19032 or NR/L2/SIG/10158.

7. Signal Visibility

Signals shall be checked during the maintenance visit.

Particular attention should be given to any signs of subsidence or disturbance to the signal structure. A 1° movement in the signal head translates into a movement in the beam alignment of 3.5m (11'6'') at 183m (200yds).

Signals are to be aligned in accordance with the signal sighting assessment record, this record can be in the form of a paper record card or an entry into the SSIFT database.

Signal mis-alignment is a critical factor in a high number of reported Signal Passed at Danger (SPAD's).

8. Beam Alignment

The beam alignment designed to position the driver's eye within the signal beam throughout the readable distance, as train approaches a signal.

It is also designed to minimise the effects of sunlight which might incur phantom aspects to the driver.

Where the signal sighting assessment record is not available on site, this shall be reported as corrective maintenance to your supervisor.

Signalling Technicians are responsible for clearing vegetation which adversely affects visibility of signals.

9. Signal Lenses (Filament Lamp Type Signals)

It is essential that signal lenses are clean and not broken or scratched. Care should be taken when cleaning a polycarbonate lens to prevent scratching, scratched or dirty lens can severely impair signal beam intensity.

Coated polycarbonate lenses are permissible at locations where there is a risk of significant vandalism.

If any signal lens has to be replaced, the 'hot strip' shall be correctly aligned.

The Typical Position of Hot Strip - Signal to Left of Track This can vary on certain signals (e.g. ground mounted heads) refer to the signal sighting form for the correct positioning. If you are in doubt, ask your SM(S)). Figure 1.

Some signals can be fitted with Spreadlite lenses; these shall be replaced by similar lenses in the correct orientation (the strips on the lens shall be vertical).

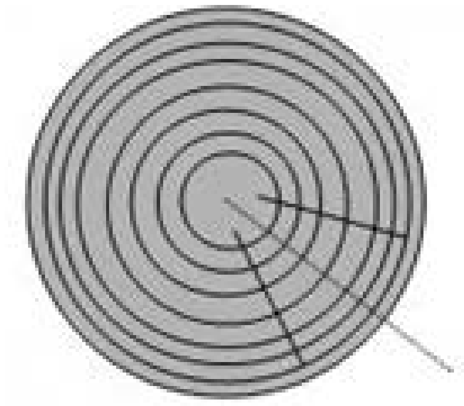


Figure 1 - Typical Hot Strip Position

10. Position Light Junction Indicators and Alpha- Numerical Route Indicators

Lamp failures can result in a false route indication being given to the driver, so it is essential that failed lamps replaced.

In many areas, lamp proving is provided on route indicators. The requirement to test the lamp proving is contained in the SMS and should be carried out for each indication where possible. NR/SMS/PartB/Test/022 (Signal Lamp and Light Module Proving Tests) applies.

In some installations, the lamp proving is set by the provision of a resistor in parallel with the UECR relay coil. A disconnection of the resistor results in the lamp proving becoming ineffective.

Check replacement lamp is matched to the UECR relay specification.

The Light Engine LED unit is a like for like replacement for a SL35 lamp in these indicators.

11. Signal House Fibre Optic Position Light Signal (PLS)

These PLS signals are distinguishable from traditional types by their use of fibre-optic bundles to guide the light from an internal quartz-halogen lamp to the front apertures.

They show two red (or yellow) lights for their 'On' aspect. The lamps to be used in these PLSs are the approved Quartz Halogen 6000hr 10V type.

The units are equipped with main and auxiliary lamps with a filament changeover device, which includes first filament monitoring systems. In the event of a detected first filament failure, the lamps should be changed in accordance with existing instructions for the systems.

If no system is in place, a lamp-changing programme should be maintained with a maximum of 6 months between lamp changes.

12. Light Emitting Diode (LED) Signals

LEDs are commonly used in all types of signalling equipment.

LED colour light signals can be searchlight or conventional multi-aspect presentation with individual LED signal modules for each aspect.

LED signal modules fitted to main colour light signals have a close-up viewing sector which is equivalent to the hot strip on conventional signals. Dependent on the manufacturer, the signal they can be left or right-handed, or they can be universal because the outer lens with the close-up viewing sector can be rotated to the correct orientation.

Because of the different features it is important that the correct replacement LED module is installed and the 'hot strip' is correctly aligned.

SEMAPHORE SIGNALS

More information on semaphore signals can be obtained from NR/L3/SIG/19014.

13. General

NR/SMS/PartC/SG12 (Semaphore Signals) applies to both upper and lower quadrant signals and ground signals.

The maintenance of a mechanical signal requires the 'whole route' to be examined between the lever tail and the signal.

Where detectors are being maintained, refer to both signal and point maintenance specifications.

Before commencing maintenance on a signal, it is beneficial to operate each signal from the lever. After maintenance work has been completed, the same Technician should again operate the levers to verify any expected improvement.

The Signaller should also operate the signal.

14. Wire Runs

Signals can be operated up to 1760 yards (1600m) from the signal box.

15. Wires

The wire run should at all times be clear of debris, vegetation and the ground.

Wires should be supported to avoid contact with one another and other railway equipment.

Wires should not come into contact with ballast or timber or any railway structure.

Wires should be run in an orderly manner, clear of one another and wires should not cross within the run.

16. Wire Stakes

Wire stakes should be no more than 9 yards (8m) apart. This distance can be reduced if it will prevent the wires fouling the ground.

Angled pulleys may be required to permit the run to negotiate a curve, the height of the wires is not fixed. Stakes shall be firmly fixed in the ground.

Any suggested improvements to the run should be made via your SM(S).

Wires shall not rub against the underside of rails, when signals are operated.

Risk of a short circuit can be reduced by fitting plastic rail clips to the underside of rails.

Orange piping is not designed for signal wires and should not be used for cross track ducting as the condition of the wire within the pipe cannot be seen.

In electrified areas correct insulators shall be fitted into the wire run.

Third and fourth rails in DC traction areas require special care.

17. Ducting

At level crossings, piping or ducting is required.

The wires passing through should be regularly checked. Jointing at one end by “S” hook or split link might be required so the wire can be drawn back for inspection and checking.

Wires should not bind against ducting walls or each other. A maximum of 3 wires should be run through a single pipe.

Do not forget to examine the draw wire. A nylon rope loop can be installed within the duct to assist in quick replacement of the signal wire.

All ducting shall be kept clear of debris.

18. Wire Joints

Wire joints are made by hand. Pliers are only used to initially cut the wire to length. They are not used to help make the joint. Each strand should be separated in turn and the joint made by hand.

Check that wire joints, within the run, cannot snag one another. One joint per bay is recommended.

Joints shall be clear of, and never foul, any stake or pulley. Cross-wires shall be joint free.

19. Wheels & Cranks

Slings and chains are designed to go around wheels. They should be of correct length so that the links and thimbles do not foul the wheel or wheel-frame during operation.

Remember to allow for adjustment by the Signaller.

Cranks in wire runs severely limit travel and can therefore only be used at the signal.

Check they do not choke the operation of a signal.

20. Wire Adjustment

Signal wire length can vary by over 1cm per 18m, depending upon the temperature. If incorrectly adjusted the wire, when cold, can pull a signal falsely off.

Adjustments, usually by a wire adjuster at the signal box, allow for seasonal variations of temperature and expansion / contraction.

Some signals are adjusted on the lever tail. After renewing any substantial length of wire, a visit should be made after one week to check the adjustment is still correct, as the wire could have stretched since installation.

There shall be enough travel / stroke at the lever to operate the signal.

21. Foundations

All wheel and crank foundations shall be solid. Check for rotting timber and movements. Check bolts / coach screws for security.

22. Signal Posts

Signal posts should be vertical. Guy wires and flying stays should be carefully checked.

Staging, handrails and decking should be checked before use.

Bracket and gantry signals should be visually checked for damage and rust on each visit.

No signal shall be climbed if the ladder does not appear to be fit for use.

An inspection of the post at and around ground level should indicate if rusting is taking place.

23. Weights

Weights on balance levers shall not be greater than required to restore the signal wire to normal. Excess weight causes wear and creates extra work for the Signaller to pull the signal.

Weights should be secured by a bolt or chain, to prevent them moving on the lever, or becoming detached.

24. Lubrication

Excess lubrication causes dirt to accumulate and can cause wear. Lack of lubrication can also cause wear. Both excess and lack of lubrication or the wrong type of lubrication can cause wrong side failures.

It is essential, that the correct amount of lubricant is applied sparingly to signalling equipment. No item of mechanical equipment needs flooding.

All old oil and grease shall be brushed / wiped away. When new is applied any excess shall also be wiped off to prevent dirt accumulating.

The wire run and its pulley wheels shall not be lubricated unless using a dry film lubricate.

Wheels, cranks, spindles, and balance weights require only a small regular amount of oil / grease to keep them operating satisfactorily.

Signal arm spindles can be prone to sticking, Check that the oil / grease reaches each end of the bearing. Do not to spill oil and grease over electrical components and any spillage should be completely wiped away.

Check all nipples are clean and permit grease to pass, this includes auto lubrication systems (where fitted). Oil holes shall be kept clean and covered when possible,

25. Repeaters

The arm shall always correspond to the lever and return to the ON position even if a normal check lock is fitted to the lever.

The chart in ‘Signal Arm Adjustment’ indicates the relevant ON and OFF or Made and Broken positions for arm indicators and for AWS.

If fitted, the backlight blinder should be adjusted to obscure the lamp back light when the arm is at more than 5° from the horizontal.

If fitted, contact boxes should not impinge upon the mechanical operation of the signal.

Arm and indicator correspondence should be regularly checked, especially when wire adjusters are fitted.

Balance lever contact boxes should be adjusted to operate between 0° - 5° and 35° - 65°.

26. Signal Arm Adjustment

Angles for lower quadrant signals are the same below horizontal (a table of these angles is in NR/SMS/PartZ/Z01 (Signal – Reference Values).

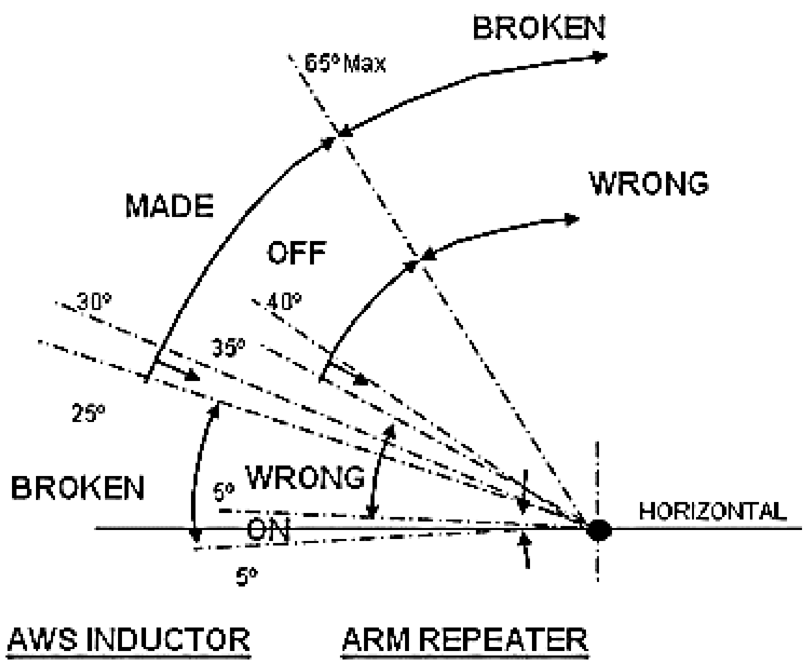


Figure 2 - Signal Indication Angles

27. Signal Sighting Distances

These can be found in on the signal sighting form, typical values are shown in NR/SMS/PartZ/Z01 (Signal – Reference Values).

28. Reflective Boards & Signs

Most railway related reflective boards and signs which are required to be retro-reflective are referenced to BS873 part 6 and divide the requirement into Class 1 (most reflective, Class 2, or non-retro-reflective.

From 01/01/06 BS873 was replaced by BS EN 12899-1. Materials tested to the old standard are not available. The new standard is not exactly equivalent to the old; a conversion table is shown as follows:

BS873 Part 6 reference	BS EN 12899-1 reference
Class 1	Class R2
Class 2	Class R1
Non retro-reflective	Class NR1

Table 1 – Standard Conversion Table

The main difference is that the order of reflectivity has been reversed.

Class R2 retro-reflective material is identified by the surface of the item being made up of small multi-sided cells (micro prismatic).

As a general rule, boards and signs that are to read by an approaching train or road vehicle at any speed above a walking pace are to be class R2 retro-reflective, boards and signs that are to be read by an approaching train or road vehicle at a walking pace are to be class R1 retro- reflective.

If the board or sign is externally or internally illuminated it can be class R1 or NR1 irrespective of the approach speed. This is a general rule, individual or local circumstances can be different, if you are in any doubt about the reflectivity of any board or sign, ask your SM(S).

Road signs at a level crossing that are between the white stop lines on the road surface and the diagram 784 signs (see NR/SMS/PartC/LC00 (Level Crossings: General) are the responsibility of Network Rail.

All other road signs are the responsibility of the local authority, any defects or problems with these signs shall be reported to them directly via your SM(S).

END

SERVICE B

1. Signal Structures

1.1 Clear ballast and vegetation from the base of the structure until the mounting bolts are visible.

If you are unable to clear the ballast from the base you shall advise your SM(S).

END

Includes:	Signal Post Replacement and Signal Box Replacement Switches
Excludes:	All other Signal Replacement Devices

SERVICE B

1. Signal Post Replacement Switch (Fig 1)

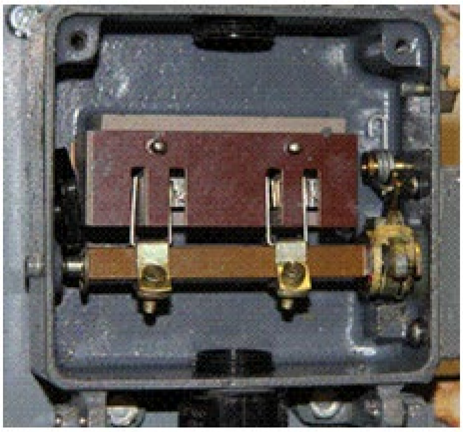


Figure 1 – Signal Post Replacement Switch

1.1 Check the ‘Auto/Red’ labelling is legible.

1.2 Check each switch is correctly labelled for the signal it controls.

1.3 Lubricate the hinges and apply petroleum jelly to keyhole.

1.4 Dust and examine interior, particularly:

- Cable cores and terminations.
- Armature retaining screws.
- Pivot springs, check for correct operation.
- Cover gasket.

1.5 Check the ceramic contact holder; look especially for cracks around the fixing holes.

1.6 Lubricate the bearings.

1.7 Carry out SPRS TEST - NR/SMS/PartB/Test/023 (Other Signal Tests) - Section 1.

1.8 Check on gantries where more than one switch might be fitted that each switch operates its corresponding signal correctly.

2. Signal Box Replacement Switch (If Provided)

2.1 Carry out SIGNAL BOX ERS TEST NR/SMS/PartB/Test/023 (Other Signal Tests) - Section 2.

END

Includes:	Main (Running) Signals
Excludes:	All Other Signals

Clarification

Main (Running) Signals: These could include multi aspect, semaphore, banner, PLJI, block markers and reflectorized signals used to control train movements on both “Passenger and Freight lines”.

On “Freight Lines only”, a risk-based approach to traffic levels and line speed to determine if a visit to sight a signal is deemed unnecessary.

Main (Running) Signals do not include signals such as GPL, PL, MARI, SARI and PoSA etc. which are passed at lower speeds.

Both Passenger and Freight Lines are indicated in Table “A” of the Sectional Appendix.

This check should be carried out during the hours of daylight and preferably during vegetation season (April to September).

If the check cannot be completed from the driving cab, then it can be carried out from ground at the signal sighting point.

Details relating to basic Signal Sighting are shown in NR/SMS/PartC/SG00 (Signals: General).

SERVICE B

1. Supervisory Checks

1.1 Check the sighting of the signal.

1.2 Any issues shall be recorded and actioned.

END

Includes:	Crown Post & Cess-mounted Counter-Balanced Signal Support Posts.
Excludes:	All other Counter-Balanced Signal Support Posts.

Asset Identification Image

Figure 1 - Crown Post signals

Overhead Line Equipment shall be isolated if access to the signal post is required outside the gantry safety cage (i.e. for non-routine maintenance activities, such as failures or component replacement).

Keep your hands and clothing clear of all moving parts as the signal-head is being moved through its full range of travel.

You shall always obtain permission from the signaller before starting work.

SERVICE B

1. Post

1.1 Externally, check that structure and all foundation/mounting bolts and fixings are secure and free from any damage, vandalism or corrosion – report any damage, treat all corrosion, remove all graffiti.

1.2 Check the condition and security of all earth straps and weather seals.

1.3 Check for signs of water ingress (mould) and general degradation of seals.

1.4 Check the security and legibility of all external labels and warning flashes – clean or replace as necessary.

1.5 Check effective operation of any door padlocks.

1.6 Internally – check that structure and all brackets and fixings are secure and free from any damage or corrosion – report any damage, treat all corrosion.

2. Post access door and door mechanism

2.1 Operate door and check that it and its operating mechanism moves freely through the full range of travel.

2.2 Check security and condition of door, door seals and door operating mechanism – checking for no signs of excessive wear or water ingress – report any damage, treat all corrosion.

2.3 Where possible, clean access door open/close lever, door restraining arm and (for gantry-mounted only) signal-head locating/lock rod linkage.

2.4 Where possible, clean door seals.

3. Cess-Mounted Posts only

3.1 Visually check the signal-head raise/lower arm (“T” Handle) and locking handle for security and freedom from any damage or corrosion.

3.2 Where visible, check that the counter-balance weights are free from corrosion – check that the weights are correctly positioned within the weight carriage.

3.3 Check the condition and security of the signal-head raise/lower arm and its attachments.

3.4 Internally – check weather seals for signs of splitting, kinks, water ingress (mould) or general degradation – check all correctly attached and located.

3.5 Check the security and legibility of all internal labels – clean or replace as necessary.

3.6 Check the signal-head carriage upper and lower guide wheel block assemblies and guide wheel channels for signs of damage or corrosion.

3.7 Clean signal-head carriage guide wheel block assemblies – use a lint-free cloth.

Signal-head raise/lower mechanism

3.8 Operate the signal-head raise/lower locking handle over-centre and check that the appropriate resistance is felt – "positive feel". Clean the wire ropes and their connecting bolts on both the signal-head and balance-weight carriages – use a lint-free cloth.

3.9 Check the security and tightness of all wire rope connecting bolts – check that all attachment brackets are secure and free from damage or corrosion.

3.10 Check that the tension of both wire ropes is similar – ropes should feel taught under pull of finger pressure.

3.11 Operate the signal-head through its full range of travel and complete the following:

a) Check the condition of each wire rope – check there is no fraying, broken strands, corrosion or signs of deterioration;

b) Check that wire ropes and pulley assemblies operate smoothly – Check that pulleys turn freely, with no signs of stiffness or juddering felt during up or down travel of signal-head;

c) Check the signal-head carriage guide wheels for signs of stiffness, juddering, wear (flat spots) or general degradation;

d) Check that signal-head carriage structure, brackets, fixings and wheel block assemblies are free from damage or corrosion;

e) Check that the final few centimetres of signal-head carriage travel are dampened in both fully raised and fully lowered positions;

f) Check that damper compression eases as the signal-head is moved away from its fully raised and fully lowered positions;

g) Using a torch and a small dentist-type mirror, check the condition and security of the damper and fixtures.

3.12 Remove post end cap – check correct alignment of each wire rope on respective pulley and security and condition of both pulley assemblies.

NOTE: *A torch will be required*

Lubrication

3.13 Clean all areas that require lubrication – remove old grease.

3.14 Lubricate, by hand application, the wire rope connecting bolts on both carriages – wipe off any excess grease.

3.15 Do not lubricate wire ropes, pulley assemblies, carriage guide wheels or guide wheel channels.

3.16 Lightly lubricate door hinges and open/close linkage.

3.17 Do not lubricate door seals.

3.18 Lubricate all bolts and screw threads exposed to the elements (include foundation bolts).

4. Gantry-mounted post

<u>Signal-head raise/lower mechanism</u>

4.1 Remove old/dirty grease from each chain and their connecting bolts – use a lint-free cloth.

4.2 Check the security and tightness of all chain connecting bolts – check that all attachment brackets are secure and free from damage or corrosion.

4.3 Check the condition and security of each lifting and winding chain top sprocket and bearing housing assembly.

4.4 Check, via the winding mechanism access door, the condition and security of the winding chain bottom sprocket and bearing housing assembly – check that the chain is correctly aligned on its sprocket.

4.5 Check that the tension of both chains is similar – chains should feel taught under pull of finger pressure.

4.6 Operate the signal-head through its full range of travel and complete the following checks:

a) Check the correct alignment of each chain on their respective sprockets;

b) Check the condition of each chain – there should be no distortion, stiff links or corrosion;

c) Check that chains and sprocket assemblies operate smoothly – check that sprocket assemblies turn freely, with no signs of stiffness or juddering felt during up or down travel;

d) Check the signal-head carriage guide wheels for signs of stiffness, juddering, wear (flat spots) or general degradation;

e) Check that signal-head carriage structure, brackets, fixings, wheel block assemblies and guide wheel channels are free from damage or corrosion;

f) Check that the final few centimetres of signal-head travel are dampened in both fully raised and fully lowered positions;

g) Check that damper compression eases as the signal-head is moved away from its fully raised and fully lowered positions;

h) Using a torch and a small dentist-type mirror, check the condition and security of the damper and fixtures.

4.7 Remove the post end cap and check that the lifting and winding chains are correctly aligned on their respective sprockets.

<u>Lubrication</u>

4.8 Clean all areas that require lubrication – remove all old grease.

4.9 Lubricate, using grease applicator on appropriate grease nipples, the lifting and winding mechanisms.

4.10 (Where accessible) – Lubricate, by hand application, the lifting and winding chains and connecting bolts on the signal-head and balance-weight carriages.

4.11 Do not lubricate guide wheel block assemblies or guide wheel channels.

4.12 Lightly lubricate door hinges, door padlock and open/close levers.

4.13 Do not lubricate door seals.

4.14 Lubricate, by hand application, all bolts and screw threads exposed to the elements.

4.15 Report any faults to your SM(S).

4.16 Once all work activities have been completed you shall notify the signaller that the signal has been returned to its normal operating position.

SERVICE R1

Includes:	Crown Post Counter-Balanced Signal Support Posts.
Excludes:	Cess-mounted Counter-Balanced Signal Support Posts.

Counter-Balanced Signal Support Posts.

5. External Inspection

5.1 Check door seals for damage.

5.2 Check earth braid is present and connected to door and casing.

5.3 Check earth braid is not snagging in door hinges.

5.4 Visually inspect condition of the chains.

5.5 Check condition of the tail cable and conduit when raising & lowering head.

5.6 Check chain lifting bracket.

5.7 Check for presence of locking nut on chain connection bolts on the weight basket using an angled mirror.

5.8 Check the winding mechanism for ease of operation for both lowering & raising.

5.9 Check the operation of the damping mechanism.

5.10 Lubricate the padlock.

5.11 Report any faults to your SM(S).

Once all work activities have been completed you shall notify the signaller that the signal has been returned to its normal operating position.

END

Includes:	Dorman Lite
Excludes:	Dorman Classic, Integrated Lightweight Signal (iLS), VMS, Signal House and all other LED signals

Identification of LED Signals

Dorman Lite - These signal heads have sloped lens in front of each aspect to reduce contamination.

The signal head configurations can be different to the examples shown.

You shall liaise with the Signaller before displacing any signal light module from its normal position to check there are no approaching trains and the possibility of a driver not being able to observe the aspect.

Figure 1 – Dorman Lite

On Dorman products maintenance can be undertaken from the rear of the signal. In the case of other manufactures, access is also required at the front. If you are unsure about the manufacturer of the signal and the access you require, ask your SM(S).

SERVICE A

1. General

1.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

1.2 If applicable, visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

1.3 If applicable, visually inspect cables suspended from the structures above overhead line equipment.

1.4 Check the signal ID plates are displaying the correct details and are not damaged or fading. Check them for security and correct aligned.

1.5 Clean the Signal ID Plates.

2. Signal Heads

2.1 Check the presence of E-clips on the pivot bar for LED module (Dorman Signals only).

Any damaged or missing E-Clips shall be replaced and treated as corrective maintenance.

2.2 Check the vertical tilt alignment bolts are torqued to 40 Nm.

2.3 Check that the lens is clean, not damaged or distorted and not obstructed.

2.4 Clean as required. This task applies to each LED Module.

2.5 If provided, carry out NR/SMS/PartB/Test/023 (Other Signal Tests) - Flasher Unit Test (Flashing Aspects).

SERVICE B

3. Signal Head

3.1 Check the signal identification plate(s). These shall be secure, correctly aligned, clean, legible, and display the correct number.

3.2 Open the access door and examine the interior of the signal head for deterioration, moisture ingress, or contamination. Rectify any problems as necessary. Dust and clean the interior.

Dorman signal heads are not designed to be watertight therefore some moisture/water can be present.

3.3 Examine cable glands, cable entries, and LED module's as applicable to the installation. Close the access door.

3.4 If provided, check the alignment from the integral sighting device.

If this task is not possible due to sighting device being obscured (e.g. painted over) it should be reported as corrective maintenance. Report immediately any actual or possible obstructions to the sighting of the signal/indicator.

3.5 Test and record the supply voltage to the SLM for each aspect (If practicable) on the outgoing links in the location.

3.6 Check and lubricate hinges, thumbscrews and padlocks.

4. Disconnection Boxes (If Provided)

4.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit / disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

4.2 Refit the lid and (if provided) padlock. Check they are fitted securely.

5. Final Checks

5.1 Check that all covers, doors, and padlocks are securely refitted, Lubricate hinges and padlocks.

5.2 Check that all aspects and indicators are showing their normal (standing) aspect/indication on completion of maintenance. If you are in any doubt, ask your SM(S).

PERIODIC TASKS

6. LED Modules

6.1 As required, replace SLM module(s).

6.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all replaced modules.

END

Includes:	VMS CLS, CLS Stacked, Position Light, Junction Indicators, and MARI / SARI indicators
Excludes:	All other LED Signals

Equipment Types

Figure 1 - Lightweight CLS

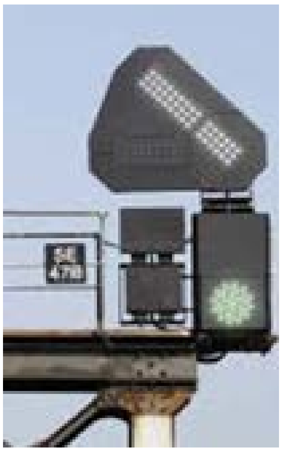


Figure 2 - CLS with JI, PL and MARI

Figure 3 - Stacked CLS

Liaise with the Signaller before displacing any signal from its normal position to check that there are no approaching trains.

SERVICE R1

1. General Signal Inspection

1.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

1.2 Check the signal ID plates are displaying the correct details and are not damaged or fading. Check them for security and correct alignment.

1.3 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

1.4 If applicable visually inspect cables suspended from the structures above overhead line equipment

1.5 Clean the Signal Aperture / Lens and Signal ID Plates.

1.6 Report any corrective action taken as this type of signal is designed to be self-cleaning.

2. Disconnection Boxes (If Provided)

2.1 Check the cables and cores are undamaged, correctly labelled and free from wet or dry wire degradation.

2.2 Check the terminations for security, corrosion, arcing, and risk of short circuit / disconnection. Protect as necessary.

2.3 Check the cable glands are fitted and effective.

Refit the lid and (if provided) padlock, check they are fitted securely.

END

Includes:	Dorman - Integrated Lightweight Signal (iLS) and iLS Modular (because of the integrated nature of the head design Position Light, Junction Indicators and Main / Sub Alphanumeric signal are included in this SMS)
Excludes:	Dorman Classic and Lite and all other signals

Equipment Types

Figure 2 – Signal with Trunnion

Figure 1 – Trunnion Unit

Integrated Lightweight Signals (iLS) - These signals are mounted on a trunnion unit which has an integrated disconnection box.

Figure 3 – Signal with Enclosure Unit

Figure 4 – Enclosure Unit

Integrated Lightweight Signals (iLS) (Modular) - This version differs from standard (ILS) in the fact that the post is mounted through the equipment enclosure which contains the plug couplers and AWS / TPWS equipment.

Liaise with the Signaller before displacing any signal light module or signal post from its normal position to check there are no approaching trains and the possibility of a driver not being able to observe the aspect.

Cleaning of the signal lenses can be undertaken from the front of the signal when it is lowered. Maintenance tasks or module changing can be eased if trunnion mounted signal posts are rotated by 180 degrees such that the modules face upwards.

It is essential that the post is re-rotated and correctly located before once again raising the post. Full details are contained in the maintenance manual. If you are unsure of this procedure, ask your SM(S).

As there is little or no space available in the iLS, wiring details and record cards for the iLS will be stored in the interlocking room that controls the signal mounted either on the enclosure or trunnion.

When the PLS is configured to act as a PoSA signal, the signal shall be tested in both the steady and flashing state.

SERVICE A

1. Signal alignment and visibility

1.1 Check the beam alignment from the detachable sighting device. Details on sighting are in NR/SMS/PartC/SG00 (Signals General).

1.2 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

2. External Inspection – Post, Enclosure / Trunnion

2.1 Check (if provided) that any guardrails and staging are secure.

2.2 Check for fire risks around the iLS. Remove or report any possible risks.

2.3 Check all doors / covers are accessible and not obstructed. Remove or report excessive foliage or obstructions.

2.4 Examine post, trunnion, enclosure metalwork, doors, foundation bolts, for corrosion, damage, obstruction, and security.

2.5 Check the signal ID plates are displaying the correct details and are not damaged or fading. Check them for security and that they are correctly aligned.

2.6 Clean the Signal ID Plates.

2.7 Check enclosure identities are clearly labelled.

2.8 Check locks are fitted and in good order.

2.9 If provided, check the earthing continuity between the enclosure / trunnion and the earth rod. Check that all connections are secure and the earth rod is secure in the ground.

2.10 AC/DC Traction Areas, check the structure bond is in place and secure.

2.11 If provided, check that any safety / warning labels / signs are correctly displayed and legible.

These can include No Smoking, Wear PPE, No Mobile Phones etc.

2.12 Lubricate locks and hinges. Before leaving site, check that covers, doors and locks are properly fitted and secure.

3. Internal Inspection – Enclosure or Trunnion

3.1 Examine cables and wires for security and damage. In enclosures, check particularly when arranged in a harness and where they pass above a heater, transformer, or any other heat source. Report any damage as a corrective maintenance item.

Immediate action shall be taken on any exposed conductors. Damage includes any new wet / dry degradation. Rodent damage can occur to wiring in harnesses which might not immediately visible.

3.2 Check that wire degradation signs are in place if this is present in the enclosure.

3.3 Check site copy diagrams are available, properly stored and fit for purpose. Submit a request for replacements as required. Report to your SM(S) any handwritten or temporary alterations to the site copy.

3.4 Check internal equipment for signs of contamination, damage or failure.

3.5 Remove any dirt / infestation.

4. Power Supplies (Transformers/ Rectifiers, TFU etc) (Enclosure unit only)

4.1 Examine earth connections.

4.2 Examine terminations.

4.3 Check for signs of overheating.

4.4 Measure the power supply and busbar voltages (±10% of rating) for all signalling supplies.

Current readings on power supplies should also be taken if this is practicable.

See the notes in NR/SMS/PartC/EL00 (Electrical Equipment General) on hazards associated with electrical supplies. Investigate any significant variation from previous records.

5. Earth Tests (Enclosure unit only)

5.1 Carry out NR/SMS/PartB/Test/051 (Busbar Earth Test) to each power supply not continually monitored (excluding earth return circuits).

5.2 Rectify any earth fault found in step 5.1 that is outside the acceptable limit.

Report to your SM(S), the problem and any difficulties in rectifying it. Failure to rectify shall be reported to your SM(S) for necessary remedial action.

The report shall be made within 24 hours.

5.3 If any earth fault is found on a circuit with a voltage above the reportable voltage NR/SMS/PartZ/Z07 (Earth Leakage - Reference Values), report it to your SM(S).

5.4 The report shall be made within 24 hours. Your SM(S) shall decide if any further action is required.

6. Rack / Shelf Mounted Equipment (Enclosure unit only)

6.1 Carry out the following steps for associated relays, T/J, resistor units, component boards.

6.2 Check internal enclosure fittings, racks, shelves, and backboards.

6.3 Clean equipment as necessary.

6.4 Check ventilation is not obstructed.

6.5 Check equipment is correctly labelled.

6.6 If not managed by a relay re-servicing database, check a sample of relays to see that they are within their Service date. Report any missing labels to your SM(S).

6.7 Check equipment for security and signs of damage, degradation, moisture, overheating, and cover distortion.

7. Cables & Cable Terminations and Internal Wiring

7.1 Check that all plug coupled connections are free from damage, secure and their cables are correctly retained.

This includes the protective covers for unused plug couplers if fitted.

Secure means firmly tightened by hand until a “click” is felt when the cover correctly engages with the receptacle.

The tightening of plug couplers by the use of tools is prohibited.

7.2 If fitted, check cables are secure and free from damage / chafing / rodent damage.

Cable clamps should be fitted to reduce the possibility of short circuits occurring if the cable is pulled from outside the enclosure.

7.3 Check wiring is correctly routed, and free from insulation damage (e.g. chafing / wire ties / rodent damage) especially if located above a heat source.

NOTE: *The examination of cables and wires for changes in wire degradation and the related timescales are now covered by NR/L2/SIG/11655 (Management of Cable and Wire Insulation).*

Harnesses should be in good condition and support the wiring.

7.4 On WAGO terminals, check that red insulation stops are fitted as required.

7.5 Check un-terminated cores and wires are correctly insulated.

7.6 Check ‘red straps’ are secure and labeled.

SERVICE B

8. All LED Modules

To carry out clause 8.1, iLS signals mounted on enclosures will have to be disconnected by means of the post plug coupler before lowering.

8.1 Check that the front apertures are clean, not damaged, distorted, discoloured and not obstructed. Clean as necessary.

Report any permanent damage or discolouration as corrective maintenance. This task applies to each LED Module.

8.2 if provided, check the indicator hoods and anti-vandal guards.

8.3 If fitted and practicable, carry out NR/SMS/PartB/Test/022 (Signal Lamp and Light Module Proving Tests).

8.4 If fitted and practicable, carry out NR/SMS/PartB/Test/023 (Other Signal Tests) – Section 6 – Flasher Unit Test (Flashing Aspects).

8.5 If fitted and practicable test and record the SLM input for each aspect and any additional unit such as PLJI, PLS, MARI's and SARI's.

Where tests 8.3 to 8.5 are not practicable, note this on the record card and on your work order.

SERVICE C

9. Cable Testing (Modular signal enclosure unit only)

9.1 Test lineside cables not monitored by a ELD equiped busbar, carry out NR/SMS/PartB/Test/054 (Cable Insulation Tests).

END

Includes:	Dorman Classic, Dorman Tunnel and Signalhouse LED
Excludes:	Integrated Lightweight Signal (iLS), VMS and all other LED signals

Identification of LED Signals

Dorman Classic – These signal heads are used as a replacement for a filament style head. The lenses are convex.

Signal House - These signal heads have a hexagon shaped layout of their LED aspects.

Figure 2 - Dorman Classic

Figure 1 – Signal House

Figure 4 – Tunnel Signal with Integrated PLS

Figure 3 – Tunnel Signal

The signal head configurations can be different to the examples shown.

You shall liaise with the Signaller before displacing any signal light module from its normal position to check there are no approaching trains and the possibility of a driver not being able to observe the aspect.

On Dorman products maintenance can be undertaken from the rear of the signal. In the case of other manufactures access is also required at the front. If you are unsure about the manufacturer of the signal and the access you require, ask your SM(S)

SERVICE A

1. General

1.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

1.2 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

1.3 If applicable visually inspect cables suspended from the structures above overhead line equipment.

1.4 Check the signal ID plates are displaying the correct details and are not damage, fading. Check them for security and are correctly aligned.

1.5 Clean the Signal ID Plates.

2. Signal Heads

2.1 Check the presence of E-clips on the pivot bar for LED module (Dorman Signals only). Any damaged or missing E-Clips shall be replaced and treated as corrective maintenance.

2.2 Check the vertical tilt alignment bolts are torqued to 40 Nm (Dorman Signals only).

2.3 Check that the lens is clean, not damaged or distorted and not obstructed.

2.4 Check the fan is working and the venting is not obstructed (Signal House type only).

2.5 Clean as required. This task applies to each LED Module.

2.6 If provided, carry out NR/SMS/PartB/Test/023 (Other Signal Tests) - Flasher Unit Test (Flashing Aspects).

SERVICE B

3. Signal Head

3.1 Open the access door and examine the interior of the signal head for deterioration, moisture ingress, or contamination. Rectify any problems as necessary. Dust and clean the interior.

Dorman signal heads are not designed to be watertight therefore some moisture/water can be present.

3.2 Examine cable glands, cable entries, and LED module’s as relevant to the installation. Close the access door.

3.3 If provided, check the alignment from the integral sighting device.

If this task is not possible due to sighting device being obscured (e.g. painted over) it should be reported as corrective maintenance. Report immediately any actual or possible obstructions to the sighting of the signal/indicator.

3.4 If practicable, test and record the supply voltage to the SLM for each aspect on the outgoing links in the location. If this is not possible, it shall be recorded on the card.

3.5 Check and Lubricate hinges, thumbscrews and padlocks.

4. Disconnection Boxes (If Provided)

4.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit / disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

4.2 Refit the lid and (if provided) padlock, check they are fitted securely.

5. Final Checks

5.1 Check that all covers, doors, and padlocks are securely refitted, Lubricate hinges and padlocks.

5.2 Check that all aspects and indicators are showing their normal (standing) aspect/indication on completion of maintenance.

PERIODIC TASKS

6. LED Modules

6.1 As required, replace SLM module(s).

6.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) all replaced modules.

Reliability – Centred Maintenance

SERVICE R1

Excludes:	Any signal located in a hostile or dirty environment

7. Reliability Centred Maintenance

Removal of the cover to gain access to the cable terminations is NOT required for any of the following tasks.

7.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

7.2 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

7.3 If applicable visually inspect cables suspended from the structures above overhead line equipment.

7.4 Check the signal ID plate for damage, fading, security and correct alignment.

7.5 Check all other signs is displaying correct signal number & type.

7.6 Wipe all signs.

7.7 Check signal structure including - post, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective meshing, hoods, (etc.). For signs of serious corrosion before using.

7.8 Check the presence of E-clips on the pivot bar for LED module (Dorman Signals only). Any damaged or missing E-Clips shall be replaced and treated as corrective maintenance.

7.9 Check for loose or damaged fittings.

7.10 Check for obvious hazards.

7.11 Check for the security of traction bonding (where fitted).

7.12 Check for effectiveness of signal & indicator door locking mechanisms.

7.13 Check the Signal head, lens hoods, backgrounds, & if provided anti- vandal guards.

7.14 Check the front aperture is clean, not damaged, distorted or obstructed.

7.15 Report any damage or discolouration.

7.16 Clean the front aperture as necessary.

7.17 Clean the interior of the signal head.

7.18 Examine the interior of the signal head for deterioration and moisture ingress.

Dorman signal heads are not designed to be watertight).

7.19 Examine the cable entries & glands, plug couplers and visible cable within the signal head.

7.20 Test and record the supply voltage to the lit SLM, on the outgoing links in the location.

7.21 Report any problems that cannot be immediately rectified

7.22 When informing the Signaller that you have completed the work on a signal, check the signal is displaying the correct aspect and that it corresponds to the signal box indications.

This is especially important when any signalling equipment has been operated by means other than a train.

END

Includes:	Main Colour Light Signals- illuminated using standard filament lamps, 8000 hr lamps, Light Engines. SPAD signals. Ansaldo Signals
Excludes:	All other Signals

SERVICE A

1. General

1.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

1.2 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

1.3 If applicable visually inspect cables suspended from the structures above overhead line equipment.

1.4 Check the signal ID plates are displaying the correct details and are not damage or fading. Check them for security and correct aligned.

1.5 Clean the Signal ID Plates.

2. Signal Heads

2.1 Check the signal head, lens hoods and backgrounds.

2.2 Check all exterior lenses are clean, not damaged or distorted, are correctly aligned and not obstructed. Polycarbonate lenses shall be cleaned using an approved cleaner. Report any permanent damage or discolouration as corrective maintenance.

2.3 Open the door and check the interior of the signal head for deterioration, moisture ingress, or contamination. Rectify any problems as necessary.

Doors on filament lamp heads shall not be opened if there is a train approaching as the driver might get a phantom aspect.

2.4 Check that the seals on the door(s) are effective.

2.5 Check that any ventilation slots in the rear of the head/indicator are clear of obstructions.

2.6 Check and lubricate hinges, thumbscrews and padlocks.

2.7 If provided carry out NR/SMS/PartB/Test/023 (Other Signal Tests) - Flasher Unit Test (Flashing Aspects).

3. Electro-Mechanical Searchlight Signals

3.1 Check that the mechanism is working correctly and releases smartly.

SERVICE B

4. Signal Heads

4.1 Open the access doors/plates, examine the units and weatherproof seals. Dust and Clean the interior.

4.2 Examine the following items as applicable:

a) Internal fixings, bolts and setscrews.

b) Internal lenses, glasses, reflectors and filters, polish with a clean, dry lint free cloth.

c) Cable entries and cable glands.

d) Internal wires and cable cores. Check that these are correctly routed, secured and terminated.

e) Exposed termination blocks. Clean and protect as necessary.

f) Relays, transformers and lamp holders. Check that transformers show no signs of corrosion; this can alter characteristics causing lamp proving to incorrectly function.

g) Spare lamps and record cards are available. The availability of spare lamps at the signal is optional.

4.3 Renew the normally lit lamp(s).

Check that the replacement(s) is/are seated correctly, and the main filament(s) is/are lit. If it is fitted with an auxiliary filament. Check that this works.

4.4 Where practicable and if required, carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests) all signal aspects (main and auxiliary) and indicators, adjust as necessary.

4.5 Where practicable and if provided, carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) all signal aspects.

4.6 Where provided, carry out NR/SMS/PartB/Test/023 (Spad Indicator Test).

Where tests 4.4, to 4.6 are not practicable, test the available aspects. Note any aspect not tested on the record card and on your work order.

4.7 Check in the immediate vicinity of the signal unit(s) for any preventable sources of vibration. Report any found to your SM(S).

5. Disconnection Boxes (If Provided)

5.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Final Checks

6.1 Check that all covers, doors, and padlocks are securely refitted, lubricate hinges and padlocks.

6.2 Check that all aspects and indicators are showing their normal (standing) aspect/indication on completion of maintenance. If you are in any doubt, ask your SM(S).

PERIODIC TASK 1

7. LED Light Engine Replacement

7.1 Renew LED Light Engine module(s).

SMTH testing is required when replacing a LED Light Engine Module.

7.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests), all replaced modules.

SERVICE R1

Includes:	Main Colour Light Signals - illuminated using 8000 hr lamps with full lamp proving of main signal.
Excludes:	SL35 signals in dirty or hostile environments, flashing aspects, SPAD indicators, searchlight signals, FOCL and other filament lamps.

Doors on filament lamp heads shall not be opened if there is a train approaching, also care shall be taken when working at night with the use of hand/head torches as either might lead to the driver getting a phantom aspect.

8. Signal Head and Structure

8.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

8.2 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

8.3 If applicable visually inspect cables suspended from the structures above overhead line equipment.

8.4 Check the exterior lenses for damage, distortion or obstructed.

8.5 Check the exterior lenses have correctly aligned 'Hot Strips'.

8.6 Check interior of signal head for deterioration, water ingress or contamination.

8.7 Any signal head ventilation is effective.

8.8 Door seals are effective.

8.9 Clean and examine the exterior lenses, if they are polycarbonate use an approved cleaner.

8.10 Clean the interior of signal head, including lenses.

8.11 Clean and examine all internal electrical components & terminations for security & corrosion.

8.12 Protect terminations as required.

8.13 Examine the condition of lamp contact springs for pitting (using dentist mirror).

8.14 Examine cable entries, glands & clamps for damage.

9. Testing

Where practicable, to carry out the following tests, after liaising with the Signaller.

9.1 Remove the lit lamp from its holder.

<u>In Non-SSI areas</u>

9.2 Check the GECR or similarly names proving relay de-energises.

9.3 Renew the lamp and check the relay re-picks.

For SSI areas

9.4 Check with Signaller that a lamp out alarm was received.

For all areas

9.5 Test and record the main filament voltage for all aspects.

Adjust, if necessary, in line with NR/SMS/PartZ/Z01 (Signal – Reference Values).

9.6 Check for 0v on auxiliary filaments with main filament illuminated.

9.7 Check auxiliary filaments voltage for all aspects by disconnecting each aspect main filament in turn using 'Faston' connection if fitted.

9.8 Check that the main filament is extinguished & auxiliary filament illuminated when the main filaments are disconnected.

9.9 Report any damage or discolouration of lenses as corrective maintenance.

9.10 When informing the Signaller that you have completed the work on a signal, check that the signal is displaying the correct aspect and that it corresponds to the signal box indications.

This is especially important when any signalling equipment has been operated by means other than a train.

SERVICE R2

Includes:	Main Colour Light Signals - illuminated using Light Engines with full lamp proving of main signal
Excludes:	Signals in dirty or hostile environments, flashing aspects, SPAD indicators, searchlight signals, FOCL and filament lamps

The resistor on the back of the LED lamp unit can become very hot, caution should be used when working near these units.

Figure 1 – LED Lamp Unit

10. Signal Head

10.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

10.2 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

10.3 If applicable visually inspect cables suspended from the structures above overhead line equipment.

10.4 Check the exterior lenses for damage, distortion or obstructed. Report any damage or discolouration of lenses.

10.5 Clean exterior lenses. For polycarbonate lenses use an approved cleaner.

10.6 Check each lenses 'Hot Strips' is correctly aligned.

10.7 Check the interior of signal head for deterioration, water ingress or contamination.

10.8 Clean and examine the interior of signal head including lenses.

10.9 Examine all internal electrical components & terminations for security & corrosion.

10.10 Protect terminals as necessary.

10.11 Check signal head ventilation is effective.

10.12 Check the door seals are effective.

10.13 Examine the condition of lamp contact springs for pitting.

10.14 Examine cable entries, glands & clamps.

11. Test

11.1 Contact the Signaller for permission before starting tests.

11.2 Where practicable carry out the following: Test the lamp proving for each aspect by disconnecting them using the 'Faston' connection (if fitted).

<u>For non-SSI areas</u>

11.3 Check the GECR or similarly named lamp proving relay de-energises.

11.4 Check the GECR relay re-picks when lamp reconnected.

For SSI areas

11.5 Check with the Signaller that a lamp out alarm was received.

For all areas

Check and record the signal lamp voltages for, where practicable, as many aspects as possible. Details of the voltage range can be found in NR/SMS/PartZ/Z01 (Signal – Reference Values).

Any problems that cannot be immediately rectified should be reported to your SM(S).

11.6 When informing the Signaller that you have completed the work on a signal, check the signal is displaying the correct aspect and that it corresponds to the signal box indications.

This is especially important when any signalling equipment has been operated by means other than a train.

PERIODIC TASK 2

12. LED Light Engine Replacement

12.1 Renew LED Light Engine module(s).

SMTH testing is required when replacing a LED Light Engine Module.

12.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests), on all replaced modules.

END

Includes:	Upper and Lower Quadrant Main and Subsidiary Signals, Mechanical Disc Signals, Fixed Signals
Excludes:	All other signals

SERVICE A

1. Signal Visibility

1.1 Carry out a NR/SMS/PartB/Test/302 (Signal Visibility Check).

2. Wire Runs

2.1 Examine signal wire for each signal, from the lever tail and / or wire adjuster, through to the arm of the signal. Arrange for any rusting or damaged wire to be replaced as soon as possible.

2.2 Check there are no kinks or joints in the vicinity of any pulley wheels.

2.3 Remove all obstructions from around the wire run and surrounding area.

2.4 Vegetation shall be cut back / killed. Anticipate growth, particularly in spring and summer.

2.5 Where necessary, wires shall be adjusted to allow for seasonal temperature variations.

2.6 Observe the operation of the signal at wheels, pulleys, detectors and at the post. Check for the correct operation of all components.

2.7 Observe the operation of the signal wire at rail crossings, boarding and footways.

2.8 In electrified areas, check the insulators. Insulations shall be at each end of the wire.

If there is any doubt about the integrity of the insulation, report immediately to your SM(S) to arrange replacements.

2.9 Examine all slings and chains, and associated wheels. Slings and chains shall be undamaged. If showing signs of damage or wear, they shall be changed as soon as possible (corrective maintenance).

3. Stakes

3.1 Check pulley stakes are vertical, solid and the alignment and spacing are correct. All wires shall be clear of the ground and any other equipment.

3.2 Check pulley wheels are correctly secured to the stakes by the designed fastenings and are free from damage. Check each pulley rotates freely. Pulley wheels shall not be lubricated unless using a dry film lubricate.

3.3 Examine all wire runs to check no signal wire comes into contact with the running rails or conductor rails. Wires shall not normally come into contact with the rails; plastic rail clips shall be fitted where required.

4. Benches and Timbers

4.1 Examine the benches and timbers on which the wheels and cranks are mounted. Check they are secure and free from damage and deterioration.

5. Wheels

5.1 Examine the foundations of the wheels. In particular look for signs of movement.

5.2 Examine wheel castings for cracking, chipping and other damage.

5.3 Check all pins and split pins.

5.4 Check nipples are clear and unblocked, and then sparingly lubricate the wheels with lithium-based grease. Oil may be required in place of grease. Lubricate with dry film lubrication if no grease nipple is provided.

During the winter period, the use of an anti-frost type lubricant helps counteract the effects of freezing temperatures.

Auto lubrication can also be used as required.

5.5 Check that ‘top hats’ are fitted to oil type wheels. Report any movement or damage to wheels as corrective maintenance.

5.6 Examine all thimbles, duplex links, c clips or shackles for wear and damage.

6. Wire Cranks

6.1 Check wire cranks are not overstroked.

The outer most holes should normally be used, to allow maximum travel of the cranks. Midway position should be 30% either side of centre.

6.2 Check the foundations are secure and the pins are undamaged.

6.3 Check (if fitted) nipples are clear and unblocked, and then sparingly lubricate the centre pin and thimble pins as necessary. Lubricate with dry film lubricate or oil if no grease nipple is provided.

During the winter period, the use of an anti-frost type lubricant helps counteract the effects of freezing temperatures.

Auto lubrication can also be used as required.

7. Structure

7.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh caps / finials (etc) are secure, not damaged and free from serious corrosion.

7.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

8. Signal Fittings

8.1 Check the security of all signal fittings. Lubricate as necessary. Replace any worn components (corrective maintenance). Check that plates and legends are secure and legible.

8.2 Examine balance weight mountings and brackets.

8.3 Check the weights are secure on the arm and the correct method of fastening is employed.

8.4 Lubricate the balance weight spindle.

8.5 Check the wire / down rod and intermediate supports. Adjustable rods shall have their fastenings cleaned. Lock nuts shall be checked for tightness.

8.6 Examine ground signal castings. Look for damage and signs of fracture. All vegetation and debris shall be well clear of the balance weights.

9. Signal Arm

9.1 Clean the signal arm front and rear. If faded or damaged report as corrective maintenance.

9.2 Check that the signal arm fixing bolts are tight.

9.3 Wipe the spectacles with a clean oil free cloth. Check for damage, transparency and discolouration.

9.4 If no automatic lubricator is fitted, Check the signal arm spindle grease nipple is clean, both components shall be cleaned of all old grease or oil before being re-lubricated. Then lubricate as necessary with lithium-based grease.

9.5 Signal arm spindles can be prone to sticking if un-lubricated or over-greased.

9.6 Check when greasing the spindle, that fresh grease exudes from each end. Wipe away any excess.

Some spindles are lubricated using oil, apply just enough oil to work the arm. The spindle and arm bearing may require stripping and cleaning.

During the winter period, the use of an anti-frost type lubricant helps counteract the effects of freezing temperatures.

9.7 Check the arm spindle for wear and there is enough clearance between the lamp and the spectacle frame to allow free movement of the arm. Significant wear shall be reported as corrective maintenance.

9.8 Check and sparingly lubricate backstop buffer springs and the down rod spring. Change weak or broken springs as corrective maintenance. Dry film lubricate or an adhesive type grease can be used on the down rod spring.

9.9 Check that backboards are clean and fit for purpose, where fitted.

9.10 Check correct operation of the signal.

9.11 Check the signal returns to danger after being cleared, even if the signal lever is returned slowly into the frame.

10. Signal Arm and Slot Repeaters

10.1 Check the operation of the circuit controller, see NR/SMS/PartC/LV31 (Circuit Controllers).

Seized controllers have in the past caused signal arms to ‘stick off’.

11. Signal Lamp (Electrically Lit Filament Lamps)

11.1 Check the lamp bracket and lamp for security. Clean the glass.

11.2 Check the backlight and blinder, where fitted. The backlight shall be obscured when the arm reaches 5° from the horizontal.

11.3 Examine tail cables and terminations. Protect as necessary.

12. Signal Lamp (NRS LED Disc Unit)

12.1 Open the signal case and remove the lamp unit.

12.2 Remove the lid from the lamp unit (4 screws) and examine the unit for signs of damage.

12.3 Clean all the lenses. Use a lint free cloth and an approved cleaner.

12.4 Disconnect and remove the battery. Insert a new replacement battery and fit connector to socket.

The disposable dry battery pack used in this unit has a six-month working life. Disposal of old battery packs shall be as per current environmental policy, see NR/SMS/PartA/A14 (Environmental Issues). The connector is polarised and only fits one way.

12.5 Check that the battery wires are clear of the LEDs and that both LEDs are illuminated.

12.6 Replace the lid and secure the screw. Replace the lamp unit in the signal. Check that the larger of the two windows faces the front of the signal. Check that a satisfactory light is given from the front of the signal and (if provided) the backlight.

13. Signal Lamp (Dorman LED Universal Semaphore Unit)

These can be battery powered or fed from an external power supply.

Battery Powered Units:

13.1 Remove the existing batteries and replace with new batteries. Check that the LEDs are illuminated.

The batteries can be with the unit itself or in a separate battery box banded to the post at ground level.

13.2 The final check is to operate the signal from the controlling point and observe correct operation.

SERVICE B

14. Auto Lubricator (If Provided)

14.1 Replace the lubricator with and equivalent and set using the procedure shown in Appendix A.

14.2 Remove any excess grease from around the auto lubricator fittings.

NOTE: *Automatic lubrication systems allow a controlled flow of grease into the spindle. These units used low temperature-based lithium grease. See appendix A*

15. Signal Lamp (Electrically Lit Filament Lamps)

15.1 Replace the signal lamp(s). Check the replacement(s) is/are seated correctly and the filament is lit.

15.2 Examine the lamp holder, fittings and terminations. Protect as necessary.

15.3 Carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests).

15.4 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests).

16. Signal Arm and Slot Repeaters

This task does not apply to Ex WR circuit controllers that have a linear movement.

16.1 Ask the Signaller to operate the signal arm to determine correct operation of the circuit controller, whilst observing On, Wrong and Off indications in the signal box.

16.2 Observe the movement of the circuit controller checking the bearing is free and not binding in any way. Report any circuit controller that does not have free movement as corrective maintenance.

17. Disconnection Boxes (If Provided)

17.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

17.2 Refit the lid and padlock, check both are fitted securely.

18. Final Checks and Tests

18.1 Gauge the signal arm, see NR/SMS/PartC/SG00 (Signals : General).

18.2 The final check is to operate the signal from the controlling point and observe correct operation.

PERIODIC TASKS 1

19. Signal Lamp (Dorman LED Universal Semaphore Unit – high intensity lamp)

19.1 Replace the entire lamp unit with a new (or serviced) unit.

19.2 Check that a satisfactory light is given from the front of the signal and (if provided) the backlight.

PERIODIC TASKS 2

20. Signal Lamp (NRS LED Disc Unit and Dorman LED Universal Semaphore Unit – low intensity lamp)

20.1 Replace the entire lamp unit with a new (or serviced) unit. On the NRS LED Disc Unit the larger of the two windows shall face the front of the signal.

20.2 Check that a satisfactory light is given from the front of the signal and (if provided) the backlight.

APPENDIX A - Automatic Lubrication systems

The Simalube automatic lubricator system is for use on mechanical signal grease points.

For signal spindles, a configuration dependent on the number of grease points is required.

Single lubrication points require 1 x 30ml unit, other configurations require a 15ml lubricator for each lubrication point.

Crank boss lubrication points require a 30ml unit whilst connecting pins require a 15ml unit.

Care should be taken to fill lubricant voids within fittings prior to installation of the lubricator.

Remove the green cap from the lubricator base and connect to the fitting as shown below.

The lubricator timer should be set to 12 by inserting the Allen key into the top of the lubricator and rotating it number to align with the arrow on the outer edge of the timer unit.

NOTE: *Setting 12 will give 1 year of lubrication. Lubricant level may be monitored via the viewing window.*

Figure 1 – Auto Lubrication Delivery systems

END

Includes:	Electro-mechanical banner repeater signals
Excludes:	LED Banner repeater signals, Banner repeater signals using Quartz Halogen lamps with fiber optic systems

SERVICE A

1. General Structure Inspection

1.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

1.2 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

1.3 If applicable visually inspect cables suspended from the structures above overhead line equipment.

<u>AC Traction Areas</u>

1.4 Check the structure bond is in place and secure.

1.5 Examine the tail cables for chafing, condition of glands.

1.6 Check signal identification plates. Check that they are correctly aligned, clean, and legible.

1.7 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

2. Signal Head: External Inspection

2.1 Examine signal head assembly, including:

a) Assembly casting and fixings.

b) Front glass. Wipe as necessary. The arm shall be clearly visible through the glass.

c) Front glass fixings.

d) Visible parts of banner arm and connections.

e) Condition of rear white face. If the interior is degraded or damaged, this should be reported to your SM(S).

2.2 Observe correct operation, where practicable.

2.3 Remove rear access cover and examine lamp holder, signal lamp, and terminations.

2.4 Carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests).

2.5 Replace and secure cover, lubricate thumbscrews and padlocks.

SERVICE B

3. Signal Operating Mechanism

3.1 Remove the cover plate and examine castings, fixings and water seal.

3.2 Check interior of casting and remove accumulated moisture and debris. Replace seal if moisture ingress if found.

3.3 Examine terminal block, internal cabling, wiring and cable terminations. Look for wire contamination, degradation, and risk of short circuit against metal parts. Clean and protect terminations as necessary.

3.4 Examine operating solenoid assembly (coils, rockers, terminations, pivots, balance weights, and fixings).

Look particularly for signs of overheating and excessive rubbing, which can result in the banner jamming in one position.

Report any such signs as corrective maintenance. The solenoid assembly shall only be renewed in a workshop environment.

3.5 Examine contact assemblies, including:

a) Spindle bearings.

b) Operating cams.

c) Fixing screws and set screws.

d) Contact springs and contact faces. Clean using a lint free cloth moistened with an approved cleaner.

e) Wiring and terminations.

3.6 Examine connection to banner arm assembly, including:

a) Connection to spindle.

b) Top and bottom lock nuts on screw thread.

3.7 Observe correct operation, where practicable. Movement shall be smooth and all components secure.

4. Banner Signal Assembly

4.1 Examine banner arm assembly, pivot and connections.

4.2 Lubricate the centre pivot with a few drops of mineral oil.

4.3 Where necessary, remove front glass and clean the glass interior, rear face and remove accumulated debris. Examine the water seal. Replace if damaged.

4.4 Examine wiring to lamp holder.

5. Signal Lamp

5.1 Replace the signal lamp(s). Check that the replacement(s) is/are seated correctly, and the filament(s) is/are lit.

5.2 Examine the lamp holder(s), fittings, and terminations. Protect as necessary.

5.3 Carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests).

5.4 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests).

6. Disconnection Boxes (If Provided)

6.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

6.2 Refit the lid and (if provided) padlock, heck they are fitted securely.

7. Final Checks and Tests

7.1 Test the ‘arm proving’ circuit, by operation of the signal to the ON and OFF positions, where practicable.

7.2 Replace all covers, without trapping any wires. Secure and Lubricate fixing bolts and thumb screws.

7.3 Observe correct operation of the signal.

END

Includes:	Position Light Signals (all types – filament lamp, fibre optic, and LED) independent (ground or post mounted) or in association with a main colour light signal (subsidiary) PoSA Proceed on Sight Authority
Excludes:	Position Light signals which are integrated into Dorman iLS and iLS (Modular) signals. Position Light Junction Indicators

Examples of Types of Position Light signals

Dorman - PLS

VMS - PLS

Filament - PLS

Figure 1 - Types of Position Light signals

The acronym PLS is used to describe Position Light Signals.

Not all the tasks are applicable to all PLSs; only undertake tasks relevant to the PLS type you are working on. If you are in doubt, ask your SM(S).

When the PLS is configured to act as a PoSA signal the signal shall be tested in both the steady and flashing state.

SERVICE A

1. Signal Mountings (all types)

<u>Independent Ground Mounted PLS</u>

1.1 Check that the signal mounting fitment is secure in the ground and undamaged.

1.2 Check that the signal is securely fixed to the mounting.

Independent Post Mounted PLS

1.3 Check the post and ladder are secure, not damaged, and free from serious corrosion.

1.4 Check that the signal is securely fixed to the post.

Subsidiary PLS

1.5 Check that the signal is securely fixed to the post.

2. General Signal Inspection (ground and post mounted)

2.1 Check that the signal aspects are clearly visible, have an uninterrupted view from the sighting distance and are not open to any misinterpretation.

The generic distance at which an independent or a subsidiary signal PLS should be visible is 100m or the length of the line, whichever is shorter.

3. Signal Heads (all types)

3.1 Check the signal head, lenses, hoods, and if provided anti-vandal guards.

3.2 Check all exterior lenses or SLMs are clean, not damaged or distorted, are correctly aligned and not obstructed. Report any permanent damage or discolouration as corrective maintenance.

3.3 Check the PLS identification plate. These shall be secure, correctly aligned, clean, legible, and display the correct number. Subsidiary PLS's do not have a separate number.

3.4 On subsidiary PLS's, check that there is no backlight, or it has been blanked off. Independent filament lamp PLS's might have a backlight, LED versions do not.

3.5 Open the door and check the interior of the signal head for deterioration, moisture ingress, or contamination. Rectify any problems as necessary. Doors on filament lamp heads shall not be opened if there is a train approaching as the driver might get a phantom aspect.

3.6 Check that the seals on the door(s) are effective.

3.7 Check that any ventilation slots in the rear of the head are clear of obstructions.

4. Fibre Optic Heads

4.1 Examine the Quartz Halogen lamp and reflector assembly for signs of blackening or deterioration. Replace the lamp if the glass envelope shows signs of blackening and replace the reflector assembly if bright white light can be seen from behind it.

4.2 Where first filament failure is not monitored and the next inspection is more than six months after the last lamp change, renew all the lamps.

4.3 Observe that the standing aspect illuminates correctly.

If practicable, arrange with the Signaller to illuminate the proceed aspect. Any inconsistencies in illumination could be caused by misaligned fibre optics, advise your SM(S).

4.4 Report any permanent damage or discolouration.

SERVICE B

5. Signal Heads (All Types)

5.1 Open the doors or covers. Examine the units and weatherproof seals.

5.2 Dust and clean the interior. Terminal boxes on LED PLS's should not be opened.

5.3 Examine the following items, as applicable:

a) Internal fixings, bolts, and setscrews.

b) Signal light modules.

c) Internal lenses, glasses reflectors and filters.

d) Polish with a clean, dry cloth (not Quartz Halogen lamp reflectors).

e) Cable entries and cable glands. Including fibre optic cables and associated clamps.

f) Internal wires and cable cores. These shall be correctly routed, secured, and terminated.

g) Exposed termination blocks. Clean and protect as necessary.

h) Lamp holders. A dentist mirror is useful for checking the condition of lamp holder springs.

i) The fibre optic cables shall be securely fitted to the lamp holder assembly in the control box and that the colour coding is correct.

5.4 Record cards should be kept in a safe location.

Filament Style Lamps

5.5 Replace the normally illuminated lamps, check that the replacements are seated correctly and are illuminated.

It is advisable to use a clean paper tissue or clean cloth to handle the replacement lamp to avoid contaminating the glass envelope.

5.6 If practicable, carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests) on all aspects (stop and proceed). Record any aspect not tested on the record card and on your work order.

LED Modules

5.7 Test and record the supply voltage to the SLM, on the outgoing links in the location. Record any aspect not tested on the record card and on your work order.

All Types

5.8 If practicable and as provided, carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) all aspects.

5.9 Check in the immediate vicinity of the signal for any preventable sources of vibration. Report any found to your SM(S).

6. Disconnection Boxes (If Provided)

6.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

6.2 Refit the lid and (if provided) padlock, check they are fitted securely.

7. Final Checks

7.1 Check that all covers, doors, and padlocks are securely refitted. Lubricate hinges and padlocks.

7.2 Check that the aspects are showing their normal (standing) aspect on completion of maintenance. If you are in any doubt, ask your SM(S).

PERIODIC TASK

8. SLM Modules

8.1 As required, replace SLM module(s).

8.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all replaced modules

SERVICE R2

Includes:	Dorman PLS
Excludes:	All other types of PLS

9. General

NOTE: *Removal of the cover to gain access to the cable terminations is NOT required for any of the following tasks.*

9.1 Clean the signal lens, check the front aperture is not damaged, distorted or obstructed.

Report any damage or discolouration.

9.2 Clean the signal ID plate and check for damage, fading, security and correct alignment.

9.3 Check all other signs are displaying correct signal number and type.

9.4 Wipe all signs.

9.5 Check signal structure including - post, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective meshing, hoods, (etc.). For signs of serious corrosion before using.

9.6 Check for loose or damaged fittings.

9.7 Check for obvious hazards.

9.8 Check for the security of traction bonding (where fitted).

9.9 Check for effectiveness of signal and indicator door locking mechanisms.

9.10 Check the Signal head, lens hoods, backgrounds, and if provided anti-vandal guards.

9.11 Examine the SLM for deterioration and moisture ingress.

NOTE: *Dorman signal heads are not designed to be watertight.*

9.12 Examine the cable entries and glands, plug couplers and visible cable within the signal head.

9.13 Test and record the supply voltage to the SLM, on the outgoing links in the location

9.14 Report any problems that cannot be immediately rectified.

9.15 When informing the Signaller that you have completed the work on a signal, check the signal is displaying the correct aspect and that it corresponds to the signal box indications.

This is especially important when any signalling equipment has been operated by means other than a train.

END

Includes:	Position Light Junction Indicators (Filament, Light Engine and LED)
Excludes:	VMS and Dorman iLS PLJI and all other Position Light Indicators

Equipment Identification

Figure 1 - Filament / Light Engine Type

Figure 2 - LED Type

The acronym PLJI is used to describe Position Light Junction Indicators.

See NR/SMS/PartC/SG00 (Signals: General) for more details on colour light signals, including signal sighting, lenses, and handling Quartz Halogen lamps.

Not all the tasks are applicable to all PLJI, only undertake tasks relevant to the type you are working on. If you are in doubt, ask your SM(S).

SERVICE A

1. Signal Structure (all types)

1.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

1.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

1.3 Check that the signal is securely fixed to its mounting point.

2. General Signal Inspection

2.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

3. Signal Heads (all types)

3.1 Check the signal head, lenses, hoods, and if provided anti-vandal guards.

3.2 Check all exterior lenses or SLMs are clean, not damaged or distorted, are correctly aligned and not obstructed. Report any permanent damage or discolouration as corrective maintenance.

3.3 Open the door and check the interior of the signal head for deterioration, moisture ingress, or contamination. Rectify any problems as necessary. Doors on lamp heads shall not be opened if there is a train approaching as the driver can get a phantom aspect.

3.4 Check that any ventilation slots in the rear of the head are clear of obstructions.

SERVICE B

4. Signal Heads (All Types)

4.1 Open the doors or covers. Examine the units and weatherproof seals.

4.2 Dust and clean the interior.

Terminal boxes on LED JPLI's should not be opened.

4.3 Examine the following items, as applicable:

a) Internal fixings, bolts, and setscrews.

b) Signal light modules (If fitted).

c) Internal lenses, glasses reflectors and filters. Polish with a clean, dry cloth (not Quartz Halogen lamp reflectors).

d) Cable entries and cable glands. Including fibre optic cables and associated clamps.

e) Internal wires and cable cores. These shall be correctly routed, secured, and terminated.

f) Exposed termination blocks. Clean and protect as necessary.

g) Lamp holders (if fitted). Inspect lamp holder springs for pitting and signs of damage.

h) Record cards should be completed.

Filament Style Lamps

4.4 If practicable, carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests) for all routes. Record any route not tested on the record card and on your work order.

LED Modules

4.5 Test and record the supply voltage to the SLM, on the outgoing links in the location. Record any aspect not tested on the record card and on your work order.

All Types

4.6 If practicable and as provided carry out, NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) all aspects.

4.7 Check in the immediate vicinity of the signal for any preventable sources of vibration. Report any found to your SM(S).

5. Disconnection Boxes (If Provided)

5.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Final Checks

6.1 Check that all covers, doors, and padlocks are securely refitted. Lubricate hinges and padlocks.

PERIODIC TASK 1

7. LED Light Engine Replacement

7.1 Replace LED Light Engine module(s).

SMTH testing is required when replacing a LED Light Engine Module

7.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all replaced modules.

PERIODIC TASK 2

8. SLM Modules

8.1 Replace SLM module(s).

8.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all replaced modules.

Reliability – Centred Maintenance

SERVICE R1

Includes:	Dorman - Position Light Junction Indicators
Excludes:	Signals in dirty or hostile environments

9. Exterior

9.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

9.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

9.3 Check exterior lenses or glass fronts for damage, distortion or obstruction and clean as required.

9.4 Check exterior lenses are correctly aligned.

9.5 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

10. Signal Proving

All Types

10.1 If practicable and as provided, NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) all aspects.

SERVICE R2

Includes:	Position Light Junction Indicators fitted with Light Engines
Excludes:	Signals in dirty or hostile environments

The resistor on the back of the LED lamp unit can become very hot, caution should be used when working near these units.

Figure 3 – LED Lamp Unit

11. Signal Head

11.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

11.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

11.3 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

11.4 Check the exterior lenses for damage, distortion or obstruction. Report any damage or discolouration of lenses.

11.5 Clean exterior lenses. For polycarbonate lenses use an approved cleaner.

11.6 Check each lenses 'Hot Strips' is correctly aligned.

11.7 Check the interior of signal head for deterioration, water ingress or contamination.

11.8 Clean and examine the interior of signal head including lenses.

11.9 Examine all internal electrical components and terminations for security and corrosion.

11.10 Protect terminals as necessary.

11.11 Check signal head ventilation is effective.

11.12 Check the door seals are effective.

11.13 Examine the condition of lamp contact springs for pitting.

11.14 Examine cable entries, glands and clamps.

12. Test

12.1 Where practicable carry out the following: Test the lamp proving for each aspect by disconnecting them using the 'Faston' connection (if fitted).

For non-SSI areas

12.2 Check the GECR or similarly named lamp proving relay de-energises.

12.3 Check the GECR relay re-picks when lamp reconnected.

For SSI areas

12.4 Check with the Signaller that a lamp out alarm was received.

For all areas

12.5 Check and record the signal lamp voltages for, where practicable, as many aspects as possible. Details of the voltage range can be found in NR/SMS/PartZ/Z01 Signal – Reference Values.

12.6 Any problems that cannot be immediately rectified should be reported to your SM(S).

12.7 When informing the Signaller that you have completed the work on a signal, check the signal is displaying the correct aspect and that it corresponds to the signal box indications. This is especially important when any signalling equipment has been operated by means other than a train.

SERVICE R3

Includes:	Position Light Junction Indicator - 8000 hr lamps
Excludes:	Signals in dirty or hostile environments, and other filament lamps

Doors on filament lamp heads shall not be opened if there is a train approaching. Also, care shall be taken when working at night with the use of hand/head torches as either might lead to the driver getting a phantom aspect.

13. Signal Head

13.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

13.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

13.3 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

13.4 Check the exterior lenses for damage, distortion or obstruction.

13.5 Check the exterior lenses have correctly aligned 'Hot Strips'.

13.6 Check interior of signal head for deterioration, water ingress or contamination.

13.7 Confirm that any signal head ventilation is effective.

13.8 Check that door seals are effective.

13.9 Clean and examine the exterior lenses, if they are polycarbonate use an approved cleaner.

13.10 Clean the interior of signal head, including lenses.

13.11 Clean and examine all internal electrical components and terminations for security and corrosion.

13.12 Protect terminations as required.

13.13 Examine the condition of lamp contact springs for pitting (using dentist mirror).

13.14 Examine cable entries, glands and clamps for damage.

14. Testing

Where practicable carry out the following tests, after liaising with the Signaller.

14.1 Remove the lit lamp from its holder.

<u>In Non-SSI areas</u>

14.2 Check the GECR (or similarly named proving relay), de-energises.

14.3 Replace the lamp and check the relay re-picks.

<u>For SSI areas</u>

14.4 Check with Signaller that a lamp out alarm was received.

<u>For all areas</u>

14.5 Test and record the main filament voltage for all aspects.

14.6 Adjust, if necessary, in line with NR/SMS/PartZ/Z01 Signal – Reference Values.

14.7 Check for 0v on auxiliary filaments with main filament illuminated.

14.8 Check auxiliary filaments voltage for all aspects by disconnecting each aspect main filament in turn using 'Faston' connection if fitted.

14.9 Check that the main filament is extinguished and auxiliary filament illuminated when the main filaments are disconnected.

14.10 Report any damage or discolouration of lenses as corrective maintenance.

14.11 Report any problems that cannot be immediately rectified.

When informing the Signaller that you have completed the work on a signal, check that the signal is displaying the correct aspect and that it corresponds to the signal box indications. This is especially important when any signalling equipment has been operated by means other than a train.

END

Includes:	Filament/Fibre Optic Style SARI and MARI Alphanumeric Route Indicators. Filament/Fibre Optic Style CD/RA indicators, platform 'OFF' indicators and Preliminary Route Indicators (PRIs)
Excludes:	LED MARI and SARI Route Indicators associated with Dorman iLS and VMS type signals. All other types of LED Route Indicators

Equipment Identification

Figure 1 - Filament - SARI

Figure 2 - Fibre Optic - SARI

Figure 3 - Fibre Optic - MARI

The acronym SARI is used to describe a Standard Alphanumeric Route Indicators these are sometimes called Theatre Indicators.

The acronym MARI is used to describe a Miniature Alphanumeric Route Indicators these are sometimes called Stencil Indicators.

See NR/SMS/PartC/SG00 (Signals General) for more details on colour light signals, including signal sighting, lenses, and handling Quartz Halogen lamps.

Not all the tasks are applicable to all Indicators only undertake tasks relevant to the PLS type you are working on. If you are in doubt, ask your SM(S).

Orientation of Dichroic lamps is important (e.g. Bombardier (formerly Adtranz) manufactured Fibre Optic Indicators). Incorrect orientation can lead to a wrong-side failure condition where a failed filament falls onto the filament support and short circuits the lamp proving circuit despite no indication being displayed.

SERVICE A

1. Signal Structure

1.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged, and free from serious corrosion.

1.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

1.3 Check that the indicator is securely mounted, not damaged, and free from serious corrosion.

2. General Signal Inspection

2.1 Check that the indicator is clearly visible and not open to any misinterpretation.

3. Signal Heads

3.1 Check the signal head, lenses, hoods, and if provided anti-vandal guards.

3.2 Check all exterior lenses are not damaged or distorted, are correctly aligned and not obstructed. Report any permanent damage or discolouration as corrective maintenance.

3.3 Open the door and check the interior of the signal head for deterioration, moisture ingress, or contamination. Rectify any problems as necessary. Doors on filament lamp heads shall not be opened if there is a train approaching as the driver can receive a phantom aspect.

3.4 Check that the seals on the door(s) are effective.

3.5 Check that any ventilation slots in the rear of the head are clear of obstructions.

4. Fibre Optic Indicators

4.1 Examine the Quartz Halogen lamp and reflector assembly for signs of blackening or deterioration. Replace the lamp if the glass envelope shows signs of blackening and replace the reflector assembly if bright white light can be seen from behind it.

4.2 Check that the lamp(s) are correctly installed.

When undertaking maintenance on Bombardier (formerly Adtranz) fibre optic signals and indicators, a correctly installed lamp shall have the wires protruding from the bottom of the lamp assembly.

4.3 Observe that the standing aspects illuminate correctly.

4.4 Report any permanent damage or discolouration.

SERVICE B

5. Signal Heads

5.1 Open the doors or covers. Examine the units and weatherproof seals.

5.2 Dust and clean the interior.

5.3 Examine the following items, as applicable:

a) Internal fixings, bolts, and setscrews.

b) Signal light modules.

c) Internal lenses, glasses reflectors and filters.

d) Polish with a clean, dry cloth (not Quartz Halogen lamp reflectors).

e) Cable entries and cable glands. Including fibre optic cables and associated clamps.

f) Internal wires and cable cores. These shall be correctly routed, secured, and terminated.

g) Exposed termination blocks. Clean and protect as necessary.

h) Lamp holders. A dentist mirror is useful for checking the condition of lamp holder springs. The fibre optic cables shall be securely fitted to the lamp holder assembly in the control box and that the colour coding is correct.

i) Record cards shall be completed.

<u>Filament Style Lamps</u>

5.4 If practicable and as required, carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests) on all aspects (stop & proceed). Record any aspect not tested on the record card and on your work order.

<u>All Types</u>

5.5 If practicable and as provided, carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all aspects.

5.6 Check in the immediate vicinity of the signal for any preventable sources of vibration. Report any found to your SM(S).

6. Disconnection Boxes (If provided)

6.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

6.2 Refit the lid and (if provided) padlock, check they are fitted securely.

7. Final Checks

7.1 Check that all covers, doors, and padlocks are securely refitted. Lubricate hinges and padlocks.

7.2 Check that the aspects are showing their normal (standing) aspect on completion of maintenance. If you are in any doubt, ask your SM(S).

Reliability - Centred Maintenance

SERVICE R1

8. General Maintenance

8.1 Clean all signs related to the signal.

8.2 Check signs for damage.

8.3 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

8.4 If applicable visually inspect cables suspended from the structures above overhead line equipment.

8.5 Check for loose or damaged fittings.

8.6 Check for obvious hazards.

8.7 Check for the security of traction bonding (where fitted).

8.8 Check for effectiveness of signal & indicator door locking mechanisms.

8.9 Check the signal head, lens hoods, backgrounds, and if provided anti- vandal guards.

8.10 Check the front aperture is clean, not damaged, distorted or obstructed.

8.11 Report any damage or discolouration.

8.12 Clean the front aperture as necessary.

8.13 Clean the interior of the signal head.

8.14 Examine the interior of the signal head for deterioration and moisture ingress.

8.15 Examine the cable entries and glands, plug couplers and visible cable within the signal head.

8.16 Test and record the supply voltage for each lamp. Replace any Halogen lamps that are discoloured / blackened. Check that all lamp(s) are correctly installed.

When undertaking maintenance on Bombardier (formerly Adtranz) fibre optic signals and indicators, a correctly installed lamp shall have the wires protruding from the bottom of the lamp assembly.

8.17 Report any problems that cannot be immediately rectified.

8.18 Check that the indicator is clearly visible and is not open to any misinterpretation.

END

Includes:	LED Style SARI and MARI Alphanumeric Route Indicators. LED CD/RA indicators, platform 'OFF' indicators and Preliminary Route Indicators (PRIs)
Excludes:	MARI and SARI Route Indicators associated with Dorman iLS and VMS type signals and all filament lamp and fibre optic style Route Indicator.

Equipment Identification Image

Figure 1 - LED - MARI

The acronym SARI is used to describe a Standard Alphanumeric Route Indicators these are sometimes called Theatre Indicators.

The acronym MARI is used to describe a Miniature Alphanumeric Route Indicators these are sometimes called Stencil Indicators.

Not all the tasks are applicable to all Indicators only undertake tasks relevant to the type you are working on. If you are in doubt, ask your SM(S).

SERVICE A

1. Signal Lens and Signal Plate (Dirty Environment)

1.1 Check the signal lens are clean, not damaged, distorted or obstructed.

1.2 Clean the signal lens and plate, as necessary.

Report any damage or discolouration.

2. General Signal Inspection

2.1 Check that the indicator is clearly visible and are not open to any misinterpretation.

The generic sighting distance for an indicator is 100m or the length of the line (whichever is shorter).

SERVICE R1

3. General Maintenance

3.1 Check the signal lens are clean, not damaged, distorted or obstructed.

3.2 Clean the signal lens and plate, as necessary.

Report any damage or discolouration.

3.3 Measure and record the supply voltage to the SLM for each aspect on the outgoing links in the location. If this is not possible, it shall be recorded on the card.

3.4 If practicable, carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests).

3.5 Check signal structure including - post, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective meshing, hoods, (etc.). For signs of serious corrosion before using.

3.6 Check for loose or damaged fittings.

3.7 Check for obvious hazards.

3.8 Check for the security of traction bonding (where fitted).

3.9 Check for effectiveness of signal and indicator door locking mechanisms.

3.10 Check the signal head, lens hoods, backgrounds, and if provided anti-vandal guards.

3.11 Examine the cable entries and glands, plug couplers and visible cable within the signal head.

Report any problems that cannot be immediately rectified.

3.12 Check that the indicator is clearly visible and are not open to any misinterpretation.

The generic sighting distance for an indicator is 100m or the length of the line (whichever is shorter).

PERIODIC TASKS

4. SLM Modules

4.1 Replace SLM module(s).

4.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all replaced modules.

END

Includes:	Point indicators, Departure direction points indicators, Points and Point departure indicators, Loading/unloading indicators and Internally lit signals.
Excludes:	All other Signals/ Indicators

You shall liaise with the Signaller before displacing any signal light module from its normal position to check there are no approaching trains and the possibility of a driver not being able to observe the aspect.

SERVICE A

1. General

1.1 Check from the sighting distance that the signal aspect(s) is clearly visible and not open to any misinterpretation of the displayed aspect(s).

1.2 Inform your SM(S) and ICC immediately of any actual or possible obstructions or problems to the sighting of the signal/indicator.

1.3 If provided, check the identification plate. These shall be secure, correctly aligned, clean, legible, and display the correct number.

2. Signal Heads

If applicable carry out the following:

2.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

2.2 If applicable visually inspect cables suspended from the structures above overhead line equipment

2.3 Check the indicator, lens hoods, backgrounds, and if provided anti-vandal guards.

2.4 Check all exterior lenses are clean, not damaged or distorted, are correctly aligned and not obstructed.

2.5 Polycarbonate lenses shall be cleaned using an approved cleaner. Report any permanent damage or discolouration.

2.6 Check that any ventilation slots in the rear of the head/indicator are clear of obstructions.

2.7 Check and lubricate hinges, thumbscrews and padlocks.

2.8 If provided, NR/SMS/PartB/Test/023 (Other Signal Tests) - Flasher Unit Test (Flashing Aspects).

SERVICE B

3. Signal Head

3.1 Open the access doors/plates, examine the units and weatherproof seals. Dust and clean the interior.

3.2 Dorman signal heads are not designed to be watertight therefore some moisture/water can be present.

3.3 Examine the following items as applicable:

a) Internal fixings, bolts and setscrews.

b) Internal lenses, glasses, reflectors and filters, polish with a clean, dry lint free cloth.

c) Cable entries and cable glands.

d) Internal wires and cable cores. Check that these are correctly routed, secured and terminated.

e) Exposed termination blocks. Clean and protect as necessary.

f) Relays, transformers and lamp holders. Check that transformers show no signs of corrosion; this can alter characteristics causing lamp proving to incorrectly function.

g) Spare lamps and record cards are available.

The availability of spare lamps at the signal is optional.

3.4 If provided, check the alignment from the integral sighting device.

If this task is not possible due to sighting device being obscured (e.g. painted over) it should be reported as corrective maintenance. Report immediately any actual or possible obstructions to the sighting of the signal/indicator.

3.5 If practicable and as required, carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests) all signal aspects (main and auxiliary) and indicators, adjust as necessary.

If practicable and as provided, carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all signal aspects.

Where tests 3.4 and 3.5 are not practicable, test the available aspects. Note any aspect not tested on the record card and on your work order.

Filament Type Indicators

3.6 If practicable, test and record the lamp voltages of each indicator.

LED Type Indicators

3.7 If practicable, test and record the supply voltage to the SLM for each aspect on the outgoing links in the location. If this is not possible it should be recorded on the card.

All Types

3.8 Check and Lubricate hinges, thumbscrews and padlocks.

4. Disconnection Boxes (If Provided)

4.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit / disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

4.2 Refit the lid and (if provided) padlock. Check they are fitted securely.

5. Final Checks

5.1 Check that all covers, doors, and padlocks are securely refitted, Lubricate hinges and padlocks.

5.2 Check that all aspects and indicators are showing their normal (standing) aspect/indication on completion of maintenance. If you are in any doubt, ask your SM(S).

PERIODIC TASKS

6. LED Modules

6.1 As required, replace SLM module(s).

6.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all replaced modules.

END

Includes:	Banner Repeater Signals - illuminated using standard filament lamps, 8000 hr lamps, Light Engines or Halogen lamps
Excludes:	Electro/Mechanical Banners and all other Signals

SERVICE A

1. General

1.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check) on full size banner repeaters only.

2. Signal Heads

When undertaking maintenance on Bombardier fibre optic signals and indicators Check that the replacement lamp is correctly installed.

A correctly installed lamp shall have the wires protruding from the bottom of the lamp assembly.

2.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

2.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

2.3 Check all exterior lenses are clean, not damaged or distorted, are correctly aligned and not obstructed. Report any permanent damage or discolouration.

2.4 If fitted, check the Quartz Halogen lamp and reflector assembly for signs of blackening or deterioration. Replace the lamp if the glass envelope shows signs of blackening and replace the reflector assembly if bright white light can be seen from behind it.

2.5 Open the door and check the interior of the signal head for deterioration, moisture ingress, or contamination. Rectify any problems as necessary. Doors on filament lamp heads shall not be opened if there is a train approaching as the driver might get a phantom aspect.

2.6 Check that the seals on the door(s) are effective.

2.7 Check that any ventilation slots in the rear of the head/indicator are clear of obstructions.

2.8 If provided, check the alignment from the integral sighting device. Details on sighting signal are in NR/SMS/PartC/SG00 (Signals – General) If this task is not possible due to sighting device being obscured (e.g. painted over) it should be reported.

2.9 Check and Lubricate hinges, thumbscrews and padlocks.

SERVICE B

3. Signal Heads

3.1 Open the access doors/plates, examine the units and weatherproof seals. Dust and Clean the interior.

3.2 Examine the following items as applicable:

a) Internal fixings, bolts and setscrews.

b) Internal lenses, glasses, reflectors and filters, Polish with a clean, dry lint free cloth.

c) Cable entries and cable glands.

d) Internal wires and cable cores. Check that these are correctly routed, secured and terminated.

e) Exposed termination blocks. Clean and protect as necessary.

f) Relays, transformers and lamp holders. Check that transformers show no signs of corrosion; this can alter characteristics causing lamp proving to incorrectly function.

g) Spare lamps and record cards are available. The availability of spare lamps at the signal is optional.

3.3 If practicable and required, carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests) all signal aspects, adjust as necessary.

If practicable and if provided, carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) all signal aspects.

4. Disconnection Boxes (If Provided)

4.1 Remove the lid and Check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

4.2 Refit the lid and (if provided) padlock. Check they are fitted securely.

5. Final Checks

5.1 Check that all covers, doors, and padlocks are securely refitted, Lubricate hinges and padlocks.

5.2 When informing the Signaller that you have completed the work on a Signal, take care to check that the signal is displaying the correct aspect and that it corresponds to the signal box indications. This is especially important when any signalling equipment has been operated by means other than a train.

PERIODIC TASKS

6. Light Engines

6.1 Replace all Light Engines.

6.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all replaced modules.

Reliability – Centred Maintenance

SERVICE R1

Includes:	Banner Repeater Signals- illuminated using 8000 hr lamps with full lamp proving.
Excludes:	Banner Repeater Signals in Dirty or hostile environments, and other filament lamps.

Doors on filament lamp heads shall not be opened if there is a train approaching, also care shall be taken when working at night with the use of hand / head torches as either might lead to the driver getting a phantom aspect.

7. Signal Head

7.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

7.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

7.3 Check the exterior lenses for damage, distortion or obstructed, carry out NR/SMS/PartB/Test/302 (Signal Visibility Check) on full size banner repeaters only.

7.4 Check interior of signal head for deterioration, water ingress or contamination.

7.5 Any signal head ventilation is effective.

7.6 Door seals are effective.

7.7 Clean and examine the exterior lenses, if they are polycarbonate use an approved cleaner.

7.8 Clean the interior of signal head, including lenses.

7.9 Clean and examine all internal electrical components & terminations for security & corrosion.

7.10 Protect terminations as required.

7.11 Examine the condition of lamp contact springs for pitting (using dentist mirror).

7.12 Examine cable entries, glands & clamps for damage.

8. Testing

Where practicable, to carry out the following tests, after liaising with the Signaller.

8.1 Remove the lit lamp from its holder.

<u>In Non-SSI areas</u>

8.2 Check the GECR or similarly names proving relay de-energises.

8.3 Replace the lamp and check the relay re-picks.

<u>For SSI areas</u>

8.4 Check with Signaller that a lamp out alarm was received.

For all areas

8.5 Test and record the voltages for all aspects. Adjust, if necessary, in line with NR/SMS/PartZ/Z01 (Signal – Reference Values).

8.6 If fitted check auxiliary filaments / lamp voltage for all aspects by disconnecting each aspect main filament in turn using 'Faston' connection if fitted.

8.7 If fitted check that the main filament /lamp is extinguished & auxiliary filament /lamp illuminates when the main filament / lamp is disconnected.

Report any damage or discolouration of lenses as corrective maintenance.

8.8 Report any problems that cannot be immediately rectified.

When informing the Signaller that you have completed the work on a Signal, check that the signal is displaying the correct aspect and that it corresponds to the signal box indications.

This is especially important when any signalling equipment has been operated by means other than a train.

SERVICE R2

Includes:	Banner Repeater Signals - illuminated using Light Engines with full lamp proving.
Excludes:	Banner Repeater Signals in Dirty or hostile environments, and filament lamps.

The resistor on the back of the LED lamp unit can become very hot, caution should be used when working near these units.

Figure 1 – LED Lamp

9. Signal Head

9.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

9.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

9.3 Check the exterior lenses for damage, distortion or obstructed. Report any damage or discolouration of lenses, Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check)on full size banner repeaters only.

9.4 Clean exterior lenses. For polycarbonate lenses use an approved cleaner.

9.5 Check the interior of signal head for deterioration, water ingress or contamination.

9.6 Clean and examine the interior of signal head including lenses.

9.7 Examine all internal electrical components & terminations for security & corrosion.

9.8 Protect terminals as necessary.

9.9 Check signal head ventilation is effective.

9.10 Check the door seals are effective.

9.11 Examine the condition of lamp contact springs for pitting.

9.12 Examine cable entries, glands & clamps.

10. Test

Contact the Signaller for permission before starting tests.

10.1 Where practicable carry out the following: Test the lamp proving for each aspect by disconnecting them using the 'Faston' connection (if fitted).

For non-SSI areas

10.2 Check the GECR or similarly named lamp proving relay de-energises.

10.3 Check the GECR relay re-picks when lamp reconnected.

For SSI areas

Check with the Signaller that a lamp out alarm was received.

For all areas

10.4 Check and record the signal lamp voltages for both indications where practicable. Details of the voltage range can be found in NR/SMS/PartZ/Z01 (Signal – Reference Values).

10.5 Any problems that cannot be immediately rectified should be reported to your SM(S).

10.6 When informing the Signaller that you have completed the work on a signal, take care to check that the signal is displaying the correct aspect and that it corresponds to the signal box indications. This is especially important when any signalling equipment has been operated by means other than a train.

END

Includes:	Reflective Distant Signal Boards, Reflective Boards associated with RETB, Externally Lit Notice, Reflective Trackside Boards associated with Level Crossings, Public Information Boards Attached to Light Units or Telephones at Level Crossings, ETD telephone number signs on signal with limited clearance, 'STOP' & STOP and Await Instruction etc. signs, 'Limit of Shunt' Signs, AWS Gap Signs, White Diamond Signs, Signal Countdown Markers, Radio channel change boards for CSR, GSMR and NRN, Fouling point markers in RETB areas.
Exclude:	TSR and PSR boards , other Trackside Information Boards

For more information on reflective boards and signs, see NR/SMS/SG00.
This SMS can be used generically for preventative maintenance of signs not directly related to signalling with authority, from the responsible Local Manager/ Engineer.

SERVICE A

1. General Inspection

1.1 Check that the post(s), brackets, fittings, supports, etc. are not corroded and securely fixed in the ground.

1.2 Repair or report any structures that are corroded or not securely fixed in the ground as corrective maintenance.

1.3 Check that the sign is clean and the legend is legible. Clean as necessary with a non- abrasive cleaner.

1.4 Report any signs that have faded or have been damaged rendering the legend unreadable as corrective maintenance.

Public information signs in Wales are required to be bi-lingual (Welsh & English).

1.5 Check on externally lit signs that the lighting works.

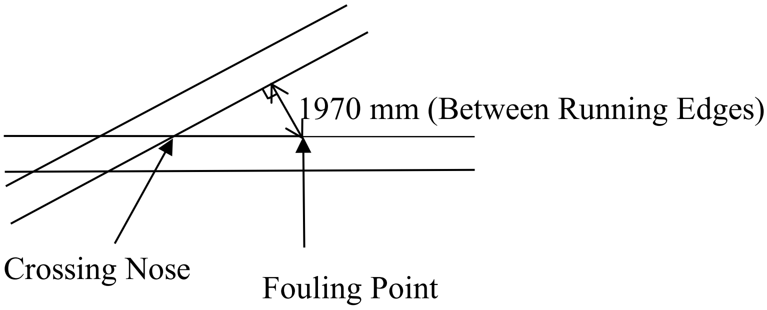
1.6 On signs that are not externally lit, check that the sign is of the correct retro-reflective material.

1.7 Report any defects with the external lighting to the appropriate responsible party.

1.8 Check that the sighting of the sign is not obscured by encroaching vegetation. Cut back as required, if this is not possible on the day report as corrective maintenance.

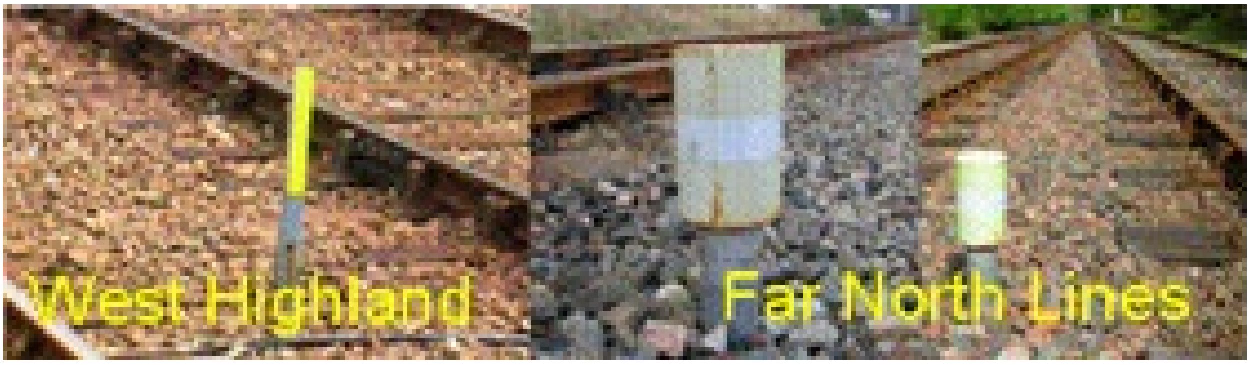
2. Fouling point Markers:

This is a position a short distance away from the point of running line divergence (crossing nose) as shown below.



2.1 Check the distance between running edges of the two rails is 1970mm, measured at right angles from the diverging line. Report to your SM(S) if the measurement is less.

3. Fouling point Marker identification



End of Service A

Reliability – Centred Maintenance

Includes:	All signs included in SG20
Exclude:	Signs in dirty or hostile environments, signs in area prone to vandalism,signs prone to vegetation overgrowth, signs that are in poor condition (e.g. rusted mounting post/fixing or unstable ground), external lit signs if the lighting source is considered likely to fail in lease than a year, TSR and PSR boards and other Trackside Information Boards

Service RA: Carry out service A of this SMS

End

Includes:	All signal types

PERIODIC TASK

1. General

1.1 Clean the signal lens or lenses and signal ID plate(s).

1.2 Check that the visibility of the signal is not at risk of becoming obstructed by encroaching vegetation. Cut back as required where it is safe to do so, or report as corrective maintenance.

END

Includes:	Banner Repeater Signal - LED
Excludes:	All other Signals

Figure 1 – LED Banner Signals

Provided a train is not approaching, it is possible to clean the front aperture of Dorman LED main signals from the rear by unlatching and tipping back the modules.

Support the weight of the module when tipping back. Check that cables do not get trapped when latching back into place.

SERVICE A

1. General Signal Inspection

1.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

1.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

<u>AC/DC Traction Areas</u>

1.3 Check the structure bond is in place and secure. On SMIS-W interlocking areas.

1.4 Check that the serrated nuts are fitted to confirm the earthing integrity.

1.5 Check from the sighting distance that the signal aspect(s) is clearly visible and not open to any misinterpretation of the displayed aspect(s).

1.6 Inform your SM(S) and ICC immediately of any actual or possible obstructions or problems to the sighting of the signal/indicator.

2. LED Banner Repeater Signals

2.1 Check that the front screen is clean and not damaged or distorted and not obstructed. Clean as necessary. Report any permanent damage or discolouration.

It is possible to clean the front aperture of Dorman LED banner repeater signals from the rear by unlatching and tipping back the module, support the weight of the module when tipping back.

SERVICE B

3. LED Banner Signals

3.1 Check the signal identification plate(s). These shall be secure, correctly aligned, clean, legible, and display the correct number.

3.2 Open the access door and examine the interior of the signal head for deterioration, moisture ingress, or contamination. Rectify any problems as necessary. Dust and clean the interior.

Dorman signal heads are not designed to be watertight therefore some moisture/water can be present.

3.3 Examine cable glands, cable entries and LED module(s). Close the access door.

3.4 If provided, check the alignment from the integral sighting device. If this task is not possible due to sighting device being obscured (e.g. painted over) it shall be reported.

3.5 Report immediately any actual or possible obstructions or problems to the sighting of the signal/indicator as corrective maintenance.

3.6 Test and record the supply voltage to the SLM, on the outgoing links in the location.

3.7 Check and lubricate hinges, thumbscrews and padlocks.

4. Disconnection Boxes (If Provided)

4.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit / disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

4.2 Refit the lid and (if provided) padlock. Check they are fitted securely.

5. Final Checks

5.1 Check that all covers, doors, and padlocks are securely refitted. Lubricate hinges and padlocks.

5.2 Check that all aspects and indicators are showing their normal (standing) aspect/indication on completion of maintenance. If you are in any doubt, ask your SM(S).

PERIODIC TASKS

6. LED Modules

6.1 Replace SLM module(s). The VMS Banner Repeater Signal is equivalent to an LED module.

6.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all replaced modules.

Reliability - Centred Maintenance

SERVICE R1

Removal of the cover to gain access to the cable terminations is NOT required for any of the following tasks.

7. LED Banner Signals

7.1 Check the signal ID plate for damage, fading, security and correct alignment.

7.2 Check all other signs is displaying correct signal number and type.

7.3 Wipe all signs.

7.4 Check for signs of serious corrosion before using signal structure including - post, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective meshing, hoods, (etc.).

7.5 Check for loose or damaged fittings.

7.6 Check for obvious hazards.

7.7 Check for the security of traction bonding (where fitted).

7.8 Check for effectiveness of signal and indicator door locking mechanisms.

7.9 Check the signal head, lens hoods, backgrounds, and if provided anti-vandal guards.

7.10 Check the front aperture is clean, not damaged, distorted or obstructed.

7.11 Report any damage or discolouration.

7.12 Clean the front aperture as necessary.

7.13 Clean the interior of the signal head.

7.14 Examine the interior of the signal head for deterioration and moisture ingress.

NOTE: *Dorman signal heads are not designed to be watertight.*

7.15 Examine the cable entries and glands, plug couplers and visible cable within the signal head.

7.16 Test and record the supply voltage to the SLM, on the outgoing links in the location.

7.17 Report any problems that cannot be immediately rectified.

7.18 When informing the Signaller that you have completed the work on a signal, check the signal is displaying the correct aspect and that it corresponds to the signal box indications.

This is especially important when any signalling equipment has been operated by means other than a train.

END

Includes:	Only the Rock Fall Detection Apparatus at Pass of Brander
Excludes:	All other Rock Fall Detection Equipment

GENERAL

This maintenance specification applies to the “stone screen” and “lever posts” Rock Fall Detection Apparatus which is designed to detect the presence of any rocks potentially fouling the line. It is situated in the Pass of Brander on the Crianlarich to Oban line.

The apparatus essentially comprises a specially adapted fence mechanically linked to semaphore signals. The signals are normally held in the “off” position but revert to danger if large boulders break the fence wires.

DEFINITIONS

Stone Screen

A system comprising a specially adapted fence mechanically linked to semaphore signals, normally held in the “off” position but designed to revert to danger if large boulders break the fence wires before falling onto or near the track.

Lever Post

Is the timber post where counterweight mechanisms detecting the tension in particular fence wires are installed. Such mechanisms are provided where wires terminate on each side of the post. The mechanisms incorporate down rods, any one of which causes the associated signal to return to danger.

Down Rod

A rod which connects the fence wire counterweight mechanism to the trigger which causes the signal to return to danger. On each side of a lever post, five such rods connect five counterweight mechanisms to one common trigger pin. To accommodate all five rods, each features a long slot at the top to allow one rod to pull the trigger pin down whilst the other rods stay in their original positions.

Perch

The position on the side of the lever post where a brass roller is held in place by the trigger balance weight lever.

Basket

An arrangement of wire netting attached to the lowermost fence wire at places where there is a depression in the ground under the fence. The netting is designed to catch small boulders which would otherwise pass undetected under the fence or deflect large boulders to break the lower wires.

SERVICE A

1. External

1.1 Obtain the Banavie Signaller's permission to undertake the following tests:

1.2 At each lever post, for the equipment on one side of the lever post:

1.3 Clean and grease all bearings, slots in the down rods and pulley wheel axles.

1.4 Examine all cotter pins and shackles; replace as necessary.

1.5 Check that the associated signal arm is in the "Off" Position.

1.6 Check there is a gap of at least 3 inches between the trigger lever pin and lower end of each slot in the five down rods. Rectify by means of adjustment to the down rod.

1.7 Taking care to avoid the trigger lever pushing the lower end of a slot in the five down rods, release the trigger balance weight lever from its perch (position of fixed brass roller attached to post). Check the signal arm drops freely and that tension in cross wire has released when the trigger balance weight arm is lifted up.

1.8 Check that the signal is now in the "On" position. Rectify as necessary by adjusting length of the cross-wire to the signal post.

1.9 With another person supporting the associated signal arm in the "Off" position, restore the trigger mechanism to its perch.

1.10 Check that with the trigger on its perch, the signal arm is now in the "Off" position.

1.11 Repeat all the above for the equipment on opposite side of the lever post.

SERVICE B

2. External

2.1 On each lever post, carry out NR/SMS/PartC/SG12 (Semaphore Signals). Pay particular attention to inspecting the condition of the posts where they enter the ground.

2.2 Check the full length of the stone screen for condition and integrity of the ten detection wires. Confirm that each wire runs through the correct pulley wheels and that joints are positioned approximately halfway between stakes.

In addition, inspect the condition of the stakes together with their pulley wheels and check the integrity and positioning of the wire mesh baskets which deflect boulders up to the detection wires.

Components which require renewal shall be reported in writing to the SM(S).

2.3 Minor repairs shall be carried out during this service as far as practicable.

2.4 If access to the lever posts or stone screen is seriously impeded by vegetation, report it to the SM(S).

END

Includes:	Machine manufactured by British Power Railway Signal Co, General Railway Signal Co, Siemens & General Electric Railway Signal Co
Excludes:	Machine manufactured by WRSL

SERVICE A

1. General Assembly

1.1 Examine the following:

a) Mounting bracket and fixing bolts.

b) The motor shall be secure on the signal post.

c) Assembly casting.

d) Look particularly for signs of cracking.

e) Crank arm.

f) Set screw and locknut or spindle nut and split pin, whichever is applicable.

2. Motor Assembly

2.1 Examine motor holding down bolts.

2.2 Examine motor terminations. Clean and protect as necessary.

2.3 Examine retaining mechanism including all split pins.

3. Circuit Controller

3.1 Examine circuit controller fixing bolts.

3.2 Examine circuit controller, including:

a) All split pins.

b) Circuit controller shaft retaining nut and split pin.

c) Terminations. Clean and protect as necessary, except contact faces.

d) Cut-off contacts. Clean and replace cut off contacts if necessary.

4. Lubrication

4.1 Lubricate the following with mineral oil:

a) Thumbscrew threads (where applicable).

b) Oil cups on main bearing (where fitted).

c) Motor cover thumbscrews.

d) Gear train.

e) Padlock (use graphite powder).

f) Circuit controller shaft oil holes.

4.2 Apply mineral oil sparingly to motor brush holder spring arm retaining mechanism and front armature bearing.

5. Final Checks

5.1 Arrange for the signal to be operated to both 'OFF' and 'ON' positions and observe the equipment functions correctly.

SERVICE B

6. General

6.1 Scrape, wash and brush machine casting.

6.2 Remove buffer cylinder and wipe inside with an oily cloth.

7. Motor

7.1 Examine the motor commutator. Clean with lint free cloth moistened with an approved cleaner.

7.2 Examine the motor brushes. The brushes shall slide freely in their holders and seat fully on the commutator. Replace the brushes when worn level with holder.

7.3 Wipe pole face and armature of retaining coil.

8. Circuit Controller

8.1 Clean circuit controller contacts and segments with a lint free cloth moistened with an approved cleaner.

8.2 Clean interior of case and remove any moisture or excess oil.

9. Final Checks

9.1 Arrange for the signal to be operated to both ‘OFF’ and ‘ON’ positions and observe the equipment functions correctly.

END

Includes:	Machine manufactured by WRSL
Excludes:	Machine manufactured by British Power Railway Signal Co, General Railway Signal Co, Siemens & General Electric Railway Signal Co

Signal operating arms shall only be changed and set up in a workshop environment.

Further information on these machines is contained in NR/L3/SIG/19019.

SERVICE A

1. General Assembly

1.1 Examine the following:

a) Mounting bracket and fixing bolts. The motor shall be secure on the signal post.

b) Assembly casting. Look particularly for signs of cracking.

c) Crank arm.

d) Locknut or spindle nut or split pin, whichever is applicable.

2. Motor Assembly

2.1 Examine the following:

a) Motor holding down bolts.

b) Motor terminations, clean and protect as necessary.

c) All split pins on brake gear assembly.

d) Clutch coil securing bolts.

e) All split pins on motion plate assembly.

3. Lubrication

3.1 Lubricate with mineral oil:

a) Thumbscrew threads.

b) Gear wheel and brake block pivot (sparingly).

c) Oil hole below brake drum.

d) All pivot pins on the motion plate (sparingly).

e) Padlock (use graphite powder).

3.2 Apply lithium-based grease or mineral oil to rollers on main gear wheel. Check that they rotate freely.

4. Final Checks

4.1 Arrange for the signal to be operated to both 'OFF' and 'ON' positions and observe the equipment functions correctly.

SERVICE B

5. General

5.1 Scrape, wash and brush machine casting.

5.2 Refill with lithium based grease the grease cup on the main spindle bearing.

5.3 Remove buffer cylinder and wipe inside with a clean oily cloth.

5.4 Examine brake block and brake drum. Check that that the drum is clean and free from grease.

6. Motor

6.1 Examine motor commutator. Clean the motor commutator with a clean lint free cloth moistened with a suitable cleaner.

6.2 Examine motor brushes. The brushes shall slide freely in their holders and seat fully on the commutator. Replace the brushes when worn level with the brush holder.

6.3 Examine cut out contacts. Clean or replace cut out contacts if necessary. With the mechanism normal there shall be 5mm clearance between the nose on the motion plate and the cut out arm.

6.4 Examine clutch coils.

6.5 Wipe pole faces and armature of clutch coils.

6.6 Clean the interior of the case and remove any moisture or excess oil.

7. Final Checks

7.1 Arrange for the signal to be operated to both 'OFF' and 'ON' positions and observe the equipment functions correctly.

END

Includes:	Fixed Systems including enabling device and signs
Excludes:	Patrolman's lockout device in the Manchester area (see NR/SMS/SW03)

SERVICE A

1. Housings

1.1 Check unit is securely mounted, and the post is secure, Clean as necessary. Report any sign of structural deterioration or forced entry as corrective maintenance

1.2 Check security locks are in order.

1.3 Check door/water seal.

1.4 Remove any heavy dirt/infestation.

1.5 Check tail cables are correctly routed, secure and not damaged or degraded.

2. Operating Devices

2.1 Check internal labelling is clean and legible.

2.2 Examine switch and mounting plate.

3. Boundary Diagram / Signs

3.1 Check the local boundary diagram is secure and legible. Clean as necessary.

SERVICE B

4. Internal Check & Test

4.1 Examine switch mechanism.

4.2 Examine internal wiring and cable terminations. Clean and protect as necessary.

4.3 Where practical, test operation of the lockout function.

4.4 Confirm with Signaller that associated indications are correctly displayed.

SERVICE RE: Carry out Service A and B of this SMS.

END

Includes:	Fixed Warning Systems -Switches/ Audible Warnings, Technicians 'Call Attention' Klaxon and Staff Annunciator / Warning System
Excludes:	Portable Staff Warning Systems

Service A

1. General

1.1 Check apparatus is secure and undamaged.

1.2 Check housings, where provided.

1.3 Check tail cables are correctly routed, secure and not damaged or degraded.

1.4 Examine switches for security and damage. Apply petroleum jelly to the keyhole.

1.5 Check labels and associated notices are legible.

1.6 Check audible warning devices are secure, undamaged, and correctly aligned towards the area of protection.

1.7 Check system for correct operation (Safe tone and warning tone as appropriate) with the passage of a train.

If this is not achievable, the check shall be carried out via simulation of a train.

1.8 Observe correct operation of associated indications.

1.9 Where provided, Test operation of the signallers 'Call Attention' / Staff Warning function.

End of Service A

Reliability - Centred Maintenance

Service RA : Carry out Service A of this SMS.

End

Includes:	Patrolman's lockout device in the Manchester (Ansaldo) area only
Excludes:	Portable Staff Warning Systems Any other Signalling lockout systems

SERVICE A

1. Exterior

1.1 Check the post, housing, door, door seal, lock, and hinges. Report the requirement for a replacement door seal as a corrective maintenance.

1.2 Examine the control point identification label. Clean as necessary. Report the requirement for a replacement identification label as a corrective maintenance.

1.3 Check tail cables and cable ties/clamps.

1.4 Lubricate the lock and hinges.

1.5 External Telephone (if applicable): Maintain in accordance with NR/L3/TEL/30181/011 - Maintenance of Operational Telephones.

2. Interior

2.1 Check that the Normal/Operate keyswitch is in the 'NORMAL' position.

2.2 Check that the TRAFFIC indicator is illuminated. Replace the lamp if failed as a corrective maintenance.

2.3 Examine the track diagram panel and artwork. Report the requirement for a replacement artwork as a corrective maintenance.

2.4 Examine the keyswitch, buttons, and indicators.

2.5 Wipe the diagram, keyswitch, buttons, and indicators.

3. Telephone (If Provided)

3.1 Examine the telephone, cradle, and cable.

3.2 Check that the telephone is operational.

3.3 Clean the handset.

SERVICE B

4. Internal

4.1 Examine the cables, wires, terminations. Clean and protect as necessary.

5. PLOD Key(s)

5.1 Examine the unique key(s). Report the requirement for a replacement if worn as a corrective maintenance.

6. Test

6.1 Carry out NR/SMS/PartB/Test/174 (Patrolman's Lockout Device Test).

END

Includes:	Pull cable at the Seven Tunnel
Excludes:	Any other pull cable system

SERVICE A

1. Pullkey Unit

1.1 Check each Pullkey unit is mounted securely on the tunnel wall.

1.2 Check the condition of the stainless steel fixings. Pay particular attention for any signs of severe corrosion.

1.3 Check the security of the catch restraint plug and socket on the base of the unit. Clean as necessary. Pay particular attention for any signs of severe corrosion.

1.4 Examine the catch restrain plug and socket for signs of moisture ingress. Lubricate sparingly using non- conductive lithium grease the joint between the plug and socket assembly.

1.5 Clean the Pullkey unit using a solvent free cleaner. Pay particular attention to the cleanliness of the two LED lenses fitted to the side of the unit and the Cats Eye reflectors fitted inside the red control knob on the front of the unit.

1.6 Check the Pullkey unit for signs of damage, rectify as necessary.

1.7 Check the two screws securing the lid of the Pullkey; Check they are tight. Check the lid for security and any signs of damage.

1.8 Check the condition of the two rubber gaiters for signs of damage and perishing. If any damage if found, replace the Pullkey unit. Do not allow any oil to come in contact with the rubber gaiters.

2. Pull Cable

2.1 Check the security and the condition of:

a) Tensioners

b) Eyelets

c) Bulldog grips

d) 'D' shackles

Replace any severely corroded items.

2.2 Check that the pull cable is taut. Rectify if necessary by adjusting the tensioner.

2.3 Check each section of the pull cable for any signs of damage to the outer insulation. Rectify as necessary. If the damage is severe, replace the complete section.

2.4 Examine the pigtails for any signs of damage or severe corrosion. Replace where necessary.

2.5 Examine the pigtail mounting bar that is fixed into the tunnel wall. Check that it is secure and examine for signs of severe corrosion.

3. Remote Oscillator

3.1 Check that the oscillator is secure on the tunnel wall.

3.2 Clean the outside of the unit using a solvent free cleaner.

3.3 Examine the catch restrain plug and socket. Lubricate sparingly using non-conductive lithium grease around the joint between the plug and socket assembly.

4. Pull Cable Control Unit

4.1 Dust and wipe the exterior of the cabinet using a damp cloth.

4.2 Check that the incoming cable connections are tight and secure.

4.3 Check the LCD display on the front of the cubicle. It should display that the system is normal with no active alarms

4.4 Using the Technician’s line test unit check that each core in the pull cable is earth free. Record the results on the test record card.

5. Pull Cable Remote Display & Alarm Unit

These items are located at Newport PSB and Seven Tunnel Junction interlocking.

5.1 Dust and wipe the exterior of the cabinet using a damp cloth.

5.2 Check that the display is indicating system normal with no alarms.

5.3 Check that the incoming cable connections are tight and secure.

5.4 Operate the test alarm adjacent to the display. Check that the alarm sounds. Operate the switch back to the normal position and check that the alarm ceases.

5.5 Disconnect the modem transmission lines and check that the display indicates 'Link Failure' and that the audible alarm sounds.

5.6 Operate the switch to the failed position and check that the audible alarm ceases.

5.7 Re-instate the modem transmission lines and check that the display indicates system normal and that the audible alarm sounds.

5.8 Operate the switch to the normal position and check that the audible alarm ceases.

SERVICE B

6. Pull Cable

6.1 Clean the pull cable with a non-abrasive solvent free cleaner.

7. Lineside Junction Box

7.1 Open the junction box and check for signs of moisture ingress. Rectify as necessary.

7.2 Check the security of the terminations, tighten where necessary.

7.3 Clean the inside of the junction box. Do not apply any treatments/protection to the terminals as this might damage the cable.

7.4 Replace the junction box cover.

8. System Tests

8.1 Carry out NR/SMS/PartB/059 (Emergency Pull Cable System Tests).

END

1. Track Circuit Types

Track circuits prove the absence of a train; they fall basically into two types, voltage, and frequency.

Voltage track circuits work on a voltage (DC or AC) being supplied at the feed end, which is fed along the rails to energise a relay coil at the relay end. The wheels of a train short out the feed voltage, which de-energises the relay coil.

Voltage TCs are separated from each other by means of Insulated Rail Joints (IRJs). At some locations the negative rail of each individual TC are connected together, this is known as common rail bonding.

Frequency track circuits operate by using the rails as part of a tuned circuit which when resonating provides a voltage to energise a relay coil.

When the wheels of a train short the rails the characteristics of the tuned circuit are altered stopping it resonating, therefore no output voltage is supplied at the relay end, which de- energises the relay coil.

Frequency TCs are separated from each other by means of bonds. These can be a simple rail-to-rail cable in a 'Z' pattern or an impedance bond with its own internal electronics.

This is a basic generic description of each type; individuals have their own equipment type and characteristics.

2. Track Circuit Testing

A track circuit maintenance test is carried out as the normal test as part of scheduled maintenance.

A track circuit full test is carried out if whenever alterations to the TC configuration (this includes relaying, tail cable or jumper cable renewal, feed or relay equipment renewal, adjustments) are carried out.

Track circuit testing and the presence of Signalling staff are not required when alterations to the following OLE bonding has taken place:

a) Structure to rail bonds

b) Traction rail to rail bonds

c) Impedance bond centre plate connections (on all types of track circuits employing impedance bonds).

d) Ole along track conductors, including earth wires, return conductors and associated connections to traction rails

e) Return screening conductors and associated connections to traction rails

f) Red bonds.

Signalling staff require to be consulted prior to the following taking place:

g) Any work involving Yellow Bonds

h) Side lead connections to impedance bonds on track circuits employing these.

A full test shall also be carried out if the obtained readings on a maintenance test are significantly different from those previously obtained.

3. Drop Shunt Test

The relay operation when being shunted should be sharp and positive. The value of the drop shunt should be taken when the Track Relay front contacts are fully open or where they exist when the back contacts are just made.

Certain types of Vane Track Relays that are used on AC track circuits have a smooth continuous action; the value of the drop shunt on these shall be obtained by observing the provided indicator.

4. Power Supplies

Most transformer/rectifier (TJs) feeding track circuits output a DC voltage that is actually only rectified AC. They rely on the battery back-up supply to smooth out the supply to provide a constant DC voltage.

On TCs which have electronics in their feeds (e.g. frequency tracks) disconnecting the battery and feeding the TC from the TJ only can result in the TC failing and possible damage to the feed equipment.

If you are in doubt about the power supply arrangements feeding a TC, ask your SM(S) before disconnecting the battery from the TJ.

5. High Voltages

Capacitors store voltage, therefore even when the supply is disconnected a high voltage might still be present across the positive and negative terminals of capacitors found in feed or relay equipment of some types of track circuit. This can be checked by means of a meter.

The voltage can be discharged by use of a linesman Avo meter (or Avo 8, Avo 9) on the resistance range between the positive terminal and earth.

Warning: An electronic meter shall not be used for this task.

Alternatively, the capacitor shall be removed from the circuit by means of insulated tools and discharged by placing a short circuit across the terminals.

NOTE: *Short-circuiting a charged capacitor can result in an arc and loud bang occurring when the short is applied, PPE shall be worn.*

The short circuit method shall not be used whilst the capacitor is still connected in the circuit.

6. Ballast Resistance

Ballast conditions can severely affect ballast resistance and the correct working of a track circuit. Ideally the ballast resistance should be high which results in very little voltage loss between the feed and relay ends of a TC.

A low ballast resistance results in a high voltage loss between the feed and relay and makes the TC prone to failure.

Wet conditions or poor ballast (e.g. ballast saturated with oil, diesel, or other contaminates) reduces the ballast resistance, in these circumstances care shall be taken when adjusting the TC to get the correct balance between feed setting and optimum drop shunt.

You shall inform your SM(S) if ballast conditions prevent you from obtaining an optimum set-up for the TC.

7. Residual Voltage

Certain combinations of ballast and ground conditions can lead to a ‘battery effect’ that can allow a voltage to develop across the rails.

Under some circumstances, this voltage can exceed the pick-up voltage of the track relay and keeps the TR coil energised even when the feed voltage is removed by disconnection or shunt.

To overcome the problem a Feed End Relay is fitted to the circuit, this de-energises when the feed voltage is first shunted. This cuts the feed to the Track Repeating Relay (TPR) even if the Relay End Relay might be still energised.

8. Track Circuit Cable Testing with Clamp Current Meters

Duplication of TC tail cables was introduced to reduce the number of failures caused by open circuit or high resistance connections.

The resistance of the connections can be tested using a current clamp meter to measure the current flowing in each duplicated lead. The reading should be equal in each; a higher reading in one indicates a high resistance or a disconnection.

The clamp meter can also be used to test the connections of jumpers, galvanised bonds and other non-duplicated TC cables by observing if the current reading fluctuates when the connections of the cable/bond under test are gently disturbed.

The use of the clamp meter does not affect the operation of the track circuit.

9. Track Circuit Drop Shunt Values

The table in NR/SMS/PartZ/Z03 (Train Detection - Reference Values) lists the minimum and desired drop shunts values for specific track circuits.

The location for obtaining the shunt is also given in the individual tests.

If a poor shunt is obtained where it has not been taken across the rails, it shall be taken again across the rails. If the minimum drop shunt cannot be achieved your SM(S) shall be informed immediately.

END

Includes:	Overlay Track Circuits, Rail circuits
Excludes:	All other type of Track Circuit

General

Overlay track circuits work in conjunction with conventional track circuits; they are superimposed or 'overlaid' over the conventional one but each work independently and have no effect on each other's operation.

The main principle behind the operation of overlay TCs is that they energise a relay with the occupation of the track circuit as opposed to de-energising a track relay with a conventional track circuit.

They are used to allow equipment to be released/operated when a train is present on the track circuit (e.g. ground frame release of trainman operated barriers etc).

They are also known as rail circuits and in this type of configuration can be used without being 'overlaid' with a conventional TC.

SERVICE A

1. Inspection

On an overlay TC tasks 1.1 to 1.10 can be undertaken as part of the "A" Service of the conventional TC. On a rail circuit TC all steps are applicable.

1.1 Examine the components of each insulated joint. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced "T" pieces.

d) Burred over rails.

e) Moved sleepers or rail fastenings that could short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint.

1.2 Check the visible tail cables, labelling, and route between rail ends and disconnection box, location or relay room.

Cables should be routed to avoid snagging. Report any damaged or degraded tail cables as corrective maintenance.

1.3 Check that the rail connections and all fittings are intact and that the cables are secure.

1.4 If provided: Visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

1.5 Check that the fishplate bonds are not broken or disconnected. Rectify as necessary. Report as corrective maintenance.

1.6 Check that signal wires, metal services (etc) are insulated from the rails using plastic rail clips.

1.7 Check for displaced rail clips, insulations, and pads (etc) which could cause an overlay TC failure. Report as corrective maintenance.

1.8 Remove conductive debris from the vicinity of the rails. This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate.

1.9 Check for any abnormal rail surface contamination on infrequently used rails.

1.10 Check the condition of the ballast and for any excessive build up against the rails.

Poor ballast condition and build up against the rails can affect to operation of the rail circuit. Report any deterioration in condition or build up.

SERVICE B

On an overlay TC tasks 2.1 to 2.2 can be undertaken as part of the “B” service of the conventional TC. On a rail circuit TC all steps are applicable.

2. Disconnection Boxes (if Provided)

2.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

2.2 Refit the lid and (if provided) padlock, check they are fitted securely.

3. Tests

3.1 Carry out NR/SMS/PartB/Test/261 – (Overlay Track Circuit Test).

3.2 Test the continuity of overlay TC double tails using a clamp meter.

The current passing through each leg to the rails of a double tailed overlay TC shall be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

END

Includes:	DC Low Voltage tracks
Excludes:	All types of track circuit and Overlay track circuits

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

If any adjustments or renewal of equipment have occurred, then NR/SMS/PartB/Test/251 (DC TC Test) Full Test shall be carried out in place of the Maintenance Test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the Signaller's indication.

Track Circuit Examination:

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

a) The type and complexity of track layout.

b) The amount of bonding.

c) Jointed track or Continuous Welded Rail.

d) Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section will only applicable if IRJs are provided at one or both ends of the TC.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced 'T' pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint

1.2 Check for correct stagger between abutting track circuits.

If un-staggered carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

Any track circuits found to be un-staggered shall be reported as corrective maintenance. DC TCs shall have opposite polarities across IRJs.

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location.

Cables should be routed or clipped to avoid snagging.

Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails.

Cables should not be stretched by the pipe, as these will prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 If provided and where practicable, examine impedance bonds, fixings and connections.

2.4 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances may not have to be inspected by a full walk through.

Your SM(S) will tell you if any or all of this section is applicable to the TC you are maintaining.

3.1 Check that track circuit jumper bonds are properly terminated and intact. Disconnected ‘yellow bonds’ shall be repaired. Where the yellow marking is degraded, arrange to renew the marking as corrective maintenance.

3.2 Check that any traction bonds are kept clear of any rails they are not bonded to.

3.3 Check that fishplate bonds are not broken, disconnected, or have been ‘tamped’ in the ballast. Renew or refit as necessary.

3.4 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.5 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails.

This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.6 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.7 Check the condition of the ballast and for any excessive build up against the rails.

3.8 Poor ballast condition and build up against the rails can affect the operation of the track circuit. Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or has enough clearance.

4.4 Check track circuit interrupters and connections. These are usually found at Catch Points and Trap Points. Refit as necessary.

SERVICE B

5. Disconnection Boxes (if provided)

5.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Track Circuit Tests

6.1 Carry out NR/SMS/PartB/Test/251 (DC TC Test) Maintenance Test.

6.2 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

6.3 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

It is recommended that on the 'B' service (If fitted) all primary cells are replaced.

To maintain reliability using this replacement frequency, the capacity of the cells used should be based on the service frequency, and the time the track circuit is in an occupied state.

There are two versions of cells which should be used:

a) AS10/1 600Ah - for low use track circuits.

b) AS10/2 1200 Ah - for heavily used track circuits.

7. Local Policy Requirement

7.1 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.

PERIODIC TASK 1

8. Residual Voltage Check

This check is not required if the track circuit is fitted with a feed end relay.

8.1 Carry out NR/SMS/PartB/Test/251 (Residual Voltage Check) - Clause 3.

PERIODIC TASK 2

9. Residual Voltage Bonding Check

This check shall only be carried out only if Residual Voltage is identified during NR/SMS/PartB/Test/251 (Residual Voltage Check) - Clause 3.

9.1 Check all bonding, jumpers and any other types of bonding which are duplicated.

SERVICE RA - Carry out Service A of this SMS.

SERVICE RB - Carry out Service B of this SMS.

END

Includes:	DC Medium Voltage tracks
Excludes:	All other types of track circuits

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

If any adjustments or renewal of equipment have occurred, then NR/SMS/PartB/Test/251 (DC Track Circuit Test) Full Test shall be carried out in place of the Maintenance Test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the Signaller's indication.

Track Circuit Examination:

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination is dependent on:

a) The type and complexity of track layout.

b) The amount of bonding.

c) Jointed track or Continuous Welded Rail.

d) Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section is only applicable if IRJs are provided at one or both ends of the TC.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced 'T' pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint.

1.2 Check for correct stagger between abutting track circuits.

If un-staggered carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

Any track circuits found to be un-staggered shall be reported as corrective maintenance. DC TCs shall have opposite polarities across IRJs.

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location.

Cables should be routed or clipped to avoid snagging.

Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails.

Cables should not be stretched by the pipe, as these prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 If provided and where practicable, examine impedance bonds, fixings and connections.

2.4 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances may not have to be inspected by a full walk through.

3.1 Check that track circuit jumper bonds are properly terminated and intact. Disconnected ‘yellow bonds’ shall be repaired. Where the yellow marking is degraded, arrange to renew the marking as corrective maintenance.

3.2 Check that any traction bonds are kept clear of any rails they are not bonded to.

3.3 Check that fishplate bonds are not broken, disconnected, or have been ‘tamped’ in the ballast. Renew or refit as necessary.

3.4 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.5 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails.

This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.6 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.7 Check the condition of the ballast and for any excessive build up against the rails.

3.8 Poor ballast condition and build up against the rails can affect the operation of the track circuit. Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C).

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or there is enough clearance.

4.4 Check track circuit interrupters and connections. These are usually found at Catch Points and Trap Points. Refit as necessary.

SERVICE B

5. Disconnection Boxes (If Provided)

5.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Track Circuit Tests

6.1 Carry out NR/SMS/PartB/Test/251 (DC TC Test) - Maintenance Test.

6.2 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

6.3 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

It is recommended that on the 'B' service (If fitted) all primary cells are replaced.

To maintain reliability using this replacement frequency, the capacity of the cells used should be based on the service frequency, and the time the track circuit is in an occupied state.

There are two versions of cells which should be used:

a) AS10/1 600Ah (cat no. 54/003198) for low use track circuits.

b) AS10/2 1200Ah (cat no. 54/003199) for heavily used track circuits.

7. Local Policy Requirement

7.1 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.

PERIODIC TASK 1

8. Residual Voltage Check

This check is not required if the track circuit is fitted with a feed end relay.

8.1 Carry out NR/SMS/PartB/Test/251 (Residual Voltage Check) - Clause 3.

PERIODIC TASK 2

9. Residual Voltage Bonding Check

This check should only be carried out only if Residual Voltage has been identified during NR/SMS/PartB/Test/251 (DC Track Circuit Test) - Residual Voltage Check.

9.1 Check all bonding, jumpers and any other types of bonding which are duplicated.

END

Includes:	DC Coded Track Circuits
Excludes:	All types of track circuit and Overlay track circuits

If any adjustments or renewal of equipment have occurred, then NR/SMS/PartB/Test/262 (DC Coded Track Circuit Test) Full Test shall be carried out in place of the Maintenance Test.

For additional information on DC Coded tracks see SMS Appendix 12.

Track Circuit Examination

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

a) The type and complexity of track layout.

b) The amount of bonding.

c) Jointed track or Continuous Welded Rail.

d) Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section will only apply if IRJs are provided at one or both ends of the TC. Your SM(S) will tell you if any or all of this section is applicable to the TC you are maintaining.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced ‘T’ pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint.

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location.

Cables should be routed or clipped to avoid snagging. Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, as these prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 If provided visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances may not have to be inspected by a full walk through.

Your SM(S) will advise you if any or all of this section is applicable to the TC you are maintaining.

3.1 Check that fishplate bonds are not broken, disconnected, or ‘tamped’ into the ballast. Renew or refit as necessary.

3.2 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.3 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails.

This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.4 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.5 Check the condition of the ballast and for any excessive build up against the rails.

Poor ballast condition and build up against the rails can affect the operation of the track circuit. Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

This section is only applicable to TCs through S&C.

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or is adequately clear.

4.4 Check track circuit interrupters and connections. These are usually found at catch points and trap points. Refit as necessary.

SERVICE B

5. Disconnection Boxes (If Provided)

5.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Track Circuit Tests

6.1 Carry out NR/SMS/PartB/Test/262 (DC Coded Track Circuit Test) Maintenance Test.

6.2 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

6.3 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

6.4 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

END

Includes:	All Reed versions of track circuit
Excludes:	All other types of track circuits

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

If any adjustments or renewal of equipment have occurred, then NR/SMS/PartB/Test/257 (Reed Type RT Track Circuit Test) Full Test shall be carried out in place of the Maintenance Test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the Signaller's indication.

Track Circuit Examination

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

a) The type and complexity of track layout.

b) The amount of bonding.

c) Jointed track or Continuous Welded Rail.

d) Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section is only applicable if IRJs are provided at one or both ends of the TC.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced 'T' pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location. Cables should be routed or clipped to avoid snagging. Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, as these prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 If provided: And where practicable, examine impedance bonds, fixings and connections.

2.4 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances may not have to be inspected by a full walk through.

Your SM(S) will advise you if any or all of this section is applicable to the TC you are maintaining.

3.1 Check that track circuit jumper bonds are properly terminated and intact. Disconnected ‘yellow bonds’ shall be repaired immediately. Where the yellow marking is degraded, arrange to renew the marking as corrective maintenance.

3.2 Check that any traction bonds are kept clear of any rails they are not bonded to.

3.3 Check that fishplate bonds are not broken, disconnected, or ‘tamped’ into the ballast. Renew or refit as necessary.

3.4 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.5 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails.

This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.6 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.7 Check the condition of the ballast and for any excessive build up against the rails.

Poor ballast condition and build up against the rails can affect the operation of the track circuit. Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or there is enough clearance.

4.4 Check track circuit interrupters and connections. These are usually found at catch points and trap points. Refit as necessary.

SERVICE B

5. Disconnection Boxes (If Provided)

5.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Track Circuit Tests

6.1 Carry out NR/SMS/PartB/Test/257 (Reed Type RT Track Circuit Test) Maintenance Test.

6.2 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

6.3 If provided, Carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

6.4 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

Reliability - Centred Maintenance

Includes:	Standard Reed type RT Track circuit, Single & Double Rail and Simple Loop RX. (Which meet the prerequisites laid down in SIG/10665)
Excludes:	High Power, High Performance & Jointless Reed Track circuits, RT compound loops and Pre type Reed RT track circuits (e.g. AEI GRS large plug in or the variant of Reed tunnel tracks). All other types of track

SERVICE RA - Carry out Service A of this SMS

SERVICE RB - Carry out Service B of this SMS

SERVICE RE

7. General Track Inspection

Traction Areas Only

7.1 Examine the negative return bonding is present and the connections are tight.

At each impedance bond, examine the aluminium tail plate is secure and check for signs of arcing.

7.2 Check the rail leads and cover are tight. Torque settings for these connections can be found in NR/SMS/PartZ/Z03 (Train Detection - Reference Values).

For All Types

7.3 Examine the track circuit for potential causes of track circuit failure.

7.4 Check tail cables are undamaged and protected.

7.5 Confirm that signal wires, point rodding, and metal services (etc) are insulated and clear of rails.

7.6 Check rail to rail, jumper and fishplate bonds.

7.7 Assess the condition of ballast/ground conditions.

7.8 Check the condition of P.Way (Report defects).

7.9 Check for metallic objects in close proximity to track (remove where possible).

7.10 Visually check all associated IRJ's for degradation or damage.

7.11 Where fitted – examine the “Simple RX loop” for damage and security.

7.12 Check track circuit interrupters and connections are undamaged.

For Single Rail Track Circuits

7.13 Check the Stretcher bar insulations.

8. Disconnection Boxes (If Provided)

8.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

8.2 Refit the lid and (if provided) padlock, check they are fitted securely.

9. Test

9.1 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

At the Relay End

9.2 Measure and record, with a digital meter, the AC voltage on the receiver track filter (RT7202, RT7212) between terminals 11 and 12 is between 150mV to 300mV.

9.3 Measure and record the voltage across the track relay coils R1 (+) and R4 (-) is between 11.5V and 13.5V DC.

9.4 Test and record the drop shunt values, see NR/SMS/PartZ/Z03 Train Detection - Reference Values) for values.

9.5 When a track circuit bonding configuration includes ‘Parallel Bonding’. Carry out a Drop shunt at all extremities of the track circuit.

For Single Rail Track Circuits with Parallel Bonding

9.6 Carry out a 0.5ohms drop shunt at each extremity.

For All Types

9.7 Compare the results with previous readings. Where there is a significant variation investigate if necessary

9.8 Report any adjustments made, components replaced or out of specification items on a WAIF.

END

Includes:	50Hz AC Tracks
Excludes:	All other Tracks and Overlay track circuits

GENERAL

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

High voltages might be present on the terminals of capacitors.

If any adjustments or renewal of equipment have occurred, then NR/SMS/PartB/Test/260 (50Hz AC Track Circuit Test) Full Test shall be carried out in place of the Maintenance Test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the Signaller's indication.

Track Circuit Examination:

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

a) The type and complexity of track layout.

b) The amount of bonding.

c) Jointed track or Continuous Welded Rail.

d) Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section is only applicable if IRJs are provided at one or both ends of the TC.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced 'T' pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint.

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location. Cables shall be routed or clipped to avoid snagging. Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, as these will prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings are intact and the cable secure.

2.3 If provided: And where practicable, examine impedance bonds, fixings and connections.

2.4 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances might not have to be inspected by a full walk through.

3.1 Check that track circuit jumper bonds are properly terminated and intact. Disconnected ‘yellow bonds’ shall be repaired. Where the yellow marking is degraded, arrange to renew the marking as corrective maintenance.

3.2 Check that any traction bonds are kept clear of any rails they are not bonded to.

3.3 Check that fishplate bonds are not broken, disconnected, or ‘tamped’ into the ballast. Renew or refit as necessary.

3.4 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.5 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails. This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.6 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.7 Check the condition of the ballast and for any excessive build up against the rails. Poor ballast condition and build up against the rails can affect the operation of the track circuit.

Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or there is enough clearance.

4.4 Check track circuit interrupters and connections.

These are usually found at catch points and trap points. Refit as necessary.

SERVICE B

5. Disconnection Boxes (If Provided)

5.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Vane Stop Plate Assembly Inspection (If a VT Relay is Fitted)

6.1 With the relay in the energised position (See Figure1) observe that the vane stop plate has minimal wear (grooving).

If damage of a minor nature is spotted (see as shown in Figure 2) this shall be reported to your SM(S).

If the level of damage is greater and a deep groove has been cut into the stop plate this shall be treated as defective, your SM(S) shall be advised, and arrangements made for the relay to be replaced.

Figure 1 – Vane in the Energised position

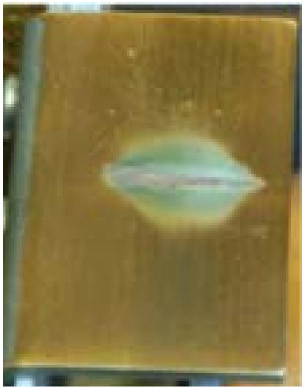


Figure 2 - Reportable Level of Damage

Figure 3 – Defective Level of Damage

7. Track Circuit Tests

7.1 Carry out NR/SMS/PartB/Test/260 (50Hz AC Track Circuit Test) Maintenance Test.

7.2 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

7.3 If provided, Carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

7.4 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

Reliability - Centred Maintenance

Includes:	AC 50 Hz Track Circuit (including Single & Double rail types)
Excludes:	Track circuits that contain un-staggered IBJs, parallel bonding, isolating transformers at the relay end of a single rail TC, or more than one TC uses the same multi-core/ tail cables within the TC feed or relay arrangements

SERVICE R1

8. General Track Inspection

8.1 Check the track connections are tight.

8.2 Check the impedance bonds, rail leads & covers are tight (if fitted).

8.3 Check the aluminium plate is secure & for signs of arcing.

8.4 Check the tail cables for damage, security and suitably protected.

8.5 Check the condition of P.Way (Report defects).

8.6 Check for any metallic objects in close proximity to track (remove where possible).

8.7 Visually examine, all associated IBJs for degradation or damage.

8.8 Check the Track relay vane for smooth continuous action and that it does not vibrate (as this can indicate problems with DC traction imbalance).

8.9 Report any adjustments made, components replaced or out of specification items on a WAIF.

8.10 Measure and record the 'Control' coil Relay voltage, (if valve has altered by more than 10% from the previous reading or there is long term trend) then investigate and report (give consideration to weather conditions).

SERVICE R2

9. Disconnection Boxes (If Provided)

9.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

9.2 Refit the lid and (if provided) padlock, check they are fitted securely.

9.3 Check tail cables for damage, security and that they are suitably protected.

9.4 Using a clamp meter, check the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

10. For VT1(SP) Track Circuits Only

10.1 Apply a train shunt set to 0 Ohms across the rails check that the track relay drops. Remove the train shunt and check that the track relay picks after a minimum delay period of 2 seconds. This proves the SP Unit is functioning correctly

11. Vane Stop Plate Assembly Inspection (If a VT Relay is Fitted)

11.1 With the relay in the energised position (See Figure1) observe that the vane stop plate has minimal wear (grooving).

If damage of a minor nature is spotted (see as shown in Figure 2) this shall be reported to your SM(S).

If the level of damage is greater and a deep groove has been cut into the stop plate this shall be treated as defective, your SM(S) shall be advised, and arrangements made for the relay to be replaced.

Figure 4 – Vane in the Energised position

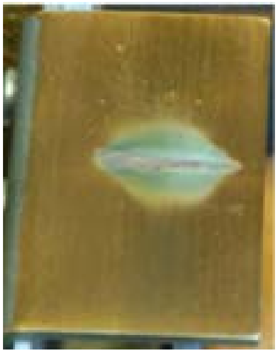


Figure 5 - Reportable Level of Damage

Figure 6 – Defective Level of Damage

12. All Track Circuit Types

12.1 Carry out Drop Shunt at Relay End and record the details on the record card.

For shunt values see NR/SMS/PartZ/Z03 (Train Detection - Reference Values).

12.2 Report any adjustments made, components replaced or out of specification items on a WAIF

12.3 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/TC09		
Track Circuits: FS2600		
Issue 01	Issue Date: 04/03/17	Compliance Date: 31/05/17

Includes:	FS2600 Tracks
Excludes:	All other Tracks and Overlay track circuits (See NR/SMS/TC02)

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

If any adjustments or renewal of equipment have occurred, then the TRACK CIRCUIT FULL TEST (259) shall be carried out in place of the maintenance test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the signaller's indication.

Track Circuit Examination:

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

- The type and complexity of track layout.
- The amount of bonding.
- Jointed track or Continuous Welded Rail.
- Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

- Metal swarf or filings.
- Broken insulations.
- Broken or displaced 'T' pieces.
- Burred-over rail ends.
- Moved sleepers or rail fastenings that can short against the rail joint.
- Broken or missing bolts.
- Signs of voiding or slurry under the joint

2. Track Circuit Feed, Relay End and Intermediate Impedance Bonds (Where fitted)

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location. Cables should be routed or clipped to avoid snagging. Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, as these will prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 Examine impedance bonds, fixings and connections.

2.4 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

2.5 Carry out TRACK CIRCUIT MAINTENANCE TEST (259) 1.1 to 1.6, 1.14 and 1.15

3. Throughout the Length of Each Track Circuit

3.1 Check that track circuit jumper bonds are properly terminated and intact. Disconnected 'yellow bonds' shall be repaired. Where the yellow marking is degraded, arrange to renew the marking as corrective maintenance.

3.2 Check that any traction bonds are kept clear of any rails they are not bonded to.

3.3 Check that fishplate bonds are not broken, disconnected, or 'tamped' into the ballast. Renew or refit as necessary.

3.4 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.5 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails. This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.6 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.7 Check the condition of the ballast and for any excessive build up against the rails. Poor ballast condition and build up against the rails can affect the operation of the track circuit. Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or is sufficiently clear.

4.4 Check track circuit interrupters and connections. These are usually found at catch points and trap points. Refit as necessary.

SERVICE B

5. Disconnection Boxes (If Provided)

5.1 Remove the lid and check the following:

- Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.
- Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.
- Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Track Circuit Tests

6.1 Carry out TRACK CIRCUIT MAINTENANCE TEST (259).

6.2 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

End of Service B

Reliability - Centred Maintenance

Includes:	FS 2600 Track Circuits (Which meet the prerequisites)
Excludes:	All other types of track

SERVICE R1

8. General Track Inspection

8.1 Check the track connections are tight.

8.2 Check the impedance bonds, rail leads & covers are tight (if fitted).

8.3 Check the aluminium plate is secure & for signs of arcing.

8.4 Check the tail cables for damage, security and suitably protected.

8.5 Check the condition of P.Way (Report defects).

8.6 Check for any metallic objects in close proximity to track (remove where possible).

8.7 Visually examine, all associated IBJs for degradation or damage. (For examples of damage refer to SMS/PartB /Test041 clause 6)

9. Disconnection Boxes (If Provided)

9.1 Remove the lid and Check the following:

- Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.
- Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.
- Cable glands are fitted and effective.

9.2 Refit the lid and (if provided) padlock, Check they are fitted securely.

9.3 Check tail cables for damage, security and suitable protected.

10. Testing

10.1 Carry out Drop Shunt at Relay End and record the details on the record card. For shunt values refer to SMS/Part Z03

10.2 Complete 0.6 ohm shunt test at intermediate bond if fitted or relay end bond.

11. 0.6 Ohms Shunt Test

11.1 Connect the DVM to the socket using the special test lead.

11.2 Check track clear monitor point voltage.

11.3 Connect the track shunt box across the rails at the intermediate impedance bond or if at the end of track circuit section connect it at the RX bond. Set the shunt box to 0.6ohms and depress the button.

11.4 The LEDs are giving the correct track shunted indications as below.

LED	Track Clear	Track Shunted
Supply	On	On
IP A Running	Flashing	Flashing
Input – A Valid	On	Off
IP B Running	Flashing	Flashing
Input – B Valid	On	Off
Output	On	Off

LEDs Input-A Valid and Input-B Valid may not change states simultaneously when the track is shunted, a momentary delay may be observed.

11.5 Measure the track shunted monitor point voltage then release the shunt button.

Compare the results with previous records obtained under similar conditions. If the results are not similar, investigate the cause and rectify as appropriate. A FULL TEST shall then be carried out.

11.6 Check the RX unit base for silver migration.

11.7 Any adjustments made, components replaced or out of specification items should be recorded on a WAIF

12. Track Circuits Bonding in DC Traction Areas

12.1 Damaged or disconnected bonds (other than red bonds) shall be investigated and actioned appropriately.

12.2 Before traction bonding is connected, all contact surfaces should be wire brushed and a thin film of electrolytic paste applied. Bonds across rail joints should be of a low resistance as this can influence the characteristics of the track.

END

Includes:	Aster SF1 / U type Tracks
Excludes:	Digital 21, TI21, EBI 200 (formally known as TI21) and EBI 400 Track All other tracks and Overlay track circuits

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

If any adjustments or renewal of equipment have occurred, then NR/SMS/PartB/Test/254 (Aster SF15 / U Type Track Circuit Test) Full Test shall be carried out in place of the Maintenance Test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the Signaller's indication.

Track Circuit Examination:

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

a) The type and complexity of track layout.

b) The amount of bonding.

c) Jointed track or Continuous Welded Rail.

d) Steel, wooden or concrete sleepers.

Earth connections shall be made/re-instated to the centre electrode of type 26A gas-discharge arresters, where these are shown to be provided in standard circuit arrangements.

Where site diagrams carry a note stating that an earth connection shall not be made, this can be disregarded, and the note should be crossed through on site diagrams and treated as Minor records Update when subsequent alterations are made Master records.

Where Type 26A gas-discharge arresters are fitted to other types of track circuit, these can be directly connected to the rail. In these cases, earth connections shall not be made.

Be aware that earth connections can inadvertently be made through the mounting screw of the holder.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section is only applicable if IRJs are provided at one or both ends of the TC.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced ‘T’ pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint.

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location. Cables should be routed or clipped to avoid snagging. Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, to prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 If provided: Check tuning units, fixings and padlocks. Lubricate padlocks. These should be secure and undamaged.

2.4 If provided: And where practicable, examine impedance bonds, fixings and connections.

2.5 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances might not have to be inspected by a full walk through.

3.1 Check that track circuit jumper bonds are properly terminated and intact. Disconnected 'yellow bonds' shall be repaired. Where the yellow marking is degraded, arrange to renew the marking as corrective maintenance.

3.2 Check that any traction bonds are kept clear of any rails they are not bonded to.

3.3 Check that fishplate bonds are not broken, disconnected, or 'tamped' into the ballast. Renew or refit as necessary.

3.4 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.5 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails. This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.6 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.7 Check the condition of the ballast and for any excessive build up against the rails.

Poor ballast condition and build up against the rails can affect the operation of the track circuit. Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or there is enough clearance.

4.4 Check track circuit interrupters and connections. These are usually found at catch points and trap points. Refit as necessary.

SERVICE B

5. Track Circuit Feed & Relay Ends

5.1 If provided, check the condition of wiring and equipment in tuning units.

6. Disconnection Boxes (If Provided)

6.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

6.2 Refit the lid and (if provided) padlock, check they are fitted securely.

7. Track Circuit Tests

7.1 Carry out NR/SMS/PartB/Test/254 (Aster SF15 / U Type Track Circuit Test) Maintenance Test.

7.2 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

7.3 If provided, Carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

7.4 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

END

Track Circuits: HVI (High Voltage Impulse)

Issue No: 06	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	HVI Tracks only
Excludes:	All other track circuit types

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

General

In 3rd rail DC traction areas and in dual electrified areas (3rd rail DC and AC overhead line) HVI track circuit transformer/terminal boxes (known as ‘bread bins’) can experience a catastrophic arcing across the terminals when the 3rd rail DC traction supply is short circuited to the ‘signalling’ rail. As these traction short circuits can be unpredictable (they can be caused by trains, conductive rubbish etc).

Either:

a) no preventative or corrective maintenance shall be undertaken inside the ‘bread bin’ with the 3rd rail DC traction current energised. The current shall be isolated for the full instant of the track circuit; or

b) alternatively remove all track leads, including any adjacent leads that are housed in the same bread bin. Measurements shall be taken on the rails.

In 3rd rail DC traction supply areas where track access can be restricted, there can be permanent ‘test leads’ installed from the rails to a special test box in a position of safety. In this situation the terminations in the test box may be used to obtain measurements where the test asks for readings “on the rails”.

The resistance of the test leads (this is shown on the test box) shall be taken into account when obtaining measurements by this method.

This does not apply in non-electrified areas or if the traction supply is by AC overhead line only.

The tests are marked with a **#** symbol. Only the tests applicable to the traction current supply in the area of the track circuit shall be carried out. If you are unsure, ask your SM(S).

If any adjustments or renewal of equipment have occurred, then the NR/SMS/PartB/Test/255 (HVI Track Circuit Test) Full Test shall be carried out in place of the Maintenance Test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the Signaller’s indication.

Track Circuit Examination:

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

- The type and complexity of track layout.
- The amount of bonding.
- Jointed track or Continuous Welded Rail.
- Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section is only applicable if IRJs are provided at one or both ends of the TC.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced ‘T’ pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location. Cables should be routed or clipped to avoid snagging. Report as corrective maintenance, damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, as these prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 If provided: Check tuning units, fixings and padlocks. Lubricate padlocks. These should be secure and undamaged.

2.4 If provided, and where practicable, examine impedance bonds, fixings and connections.

2.5 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances might not have to be inspected by a full walk through.

3.1 Check that track circuit jumper bonds are properly terminated and intact. Disconnected ‘yellow bonds’ shall be repaired. Where the yellow marking is degraded, arrange to renew the marking as corrective maintenance.

3.2 Check that any traction bonds are kept clear of any rails they are not bonded to.

3.3 Check that fishplate bonds are not broken, disconnected, or ‘tamped’ into the ballast. Renew or refit as necessary.

3.4 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.5 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure.

3.6 Remove conductive debris from the vicinity of the rails. This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.7 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.8 Check the condition of the ballast and for any excessive build up against the rails.

3.9 Poor ballast condition and build up against the rails can affect the operation of the track circuit. Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or there is enough clearance.

4.4 Check track circuit interrupters and connections. These are usually found at Catch Points and Trap Points. Refit as necessary.

SERVICE B

5. Track Circuit Feed & Relay Ends

5.1 If provided, check the condition of wiring and equipment in trackside units.

5.2 Visually examine the track relay for excessive corrosion or contamination.

6. Disconnection Boxes (If Provided)

6.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

6.2 Refit the lid and (if provided) padlock, check they are fitted securely.

7. Track Circuit Tests

7.1 Carry out a 0.5 Ohms drop shunt at each extremity.

7.2 Carry out NR/SMS/PartB/Test/255 (HVI Track Circuit Test) Maintenance Test.

7.3 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

7.4 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

7.5 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

SERVICE RE

8. General Track Inspection

Traction Areas Only

8.1 Examine the negative return bonding present and connections are tight.

For All Types

8.2 Examine the track circuit for potential causes of track circuit failure.

8.3 Visually check, all associated IRJ's for degradation or damage.

8.4 Check tail cables for damage, security and protection.

8.5 Signal wires, point rodding, and metal services (etc) are insulated and clear of rails.

8.6 Check rail to rail, jumper and fishplate bonds.

8.7 Assess the condition of ballast/ground conditions.

8.8 Condition of P.Way (Report defects).

8.9 For metallic objects in close proximity to track (remove where possible).

8.10 Track circuit interrupters and connections.

For Single Rail Track Circuits

8.11 Check the stretcher bar insulations.

9. Test

9.1 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

9.2 Carry out a 0.5 Ohms drop shunt at each extremity.

9.3 Carry out NR/SMS/PartB/Test/255 (HVI Track Circuit Test) Maintenance Test.

9.4 Visually examine the track relay for excessive corrosion or contamination.

END

Includes:	Western Region Quick Release Tracks
Excludes:	All other Track Circuits

If any adjustments or renewal of equipment have occurred, then the NR/SMS/PartB/Test/256 (BR-WR Quick Release Track Circuit Test) Full Test shall be carried out in place of the Maintenance Test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the Signaller's indication.

Track Circuit Examination:

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

- The type and complexity of track layout.
- The amount of bonding.
- Jointed track or Continuous Welded Rail.
- Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section is only applicable if IRJs are provided at one or both ends of the TC.

Your SM(S) will advise you if any or all of this section is applicable to the TC you are maintaining.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced 'T' pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location. Cables should be routed or clipped to avoid snagging. Report as corrective maintenance, damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, as these prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 If provided, and where practicable, examine impedance bonds, fixings and connections.

2.4 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances might not have to be inspected by a full walk through.

Your SM(S) is responsible for advising you if any or all of this section is applicable to the TC you are maintaining.

3.1 Check that fishplate bonds are not broken, disconnected, or ‘tamped’ into the ballast. Renew or refit as necessary.

3.2 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.3 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure.

3.4 Remove conductive debris from the vicinity of the rails.

This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.5 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.6 Check the condition of the ballast and for any excessive build up against the rails.

Poor ballast condition and build up against the rails can affect the operation of the track circuit.

Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

This section is only applicable to TCs through S&C.

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or there is enough clearance.

4.4 Check track circuit interrupters and connections. These are usually found at Catch Points and Trap Points. Refit as necessary.

SERVICE B

5. Track Circuit Feed & Relay Ends

5.1 If provided, check the condition of wiring and equipment in trackside units.

6. Disconnection Boxes (If Provided)

6.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

6.2 Refit the lid and (if provided) padlock, check they are fitted securely.

7. Track Circuit Tests

7.1 Carry out NR/SMS/PartB/Test/256 (BR-WR Quick Release Track Circuit Test) Maintenance Test

7.2 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

7.3 If provided, Carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

7.4 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

Reliability - Centred Maintenance

SERVICE RA - Carry out Service A of this SMS.

END

Includes:	AC Rectified (Diode) Track Circuits
Excludes:	All other types of Track Circuit.

General

If any adjustments or renewal of equipment have occurred, then the NR/SMS/PartB/Test/258 (AC Rectified Circuit Test) shall be carried out in place of the Maintenance Test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the Signaller's indication.

Track Circuit Examination:

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

a) The type and complexity of track layout.

b) The amount of bonding.

c) Jointed track or Continuous Welded Rail.

d) Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section is only applicable if IRJs are provided at one or both ends of the TC.

Your SM(S) will advise you if any or all of this section is applicable to the TC you are maintaining.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced 'T' pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location. Cables should be routed or clipped to avoid snagging. Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, as these will prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 If provided visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances may not have to be inspected by a full walk through.

Your SM(S) will advise you if any or all of this section is applicable to the TC you are maintaining.

3.1 Check that fishplate bonds are not broken, disconnected, or ‘tamped’ into the ballast. Renew or refit as necessary.

3.2 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.3 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails.

This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.4 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.5 Check the condition of the ballast and for any excessive build up against the rails.

Poor ballast condition and build up against the rails can affect the operation of the track circuit. Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

This section is only applicable to TCs through S&C.

Your SM(S) will advise you if this section is applicable to the TC you are maintaining.

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or is there is enough clearance.

4.4 Check track circuit interrupters and connections. These are usually found at catch points and trap points. Refit as necessary.

SERVICE B

5. Disconnection Boxes (If Provided)

5.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Track Circuit Tests

6.1 Carry out NR/SMS/PartB/Test/258 (AC Rectified Circuit Test) Maintenance Test.

6.2 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

6.3 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

6.4 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

END

Includes:	EBI Track 200, (Formally known as TI21) and Aster21 Audio Frequency Track Circuits
Excludes:	All other types of Track Circuit

GENERAL

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

If any adjustments or renewal of equipment has occurred, then the NR/SMS/PartB/Test/253 (EBI Track 200 (Audio Frequency) Track Circuit Test) shall be carried out in place of the Maintenance Test.

Track Circuit Examination:

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination is dependent on:

a) The type and complexity of track layout.

b) The amount of bonding.

c) Jointed Track or Continuous Welded Rail.

d) Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section is only applicable if IRJs are provided at one or both ends of the TC.

1.1 Examine the components of each IRJ. Check for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced ‘T’ pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint.

2. Track Circuit Feed and Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location. Cables shall be routed or clipped to avoid snagging. Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, as these prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings are to be intact and the cable secure.

2.3 If provided: Check tuning units, fixings and padlocks. Lubricate padlocks. These shall be secure and undamaged.

2.4 If provided: And where practicable, examine impedance bonds, fixings and connections.

2.5 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances might not have to be inspected by a full walk through.

3.1 Check that track circuit jumper bonds are properly terminated and intact. Disconnected ‘yellow bonds’ shall be repaired immediately. Where the yellow marking is degraded, arrange to renew the marking as corrective maintenance.

3.2 Check that any traction bonds are kept clear of any rails they are not bonded to.

3.3 Check that fishplate bonds are not broken, disconnected, or ‘tamped’ into the ballast. Renew or refit as necessary.

3.4 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.5 Check for displaced rail clips, insulations, pads (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails.

This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.6 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.7 Check the condition of the ballast and for any excessive build up against the rails.

Poor ballast condition and build up against the rails can affect the operation of the track circuit.

Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or is clear.

4.4 Check track circuit interrupters and connections. These are usually found at Catch Points and Trap Points. Refit as necessary.

SERVICE B

5. Track Circuit Feed and Relay Ends

5.1 If provided, check the condition of wiring and equipment in tuning units.

6. Disconnection Boxes (if provided)

6.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

6.2 Refit the lid and (if provided) padlock, check they are fitted securely.

7. Track Circuit Tests

7.1 Carry out NR/SMS/PartB/Test/253 (EBI Track 200 (Audio Frequency) Track Circuit Test) Maintenance Test.

7.2 Carry out an NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Tests).

7.3 If provided, carry out a NR/SMS/PartB/Test/062 (Line Protection Unit Test).

7.4 If fitted, using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

NOTE: *The doubling of track circuit leads has been designed out by using different specifications of cable.*

SERVICE C

This service shall only be used on track circuits that are remotely maintained.

Information on faulting procedures for all variants of the EBI Track 200 can be found in NR/SMS/Appendix/08 (General Information on the EBI 200 Audio Frequency Track Circuit Equipment).

8. Remote Maintenance

8.1 Log in to the Monitoring system and search for required asset.

8.2 Check the identity of the track circuit to be reviewed (confirm using Ellipse number) see Figure 1.

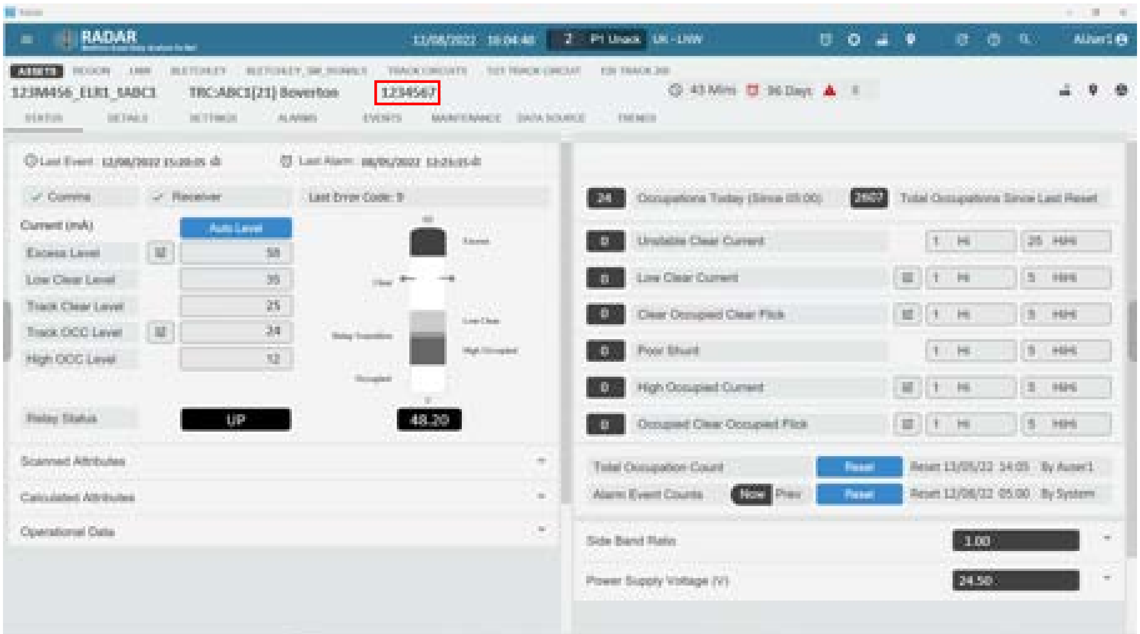


Figure 1 – Screen shot showing Ellipse number highlighted

8.3 Check that the track circuit “Last Event” is up-to-date (less than 6 hours since the last update) See Figure 2.

If the last event recorded is not up-to-date, it shall be referred to Intelligent Infrastructure monitoring staff for investigation.

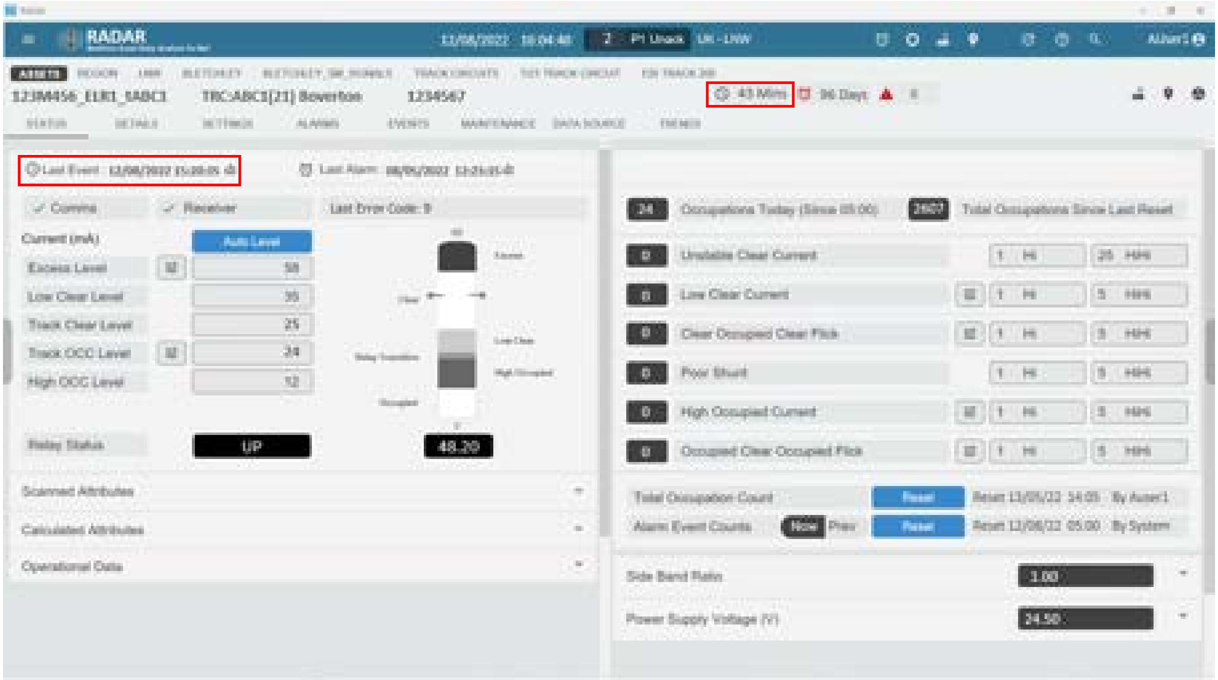


Figure 2 - Screen shot showing Current Status

8.4 If unable to acquire data after 24hrs, carry out an onsite investigation of the logging equipment.

8.5 Once the cause has been identified and rectified, restart from step 8.1.

8.6 Check that the asset monitoring is correctly set up and calibrated. See Figures 3 and 4.

If the “Channel Desc”, or the calibration levels are incorrect, this shall be referred to Intelligent Infrastructure monitoring staff for investigation.

NOTE: *- MPEC loggers show Track Circuit ID in “Channel Desc”. CDS (VA) loggers show Key Serial Number*

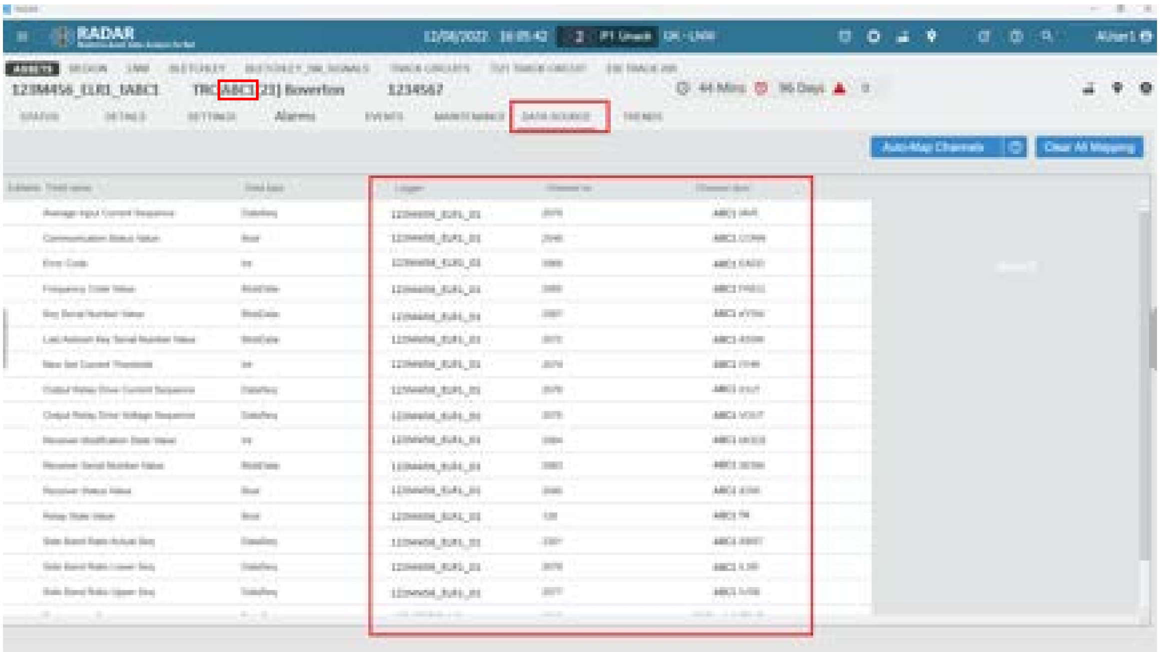


Figure 3 - Screen shot showing Setup

For further information on Calibration see NR/GI/R001 (Remote Maintenance – EBI Track 200 Calibration Guide).

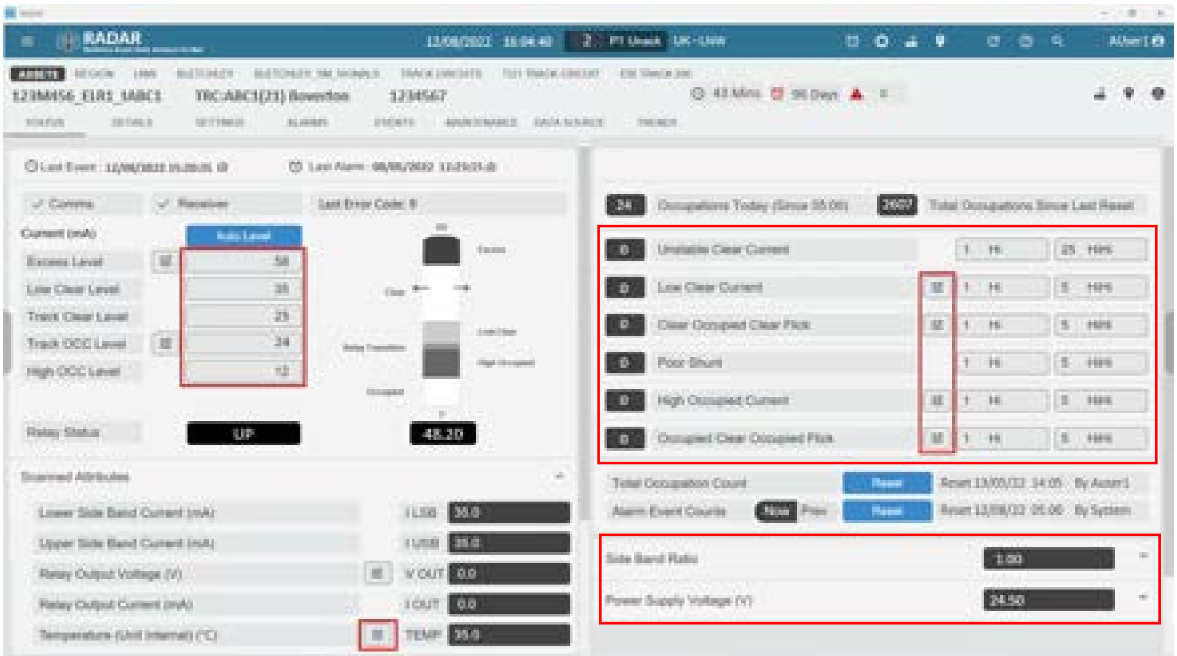


Figure 4 - Screen shot showing Calibration

8.7 If the system is recalibrated, allow trains to traverse the asset for 24 hours then restart from step 8.1.

8.8 Check that there are no Alarms present on the “ALARMS” tab (See Figure 5). If there are no Alarms present, proceed to Step 8.11.

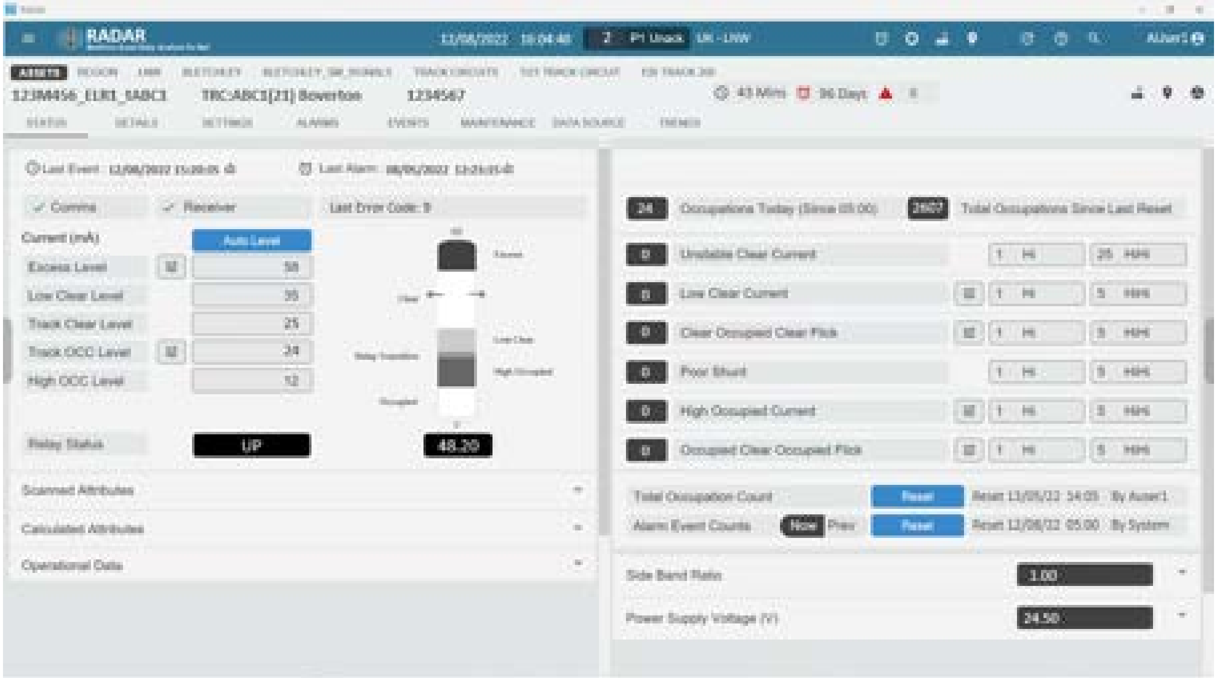


Figure 5 - Screen shot showing Asset free from Alarms

NOTE: *- The "ALARMS" tab will show as **CYAN (P3)** or **RED (P1)** if an Alarm is present (See Figure 6).*

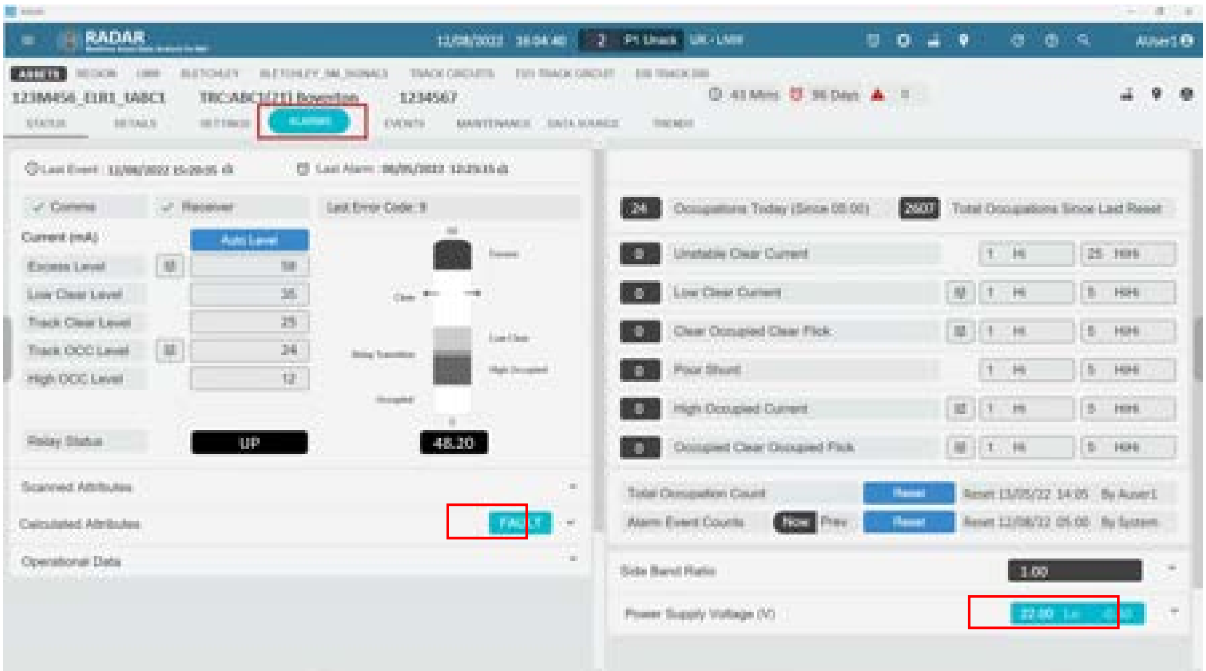


Figure 6 - Screen shot showing Asset with Alarms present

If cyan/red Alarms are present, check the Known Issues Log.

Where the issue is not captured in the Known Issues log, refer to intelligent infrastructure monitoring staff for investigation.

8.9 Once the checks of the cyan/red Alarms have been completed:

a) If the issue has been rectified, restart from step 8.2.

Or

b) If the cause of the cyan/red Alarms are recorded as “known issues”, no further investigation is required at this time.

Or

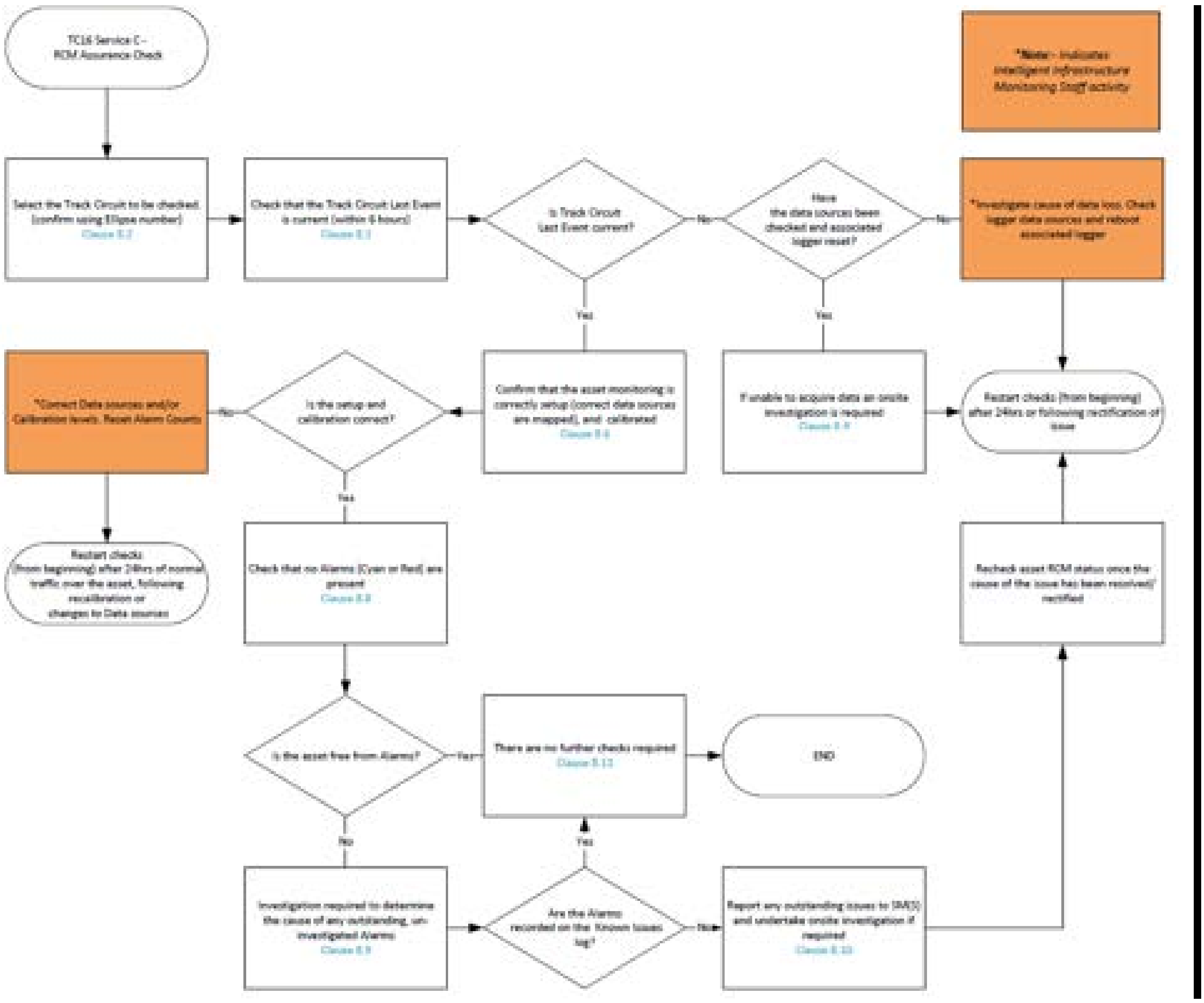
c) Any issues that have not been rectified and are not on the Known Issues log, shall be escalated to your SM(S). Onsite investigation may be required to determine the cause of the Alarm(s)

8.10 All outstanding issues, or cyan/red Alarms shall be reported to SM(S).

NOTE: *Investigations of the track circuit are detailed in steps contained within NR/SMS/Appendix/08. (General Information on the EBI 200 Audio Frequency Track Circuit Equipment).*

8.11 No further checks are required. Update all relevant documentation.

APPENDIX A - Service C - Process Flow Chart



END

Includes:	EBI Track 400
Excludes:	EBI Track 200, Aster 21, and TI21 (Audio Frequency) Tracks and all other Track Circuits

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

General

If any adjustments or renewal of equipment have occurred, then NR/SMS/PartB/Test/263 (EBI Track 400) Full Test shall be carried out in place of the Maintenance Test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the Signaller's indication.

Track Circuit Examination

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

a) The type and complexity of track layout.

b) The amount of bonding.

c) Jointed track or Continuous Welded Rail.

d) Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section is only applicable if IRJs are provided at one or both ends of the TC.

Your SM(S) will advise you if any or all of this section is applicable to the TC you are maintaining.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced 'T' pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint.

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location. Cables should be routed or clipped to avoid snagging. Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, as these will prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 If provided: Check tuning units, fixings and padlocks. Lubricate padlocks. These should be secure and undamaged.

2.4 If provided: And where practicable, examine impedance bonds, fixings and connections.

2.5 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances may not have to be inspected by a full walk through.

Your SM(S) will advise you if any or all of this section is applicable to the TC you are maintaining.

3.1 Check that track circuit jumper bonds are properly terminated and intact. Disconnected ‘yellow bonds’ shall be repaired immediately. Where the yellow marking is degraded, arrange to renew the marking as corrective maintenance.

3.2 Check that any traction bonds are kept clear of any rails they are not bonded to.

3.3 Check that fishplate bonds are not broken, disconnected, or ‘tamped’ into the ballast. Renew or refit as necessary.

3.4 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.5 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails.

This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.6 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.7 Check the condition of the ballast and for any excessive build up against the rails.

Poor ballast condition and build up against the rails can affect the operation of the track circuit.

Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

This section is only applicable to TCs through S&C.

Your SM(S) will advise you if this section is applicable to the TC you are maintaining.

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or there is enough clearance.

4.4 Check track circuit interrupters and connections. These are usually found at catch points and trap points. Refit as necessary.

SERVICE B

5. Track Circuit Feed & Relay Ends

5.1 If provided, check the condition of wiring and equipment in tuning units.

6. Disconnection Boxes (If Provided)

6.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

6.2 Refit the lid and (if provided) padlock, check they are fitted securely.

7. Track Circuit Tests

7.1 Carry out NR/SMS/PartB/Test/263 (EBI Track 400 Track Circuit Test) Maintenance Test.

7.2 Carry out an NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

7.3 If provided, carry out a NR/SMS/PartB/Test/062 (Line Protection Unit Test).

END

Includes:	Track Circuits where an additional bonding check is required
Excludes:	All other Track Circuits

General

Missing or defective yellow and parallel bonding could result in a wrong side failure of the track circuit.

Parallel bonding might not have yellow marking (e.g., older installations and manufacturer-fitted rail to rail bonding within S&C).

Reference shall be made to the Bonding Plan to verify that all bonding is present.

SERVICE A

1. Bonding Checks

1.1 Check that any track circuit jumper bonds are properly terminated and intact.

1.2 Check that 'yellow bonds' are properly terminated and intact.

1.3 Disconnected 'yellow bonds' shall be repaired immediately. Where the yellow marking is degraded, arrange to renew the marking.

1.4 Check all rail connections and bonding are properly terminated and intact and where specified in NR/SMS/PartZ/Z03 (Train Detection Reference Values) are checked to the correct torque. Any defects shall be rectified immediately.

1.5 On stub ends, check that fishplate bonds are not broken, disconnected, or 'tamped' into the ballast. Renew or refit as necessary.

SERVICE B

2. Functional Test

2.1 Apply a shunt at the extremities of the track circuit, in accordance with the track plan, and check the track relay drops for each application.

2.2 Minimum Shunt values are detailed in NR/SMS/PartZ/Z03 (Train Detection Reference Values).

END

Includes:	TCAID(N) and TCAID(D)
Excludes:	All other Track Circuit assistance devices

GENERAL

The TCAID is used to detect a 165kHz signal from a train fitted with a Track Circuit Assistor (TCA) and provide a supplementary shunt to the track circuit.

The different types of TCAID are listed below.

a) TCAID(N) Non-direction selective TCAID.

b) TCAID(D) Directionally selective TCAID.

TCAID(N) (&MC)

These installations can be identified by a three-core cable coloured Brown, Blue and Green/Yellow between the TCAID unit and the disconnection box, this is for MOD 0-2 versions only.

For MOD 3 versions these installations can be identified by a two-core cable coloured Brown and Blue between the TCAID unit and the disconnection box.

TCAID(D)

These installations can be identified by a four-core cable coloured Brown, Blue, Black and Green/Yellow between the TCAID unit and the disconnection box.

Whenever the lid of a TCAID unit is removed, its seal needs to be checked for damage and when securing the lid back in place, the lid and seal should be checked for correct alignment.

The TCAID contains no serviceable items; the lid of the unit must only be removed to renew the battery.

TCAID(MC) This is a non-direction selective TCAID mounted in a metal case. This type is not now used, and all should have now been replaced with (N) types. Any found should be reported to your SM(S).

SERVICE A

1. All TCAID Installations

TCAID's that have been de-commissioned but, the disconnection box and cables that are still in place, should also be included in these tasks.

The tasks should be performed as part of the associated Track Circuit Service A.

1.1 Examine the security of the TCAID unit, its mounting stake and associated disconnection box.

1.2 Check the terminations in the disconnection box, protect as necessary.

1.3 Check the cables and rail terminations; they should be secure and undamaged.

1.4 Check the labelling of the TCAID unit, cables and cable glands. They should be secure and legible.

1.5 Lubricate the disconnection box padlock.

SERVICE B

2. **Pre-Leaf Fall Season Checks**

These tasks should be performed within the two months (60 days) prior to leaf fall season.

2.1 Examine the interior of the TCAID unit, if it is found to be damp the unit shall be regarded as faulty and replaced.

2.2 The battery shall be replaced if it has been in service close to its estimated usage calculation.

2.3 Carry out NR/SMS/PartB/Test/043 (Track Circuit Aid (TCAID) Test).

PERIODIC TASK

3. **All TCAID Installations**

3.1 Renew the silica gel sachet. The battery shall also be replaced if it has been in service for 3 years. Check that the lid replaces correctly and that the bag is not trapped.

3.2 Replace the TCAID unit. Check that the replacement is of the correct type.

3.3 Carry out NR/SMS/PartB/Test/043 (Track Circuit Aid (TCAID) Test) before commissioning the new unit.

END

Development

Train describers are a means of passing on an individual train identity between signal boxes or in PSBs between panels and adjacent PSBs and fringe boxes.

In the early days when block working was first introduced train identity was passed between signals boxes by means of a bell code. This method is still used on mechanically signalled or 'green field' areas today.

With the advent of track circuit block working which allows the running of several trains between signals boxes a means of storing train identities was required as a memory aid to the Signaller.

This led to the first development of a train describer that used simple lamp displays with direct wire or simple DC pulsing transmission systems.

With the development of PSBs which control large amounts of train movements more sophisticated train describers were produced in line with technology from electro-mechanical to microprocessor.

Displays

These can vary depending of the age and type of system in use; older PSB systems can use Cathode Ray Tubes (CRTs) or a LED alphanumeric display at the required positions in the panel.

Newer systems combine the TD display on the monitors used for the track display. Older systems at fringe signal boxes can use a cold cathode display tube.

Descriptions

In the early 1960's an alpha/numerical system of classifying and identifying trains was introduced which still forms the basis of all TD systems. The four characters in the description are made up as follows:

Character Position	Character Range	Meaning
First	0 to 9	Class of train
Second	A to Z *	Destination District
Third	0 to 9	Individual train number or local route number
Fourth	0 to 9	

Table 1 - Character Designations

* The letter Q is not used.

Train Describer Terminology

> ***NOTE:*** *This is intended as a general guide to the unique terminology used in TD systems, it is not specific to any one type of system. Some newer systems may have controls and/or functions that might differ from the descriptions given but the basic concept of operation is the same.*

Term	Meaning
Set Up	The keying into the system of a train description by means of a keyboard
Interpose	The transfer of the set-up train description to the chosen address
Cancel	The removal of a train description by keying in the address of the berth or remote location and operating the cancel function
Step	The transfer of a train description from one berth to another when a train moves forwards and causes a specified set of track circuit and signal conditions to be satisfied
Clear Out	This may be manual or automatic. Manual is initiated by a cancel sequence. Automatic is initiated when a train leaves the area covered by the TD system and a specified set of signalling conditions is satisfied
Manual Transmission	This is affected by setting up the address of a fringe signal box and the train description on the operators' panel and operating the interpose function. Likewise, it is the setting up of the train description at a fringe box and operating the interpose function to transfer the description to the PSB
Automatic Transmission	This is the automatic transfer of a train description from one PSB to another when a specified set of signalling conditions is satisfied
Transmission Fault Alarm	The failure of a manual or automation transmission which initiates a visual/audible alarm which must be acknowledged by the Signaller
Equipment Fault Alarm	An alarm initiated by the TD system during its monitoring sequence. An audible alarm is sounded which must be acknowledged and a visual alarm is displayed until the problem is rectified. If the system is fitted with a fault printer/monitor it will be printed at regular intervals or continually displayed
Non-Described Alarm	This is initiated when a train without a description is stepped with the correct signalling conditions satisfied
Interrogate (Train description)	This facility enables the Signaller to determine the description at an address. The information is available after the address has been keyed up and the interrogate function operated on the set-up panel

Term	Meaning
Interrogate (Address)	This facility enables the Signaller to determine the position of a train in the controlled area. Four asterisks are set up in the address and the specified description and operating the interrogate function on the set-up panel
Description Received Warning	This a brief audible alarm generated by the reception of a train description from an adjacent PSB or a fringe box. It is also generated in fringe boxes when a description is received from a PSB
Receiver Full	An indication to the Signaller when all the approaching berths at an adjacent/fringe box are occupied. Any further descriptions will be inhibited
Acknowledge Up Date	This is a co-operative cancel between a main PSB and an adjacent PSB or fringe box. If a Signaller at either end cancels a transmitted description an audible/visual alarm will be given at reception end. The audible alarm will extinguish if not acknowledged after a period of time, but the visual alarm will remain until acknowledged.
Berth	A store and display position for one train description
Ripple Berths	Two or more berths in a permissive section (e.g. goods)
Shuttle Berths	Two berths in a two-way working section (e.g. platform)
Blind Store	A berth without any display facilities
Automatic Code Insertion	When a train enters a terminal platform, a new description will be required for its departure. The system will change the first character of the old description to an asterisk as a reminder to the Signaller (this will operate the not described alarm should the description step without the new code). Some systems will automatically insert a new description.

END

Includes:	Train Describer Electro-Mechanical
Excludes:	All other types of Train Describer

SERVICE A

1. Power Supplies

1.1 Using a meter and/or oscilloscope measure the output voltages of the system power supply and the AC ripple content of the DC voltages. Check they are within the limits as stated in the table below:

Voltage	Limits	Ripple
50V DC	49V to 54V	<100mV
18V DC	17V to 19V	<50mV
12V AC	11V to 12.5V	NA
6V AC	5.5V to 6.5V	NA

Table 1 - Voltage Limits

Report as corrective maintenance any voltage ranges that have been corrected or cannot be corrected.

2. Console

2.1 Clean the facia panel and indication window or screen.

2.2 Check all lamps are working. Ask the Signaller if any are not illuminating correctly.

<u>In Line Type:</u>

Clean the interior and examine all terminations when lamps are renewed. Clean the inner covers and lamps.

<u>WBS Digital Type:</u>

When changing a lamp check that the focus and alignment of the filament is correct.

2.3 Examine all push buttons and rotary switches. Report as corrective maintenance any that are broken.

2.4 Examine the faceplate lettering. Report as corrective maintenance any illegible lettering to be replaced.

SERVICE B

3. Console

These tests shall be performed with co-operation of the Signallers at the transmission and receiving end of the system.

Any failures or defects that cannot be rectified immediately shall be reported as corrective maintenance.

All test descriptions shall be cancelled on completion of maintenance.

3.1 Check that the operation of each push button or rotary switch in turn displays the correct character in the set-up berth.

3.2 Select a description in the set-up berth, operate the interpose button and check that the complete description is transferred to the correct berth.

3.3 Arrange for the adjacent signal box to transmit a description. Check that the transmitted description is received and displayed correctly.

3.4 Where provided, by means of the emergency stepping buttons, step the received description through all the necessary berths.

3.5 Repeat 3.3 and 3.4 for all running lines where descriptions are received.

3.6 Where applicable, set up a description in the transmission berth and transmit to the adjacent signal box. Check that the transmitted description is received and displayed correctly.

3.7 Where applicable, interpose a complete description to the early transmission berth. Set up the signal conditions to affect the transmission and check that the transmitted description is received and displayed correctly at the adjacent signal box.

3.8 Repeat 3.7 for all other early transmission berths.

4. Alarms

4.1 Test the system alarms as follows:

a) Fuse Alarm. Short the common to the fuse busbar.

b) ND Alarm. Manually operate the correct relay.

c) TX Alarm. Manually operate the correct relay.

d) Lockout Alarm (where fitted). Operate the test switch.

END

Includes:	2100, 2108 and variant types within these series
Excludes:	All other types

General

If any readings obtained are outside the limits stated they shall be reported as corrective maintenance.

These systems date from the early 1970's and use two Hewlett Packard 21MX series computers as the basis of the systems. Original interfacing equipment was produced by either Hewlett Packard or Westinghouse.

Over the years various interfacing equipment (e.g. printers and tape readers) have been replaced with more modern equipment from different manufacturers.

The NR/SMS's shall be used for the system type and interface equipment as necessary.

DAILY SERVICES

1. System Fault Printers (Both Series)

1.1 Check both system printers for any failures. Take remedial action as necessary.

1.2 At the same time each day, type the date on both system status printers.

SERVICE A

2. Power Supplies (2100 Series)

2.1 Using a meter and/or oscilloscope, measure the following DC voltages and AC ripple content check that they are within the limits stated:

Cubicle	Identity (WBS)	Monitor Position	Limits	Ripple
C4 & C8	+5.5V	OCB & ETH	+5.2 to 5.8V	<50mV
	+9.5V		+9 to 10V	
	+17.5V		+16.6 to 18.4V	
	+24V(F)		+22.8 to 25.2V	<70mV
	+24V		+22.8 to 25.2V	

Table 1 - Power Supplies (2100 Series)

3. Power Supplies (2108 series)

3.1 Using a meter and/or oscilloscope measure the following DC voltages and AC ripple content. Check that they are within the limits stated:

Cubicle	Identity	Monitor Position	Limits	Ripple
C1	Advance +5vL	Unit Terms	+5V to 5.25V	<50mV
	Advance +5vR		+5V to 5.25V	
	WBS 24vL	OCB & ETH	+23.5V to 24.5V	<70mV
	WBS +24vR		+23.5V to 24.5V	
C4 to C8	WBS +6V		+6V to 7V	<50mV
	WBS +9.5V		+9V to 10V	
	WBS +18V		+18V to 19V	
	WBS +24V		+23.5V to 24.5V	<70mV
C5 to C7	Advance +5V	Unit Sense Terms	+5V to 5.25V	<50mV
	Advance +12V		+12V to 12.5V	
	Advance -12V		-12V to 12.5V	
	WBS +5V Reg	Monitor Sockets	+4.9V to 5.1V	
C6	WBS +5V Reg		+4.9V to 5.1V	
	WBS +12V Reg		+11.9V to 12.1V	

Table 2 - Power Supplies (2108 series)

4. Intermediate Distribution Frame (Both Series)

4.1 Check that the Automatic Voltage Stabiliser (AVS) reading STAB 1,2,3 & 4 are between 105V and 115V. This shall be within the NOM green sector on panel meters.

5. Auto Switch Card (Both Series)

5.1 Switch the operating mode of the computers by turning the ‘Auto’ switch to the opposite mode and then back to the ‘Auto’ position (e.g. if the right hand computer is driving both highway outputs turn the ‘Auto’ switch to the Left then back to ‘Auto’.

5.2 Check the printout for any failures caused by 5.1, take remedial action as necessary.

6. System Fault Printers (Both Series)

6.1 Check that the printers have enough paper and that printer ribbons/cartridges do not need replacing.

SERVICE B

7. HP 21MX Computers (Both Series as Applicable)

Tasks 7.1 to 7.2 applies to both series.

7.1 Dust and clean the computers. Pay particular attention to the heat dissipating areas.

7.2 Turn the 'Auto' switch (in C5) to either the Left or Right depending on which computer is driving both highways.

On the OFF line computer stop the programme by turning the key operate switch to 'Power On' and press the Halt/Cycle button.

The Equipment Failure Alarm (EFA) illuminates and a WGFL or WGFR fault printout is produced.

Operate the fault alarm switch to 'Inhibit' for the remainder of the maintenance.

Tasks 7.3 & 7.4 apply to the 2100 series.

7.3 Remove the two air filters and clean as necessary. Replace on completion.

The filters are held in place by metal 'banana plugs in each corner, pull firmly on these to remove the filter from the frame.

7.4 Using a meter and/or oscilloscope measure the following DC voltages and AC ripple via the test jacks mounted on the rear panel of the computer.

Test Point Voltage	Voltage Limits	Ripple
+30V	+28.5V to +30.5V	<1.5V
+20V	+19.5V to +20.5V	<100mV
+12V	+11.5V to +12.5V	<240mV
+4.85V	+4.65V to +5V	<97mV
-2V	-1.7V to -2.5V	<40mV
-12V	-11.5V to -12.5V	<240mV
-20V	-19.5V to -20.5V	<100mV

Table 3 - Voltage Limits

Tasks 7.5 to 7.13 apply to the 2108 series.

Hazardous voltages might be exposed while the front power shield is removed. Care shall be taken, see NR/SMS/PartC/EL00 (Electrical Equipment - General) - Hazards Associated With Electrical Supplies.

7.5 Operate the AC line-switch on the rear computer panel to the 'OFF' position and withdraw the computer from the cubicle until the lock on the sliding rails activates. Check the cable loom does not snag on the cubicle metalwork.

7.6 Loosen the two quarter-turn fasteners on the operators' panel and lower to the access position.

Place the maintenance table in front of the computer, remove the front panel wire stays from the main frame by removing the fixing bolts, and lower the front panel onto the table.

7.7 Remove the three screws and lock washers securing the front power supply shield to the computer main frame and remove the panel.

Disconnect the key operated switch assembly cable from the lower power supply printed circuit assembly (PCA) connector and remove the front power supply shield. Reconnect the key operated switch key assembly cable.

7.8 Connect the test adaptor to the J8 test point array. Test points are numbered 1-10 reading right to left.

7.9 Operate the AC line switch on the rear computer panel to the 'ON' position. On the operator's panel rotate the key operated switch to 'R' (reset) via 'STANDBY' and then to 'OPERATE'.

7.10 Using a meter and/or oscilloscope measure the following DC voltages & AC ripple via the test adaptor. Connect the common lead (back) of the meter and oscilloscope to TP2 of the test adaptor.

Terminal	Identity	Voltage Limits	Ripple
TP1	-12V	-11.4 to 12.6V	<600mV
TP3	+12V	+11.4 to 12.6V	<600mV
TP4	-2.3V	-2.1V to 2.5V	<115mV
TP6	+5V(m)	4.95V to 5.05V	<250mV
TP9	+12V(m)	+11.4 to 12.6V	<600mV
TP10	-12V(m)	-11.4 to 12.6V	<600mV

Table 4 - Voltage Limits

7.11 Set the key operated switch to 'STANDBY' and operate the AC line-switch on the rear computer panel to the 'OFF' position.

7.12 Disconnect the measuring equipment and remove the test adaptor. Remove the key operated switch assembly cable, thread the lead through the front power shield and reconnect and secure the shield.

Replace the PCA cover and reconnect the front panel stay wires. Replace the operator panel assembly and tighten the two quarter turn screws.

7.13 Operate the AC line switch on the rear computer panel to the ‘ON’ position and rotate the key operated switch on the computer front panel to R’ (reset) via ‘STANDBY’ and then to ‘OPERATE’.

<u>Tasks 7.14 & 7.15 apply to both series</u>

7.14 Re-start the programme in the off line computer. This is detailed in the ‘First Line Servicing Manual’ under the sub-heading ‘Running Programme’.

Do not clear the display before pressing the ‘S Register’ button (2100 series) or the ‘P Register’ button (2108 series), as this deletes the instruction at the point where the programme was halted. This results in one or more fault printouts and then requires the reloading of the operational program.

7.15 Repeat 7.2 to 7.4 (2100 series) or 7.5 to 7.13 (2108 series) for the other computer.

Check that the conditions in the ‘First Line Servicing Manual’ are met in the former off line computer, especially in respect of updating the displays and the ATR clock on the control panel.

8. Standby Battery Module (2100 Series)

8.1 Disconnect the battery in the rear of C5 and C7. Measure using a meter the battery voltage:

- 8v ±1.5V.

Reconnect the battery and check that a fault printout of either BATL or BATR has occurred.

9. Standby Battery Module (2108 Series)

9.1 With the unit operating under normal conditions, measure using a meter the battery voltage at the Battery Test Monitor Points. Confirm the results are as follows:

a) Charge voltage (Test button not pressed) >8V.

b) Discharge voltage (Test button pressed) >7.2V.

If the voltage drops below 7V after 15 seconds with the test button pressed the battery module should be replaced.

10. HP Battery Modules C5/C7

10.1 Operate the battery On/Off switch on the rear of the computer to the ‘Off’ position.

Check that the Power Fail/Battery lamp on the front of the computer is illuminated. If not replace the lamp or investigate the cause.

10.2 Remove the 2-pin plug from the rear of the computer, then operate the battery On/Off switch to the ‘On’ position.

10.3 Measure using a meter the charging voltage on the removed 2-pin plug.

a) 17V ±1V.

Measure the battery voltage at the plug socket

b) >12V.

10.4 Operate the battery On/Off switch to the ‘Off’ position and replace the 2-pin plug into its socket.

Operate the battery On/Off switch to the ‘On’ position and check that the Power Fail/Battery lamp on the front of the computer extinguishes.

11. Auto Switch Card and System Operating Modules (Both Series)

11.1 Check that each position of the module switch works correctly (Left, Auto, Right & Divide) and that the Highway and Set lamps illuminate correctly.

11.2 Set the fault alarm switch to INHIBIT and check that the fault lamp illuminates with a steady light and the alarm lamps on C4, C8 and the operators set-up panel illuminate.

Press the reset button and check that the fault lamp is momentarily extinguished and the Set Fault lamps extinguish.

11.3 Check that on compilation of these tasks, the auto switch is left in the AUTO position and the fault alarm switch is in the NORMAL position.

12. Paper Tape Reader (Both Series if Provided)

12.1 Clean and dust the tape reader.

12.2 Check the electronic components for signs of overheating, leakage, frayed insulation and any other signs of deterioration.

12.3 Check the mechanical parts for excessive wear, looseness, misalignment, corrosion and any other signs of deterioration.

12.4 Check and clean the glass slide covering the phototransistors, the light holes, the brake surface, the drive capstan, and the plastic covered wire foot that holds the tape flat against the tape head.

Accumulated lint around any of these parts can cause errors in the readout.

12.5 Switch the POWER on and check that all eight reader lamps illuminate.

12.6 Check the oil wick located on the back end of the motor housing. If it appears to be dry lubricate with 2 or 3 drops of a light machine oil (SAE 20).

13. Paper Tape Punch (Both Series if Provided)

13.1 Connect the paper punch and confirm that by using the copy tape routine that data fed to the punch is punched out on the tape.

14. Operation Computers (Both Series if Provided)

14.1 Check all fans are running and air filters are not blocked.

14.2 Clean air filters and rectify faulty fans as necessary. Visually check all plugs, connectors and leads are secure.

15. Modems (2100 Series) Pye D200E

15.1 Measure using a meter and/or oscilloscope the DC voltages and AC ripple on the modem units:

Voltage	Limits	Ripple
-24V	-22V to –26V	<70mV
+12V	+11V to +6.6V	<50mV
-6V	-5.4V to –6.6V	
+6V	+5.4V to +6.6V	

Table 5 - Voltage Limits

Other Types

15.2 Check that the indications and supply voltages are correct Refer to the manufacturer's manual for information.

16. Console Equipment Cathode Ray Tubes (Both Series)

16.1 Disconnect seven cathode ray tubes (CRT) at one time (one distribution box) and dust and clean as required.

Clean the window on the face of the panel. Unscrew and remove the associated Perspex screen from the panel and dust as necessary.

Replace all parts and reconnect the CRT.

17. Common Service Modules (Both Series)

17.1 Place the Volts/Ripple switch into the Volts position and check the following voltages:

Voltage	Reading
100V	95V to 105V
180V	171V to 189V
2kV	Within shaded zone on the meter

Table 6 - Voltage Limits

17.2 Place the Volts/Ripple switch into the ripple position and check that the percentage ripple is less than 5%.

18. Transmission (2108 Series)

18.1 Test each fringe box link by using the main box back-to-back link panel in cubicle 9.

This is detailed in the ‘First Line Servicing Manual’.

19. Fringe Box Units (Both Series)

19.1 Remove the front and rear covers of the unit and dust as required. Check cables, wires and terminations for signs of deterioration or damage.

19.2 Test each fringe box unit in the back-to-back mode. This is detailed in the ‘First Line Servicing Manual’.

20. Gate Box Units (2100 Series)

20.1 Remove the front and rear covers of the unit and dust as required. Check cables, wires and terminations for signs of deterioration or damage.

20.2 Test each gate box unit in the back-to-back mode. This is detailed in the ‘First Line Servicing Manual’.

21. Signal Levels (2100 Series)

21.1 At the main box, measure using a meter the AC signal levels on the line connection unit (pins A1 and A2). Compare the obtained reading with those previously recorded.

21.2 Measure using an oscilloscope the lines to the fringe boxes via pins AN and AR at the rear of the carrier card edge connectors in the carrier cubicle.

If there are any variations in the obtained signal levels from previous recorded ones or if the lines appear unduly noisy, inform your Supervisor.

22. Diagnostics (Both Series)

22.1 Run the diagnostic programs on the computers.

23. Spares and Change (Both Series)

Possession of the train describer shall be obtained before the substitution of the spare units.

23.1 Substitute the spare units in turn into the system. After each change wait for 2 to 3 minutes, if no fault printout occurs continue on to the next unit.

23.2 The substituted units should be left in the system and the former working units now constitute the spares. The spare units shall be stored in a place where they are protected from damage.

END

Includes:	Vaughan Type 4M Small TD and Normal TD
Exclude:	Vaughan Small TDs fitted on the former BR-WR (see SMS/TD32) and TD Scottish Type (See SMS/TD33)

This system along with displaying TDs to the Signaller also provides automatic transmission of the information to adjacent signal boxes or control centres. Provision may also be made for transmission of TDs to management information systems (e.g. ATR, SMART or TRUST).

Small TD systems will generally have only one monitor per site. Normal TD systems will have two or more monitors to enable the display of all the area covered by the signal box or control centre.

Equipment Identification

Fig 1- Combined unit

Fig 2 - Keyboard with Remote PC unit (Black box)

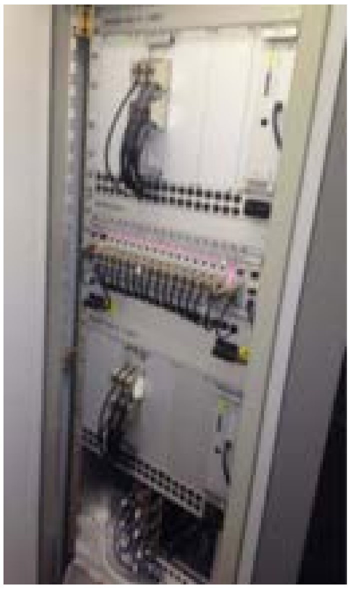


Fig 3 – Remote TD cabinet

SERVICE A

1. System

1.1 Ask the Signaller if they are aware of any faults present on the system. Rectify as necessary.

1.2 Check that an audible 'Update Alarm' is received when a new train description is received.

1.3 If necessary ask the signaller at an adjacent box to interpose a description.

2 Cubicle

2. 1 Open the rear of the TD cubicle and visually check that all cards and connectors are secure.

2. 2 Check the indications on the system cards (Appendix A).

2. 3 Close and secure the rear cover.

3 Keyboard

3.1 These tasks shall be done in liaison with the signallers at both ends of the system. During these tasks the TD will continue to step and transmit/receive any descriptions to and from any adjacent system.

3.2 Check that each key performs the correct function.

In most systems the ‘Q’ key will place the system into ATR mode if it is entered as the first character

3.3 Remove the keyboard assembly from the crate by unscrewing the four fixing screws. Dust and clean as required.

3.4 Hold the keyboard upside down when dusting

3.5 If the keyboard is damaged or cleaning if ineffective, arrange for a replacement.

3.6 Dust and clean the keyboard housing, then refit the keyboard.

3.7 Check that the keyboard operates correctly.

4 Displays

4.1 Dust and clean the monitor display(s).

4.2 Check that the displays are well focused and there is adjustment available on both the brightness and contrast. Check that there are no image burns visible.

4.3 Check that the signaller is satisfied with the display.

4.4 Check that all the leads to the monitor(s) are secure and in good condition.

4.5 Check that the line displays are showing the correct characters. Investigate any problems. Incorrect displays can lead to misleading descriptions.

4.6 Normal TD sites Only: Check that the power indication on the controller unit is illuminated.

5 Power Supplies

5.1 Using a suitable meter Measure the 110V AC supply to the equipment.

5.2 Between 105V and 115V.

5.3 If fitted, Check the security of the constant voltage transformer and associated wiring.

5.4 Using a suitable meter and oscilloscope, Measure the DC output voltages and ripples from the power supply units on each system using the test points on the processor card.. Check that they are within the limits given in the table

Voltage	Limits	Ripple (50/100Hz)
+5V	+5.05 to 5.15V	<50mV
+12V	+12 to 12.5V	
+12V I/F	+11.5 to 12.5V	
-12V I/F	-11.5 to 12.5V	

Fig- 4 DC Output Test points

5.5 Check the memory retention battery on each CP-E card. If there is any evidence of corrosion/leakage or if the battery is more than 5 years old, the card shall be replaced with a known good working spare. Check that the battery on the spare card is less than 5 years old.

Fig 5 – Battery card

Fig 6 – Close up of a corroded battery terminal

5.6 Check (where fitted) the battery on the SM-T module using the same criteria as 5.5.

6 Line Levels

6.1 Measure the transmit and receive line level readings for each external link. Compare readings obtained to previous ones, investigate any variations.

SERVICE B

7 Tests

7.1 Check the fault alarms are functional by disconnecting then making up each external link in turn.

7.2 Check (where the facility exists) the system can be placed into 'Engineering mode' by typing <CR*ENG*CR>.

7.3 Check the system can be returned to 'OCU Mode' by typing <CR*OCU*CR>. CR indicates the CR key. This test does not affect the stepping of train descriptions.

End of Service B

Reliability – Centred Maintenance

SERVICE R1

8.1 Examine cables / plug couplers on monitor / keyboard & Remote PC unit (Black box), if fitted for security.

8.2 Examine cables & wiring for damage or degradation

8.3 Examine cables / plug couplers to IDF block & to cards in TD cabinet for security

8.4 Examine the memory retention battery on each card. If there is any evidence of corrosion/leakage or if the battery is more than 5 years old, the card shall be replaced with a known good working spare

> The battery on spare cards should be isolated from the PCB where possible by positioning the battery enable link to the disabled position; this will prevent the battery from discharging when not in service.
> Move to Battery Enable Position (BEN) when installing card in system

8.5 Measure and record the DC output voltages and ripples from the power supply using the test points on the processor card. Check that they are within the limits given in the table shown in clause 5.2 :

8.6 Any adjustments made, components replaced or out of specification item on a WAIF.

APPENDIX A

LED Indications

There are several versions of the boards in use, not all of them will be present in any given system.

Unit	Indication	Colour	Normal State
CP-C	Halt	Red	Extinguished
CP-D	Halt	Red	Extinguished
CP-E	Halt	Red	Extinguished
MS-A	Tx	Red	Illuminated, flickers when data Tx
MS-A	Rx	Red	Illuminated, flickers when data Rx
MS-G	Tx	Red	Illuminated, flickers when data Tx
MS-G	Rx	Red	Illuminated, flickers when data Rx
MS-M	Tx	Red	Illuminated, flickers when data Tx
MS-M	Rx	Red	Illuminated, flickers when data Rx
MS-M	DCD	Red	Illuminated
PP-B		Yellow	Illuminated#

Note that on some older systems this indication is not used.

End

Includes:	Vaughan small TDs fitted on the former BR-WR
Excludes:	Other Vaughan types.

General

At most installations several 'small' TDs are installed and connected together to cover the panel's area of control.

SERVICE A

1. Displays

1.1 Dust and clean all the displays.

.

1.2 Check all the panel displays are well focussed and correctly coloured. Adjust the brightness and contrast if necessary. Check that the Signaller is satisfied with the display.

1.3 Check (where provided) on the ITD monitor that each available map display can be obtained.

1.4 On the alarm screen (xxAL) acknowledge any flashing alarms. Check that all links are showing 'OK'. Some of the links might no longer be in use.

1.5 Check that the correct time is displayed on the ITD monitor. Reset if necessary.

SERVICE B

Electrostatic Precautions shall be taken when handing any of the system cards.

When restarting the system, always press the reset button on the relevant power unit.

2. Cabinets

2.1 Dust and clean the inside and outside of the cabinets.

2.2 Check the cards in the system cabinet(s), confirm they are indicating as shown in Appendix A.

2.3 (Where provided) dust and clean the ITD monitor and keyboard. Hold the keyboard upside down when dusting.

2.4 Using a meter measure the main cabinet 110V AC supply. It should be between 105V and 120V.

2.5 Using a meter and oscilloscope, measure the DC output voltages and ripples from the power supply units on each system using the test points on the crate back plane. Check they are within the limits given in Table 1:

Voltage	Limits	Ripple (50/100Hz)
+5V	+5.05 to 5.2V	<50mV
+12V	+11.8 to 12.5V	
+12V I/F	+11.5 to 12.5V	
-12V I/F	-11.5 to 12.5V	

Table 1 – DC Voltages

NOTE: *That the +5V supply is particularly critical.*

2.6 Check the memory retention battery on each CP-E card. If there is any evidence of corrosion/leakage or if the battery is more than 5 years old, the card shall be replaced with a known good working spare.

Check that the battery on the spare card is less than 5 years old.

2.7 Check (where fitted) the battery on the SM-T module using the same criteria as in 2.6.

2.8 Check (where provided) the time on the ITD system. Reset if necessary.

2.9 Check the time on each individual TD system.

2.10 Test all the spare cards in the system. Any that do not function correctly shall be suitably labelled and sent for repair/service.

2.11 Measure all the modem link send and receive line levels (MS-M cards). Compare the readings obtained to previous ones, investigate any variations.

This can be measured via the cable termination frame or alternatively an RS232C 15 way 'break out' box may be used.

2.12 Check that the serial link 'loop back' plugs work correctly (MS-# cards).

This depends on the type of MS card as different versions are provided; refer to the Vaughan technical manual for further information.

2.13 Test the 'test' switches fitted to the MS-M cards. Refer to the Vaughan technical manual.

3. Remote Location Display Screens

3.1 Dust and clean the monitor, modem unit and keyboard. Hold the keyboard upside down when dusting.

3.2 Check that all the TD maps that can be selected, are displayed correctly.

3.3 Check that all the fittings, connectors, cabling and wiring are secure and free from damage.

3.4 Using a meter measure the 110V AC supply to the equipment. It should be between 105V and 120V.

3.5 At a convenient connection point measure the modem link send and receive levels.

Compare the readings obtained to previous ones, investigate any variations.

4. Fringe Units

4.1 Dust and clean the monitor, modem unit and keyboard. Hold the keyboard upside down when dusting.

4.2 Check that all the maps can be selected are displayed correctly.

4.3 Check that all the fittings, connectors, cabling and wiring are secure and free from damage.

4.4 Check that the current loop status LED’s (TX and RX pair) fitted at the rear of the card frame cabinet are operational.

4.5 Using a meter measure the 110V AC supply to the equipment it should be between 105V and 120V.

4.6 At a convenient connection point measure the modem link send and receive levels.

Compare the readings obtained to previous ones, investigate any variations.

4.7 Using a meter and oscilloscope measure the DC output voltages and ripples from the power supply units on each system using the test points on the crate back plane. Check that they are within the limits given in Table 2:

Voltage	Limits	Ripple (50/100Hz)
+5V	+5.05 to 5.2V	<50mV
+12V	+11.8 to 12.5V	
+12V I/F	+11.5 to 12.5V	
-12V I/F	-11.5 to 12.5V	

Table 2 – DC Voltage Limits

NOTE: *That the +5V supply is particularly critical.*

4.8 Check the memory retention battery on the CP-E/CP- D card. If there is any evidence of corrosion/leakage or if the battery is more than 5 years old, the card shall be replaced with a working spare.

Check that the battery on the spare card is less than 5 years old

4.9 Check the time on the fringe TD system. Reset if necessary.

4.10 Test all the spare cards in the system. Cards in the Fringe units are unique to this system. Any that do not function correctly shallbe suitably labelled and sent for repair/service.

4.11 Check that the serial link ‘loop back’ plugs work correctly. Refer to the Vaughan technical manual.

4.12 Test the ‘test’ switches fitted to the MS-M cards. Refer to the Vaughan technical manual.

4.13 Check that the audible alarm (fitted inside the keyboard unit) is working correctly. Test by simulating a modem link failure.

APPENDIX A - System Cabinet Normal Indications

Location	Card	Function	Colour	Status
Power Unit	PP-D	Power	Yellow	Lit
Processor	CP-x	Halt	Red	Out
Serial Link	MS-A,	Tx Rx DCD	Red	Flashing # Flashing # Lit
Serial Link	MS-M,	Tx Rx	Red	Flashing # Flashing #
Serial Link	MS-W	Tx Rx	Red	Flashing # Flashing #
Parallel I/F	MI-C	No Indications		
Display Driver	VM-			
Line Interface	3LI, LI-			
Remote VDU Controller	RV-			
Real Time Clock	SM-T			

#: Flashing with messages sent/received

END

Includes:	TD Scottish Type (See SMS/TD33)
Excludes:	Vaughan Type 4M Small TD and Normal TD (See SMSTD31) Vaughan Small TDs fitted on the former BR-WR (see SMS/TD32)

GENERAL

This system along with displaying TDs to the Signaller also provides automatic transmission of the information to adjacent signal boxes or control centres. Provision may also be made for transmission of TDs to management information systems (e.g. ATR, SMART or TRUST).

Small TD systems will generally have only one monitor per site. Normal TD systems will have two or more monitors to enable the display of all the area covered by the signal box or control centre.

SERVICE A

1. System

1.1 Ask the Signaller if they are aware of any faults present on the system. Rectify as necessary.

1.2 Check that an audible 'Update Alarm' is received when a new train description is received.

1.3 If necessary, ask the Signaller at an adjacent box to interpose a description.

2. Cubicle

2.1 Open the rear of the TD cubicle and visually check that all cards and connectors are secure.

2.2 Check the indications on the system cards (Appendix A).

2.3 Close and secure the rear cover.

3. Keyboard

3.1 These tasks shall be done in liaison with the Signallers at both ends of the system. During these tasks the TD continues to step and transmit/receive any descriptions to and from any adjacent system.

3.2 Check that each key performs the correct function.

In most systems the 'Q' key places the system into ATR mode if it is entered as the first character.

3.3 Hold the keyboard upside down when dusting

3.4 If the keyboard is damaged or cleaning is ineffective, arrange for a replacement.

3.5 Dust and clean the keyboard housing.

3.6 Check that the keyboard operates correctly.

3.7 Check the cooling fans are working (where provided)

4. Displays

4.1 Check that the Signaller is satisfied with the berth display unit.

4.2 Check that all the leads to the monitor(s) are secure and in good condition.

5. Power Supplies

5.1 Using a meter measure the 110V AC supply to the equipment.

5.2 Between 105V and 115V.

5.3 If fitted, check the security of the constant voltage transformer and associated wiring.

6. Line Levels

6.1 Measure the transmit and receive line level readings for each external link. Compare readings obtained to previous ones, investigate any variations.

SERVICE B

7. Tests

7.1 Check the fault alarms are functional by disconnecting then making up each external link in turn.

7.2 Operate test switch on computer swing frame to test the routing system and display function.

APPENDIX A - LED Indications

There are several versions of the boards in use, not all of them will be present in any given system.

Unit	Colour	Normal state
Control Card – SD "OK"	Green LED	Illuminated, flicker Card is Tx or Rx
Control Card - Rx Fault	Yellow LED	Extinguished
Control Card - Fault	Red LED	Extinguished
Power Supplies- Module PK55 No1	V1- Red LED, V2- Green LED & V3- Yellow LED	All Illuminated
Power Supplies- Module PK55 No 2	V1, V2 &V3 - Green LEDs	All Illuminated
Power Supplies-12V 5 Amps Module	Green LED	Illuminated
Unit	Colour	Normal state
Control Card – SD "OK"	Green LED	Illuminated, flicker Card is Tx or Rx
Control Card - Rx Fault	Yellow LED	Extinguished

NOTE: *On some older systems this indication is not used.*

END

Includes:	Train Describer WRSL VME Bus Based
Excludes:	Other types

GENERAL

Software loading and upgrades shall only be carried out by authorised personnel; it is not a first line maintenance operation.

System events are recorded onto the Technicians' terminal equipment and kept for 14 days before it is deleted.

The maintenance and repair of the train describer is based upon automatic system monitoring and fault reporting.

The system checks the health of each serial link and the associated equipment, reporting any defects to the Technicians terminal.

Serial link activity is also shown on the LED indications on the modems, TD changeover housing, serial cards and processors.

SERVICE A

1. System Changeover

This task shall be carried out during a light traffic period in liaison with the Signaller.

1.1 Observe on the front of the CM-2 module that the following LED's are indicating as follows:

LED	Status
Sys1 / Sys2	Either illuminated for the system on line
Watchdog	On line system flashing Off line system extinguished
Available	On line system illuminated Off line system extinguished
Auto Latch	Flashing
PSU Fail	Extinguished

Table 1 - Module LED Indications

If any of the LEDs are not indicating as shown, rectify the fault before proceeding.

1.2 Set the rotary switch to manually select the off line system and observe that the systems switch over.

Check the Technicians' terminal fault reports to confirm that the system is working correctly.

1.3 Set the rotary switch to the 'Auto' position and check that the Auto Latch LED is flashing. If it is not press the 'Latch Reset' button.

1.4 Record the results of the changeover in the system log book.

2. Link Status

This enables a report to be obtained on the statistics with any external communications links. The items reported are:

a) Transmitted messages successfully acknowledged.

b) Transmitted messages not acknowledged.

c) Transmitted messages with no response.

2.1 Using the on line Technicians terminal select the report command (ALT+R) and the link statistics command (L).

The link statistics are stored on the Technicians' terminal.

2.2 Examine the screen listing for the previous 24-hour period and rectify any problems found. To obtain a printout for this listing, the procedure in the manufacture's manual should be followed.

3. Equipment

3.1 Visually check all cards, leads and connectors are secure.

3.2 Clean using a lint free cloth the exterior of the TD cubicle. Check both the front and rear access doors are closed when cleaning.

3.3 Clean the screens of the monitors using an anti-static screen cleaner to the manufacturer's instructions.

3.4 Clean the mouse using a soft cloth with a detergent solution diluted to the manufacturer's instructions. Do not use abrasive cleaners or pads.

3.5 Dust and clean the keyboards using a soft brush and a soft cloth dampened with a detergent solution diluted to the manufacturer's instructions.

Do not use abrasive cleaners or pads.

Do not allow the keyboard to become wet. Hold keyboards upside down when dusting.

3.6 If provided, check the operation of the mouse. If it has become jerky or intermittent, remove the ball from underneath the mouse and clean the ball and rollers as required.

3.7 Check that the Technicians' terminal processor fans are running without excessive noise.

3.8 Check that the line displays are showing the correct characters. Investigate any problems. Incorrect displays can lead to misleading descriptions.

SERVICE B

4. TD Cubicle

4.1 Clean using a dry lint free cloth the equipment faceplates and blanking plates. Pay particular attention to the heat dissipation areas.

END

Includes:	WRSL Small train describer and Medium train describer
Excludes:	Other types of Train Describer

General

Software loading and upgrades shall only be carried out by authorised personnel; it is not a first line maintenance operation.

The 'Medium Train Describer' uses the same hardware as the 'Small Train Describer' but with a larger number of berths or links.

The maintenance and repair of the train describer is based upon automatic system monitoring and fault reporting.

The system checks the health of each serial link and the associated equipment, reporting any defects to the Technicians' terminal.

Serial link activity is also shown on the LED indications on the modems, TD changeover housing, serial cards, and processors.

System events are recorded on the on-line system printer.

SERVICE A

1. System Status

1.1 Check that the printers are supplied with enough paper and that printer ribbons/cartridges do not need replacing.

1.2 Request a list of the current faults on the system from the on line printer. Rectify any faults as necessary.

The command for a fault printout is CCPF <RETURN>.

1.3 Check that the time and date on the printout is correct. Rectify if necessary.

2. System Changeover (Duplicated Systems)

This task shall be carried out during a light traffic period in liaison with the Signaller.

2.1 Manually force a system changeover to the off line system by using the rotary switch provided. Observe that the system switches over correctly. Return the switch to the 'Auto' position.

2.2 Check the now 'on line' printer for faults as detailed in 1.2.

3. Equipment

3.1 Visually check all cards, leads and connectors are secure.

3.2 Clean the screens of the monitors using an anti-static screen cleaner to the manufacturer's instructions.

3.3 Dust and clean the keyboards using a soft cloth with a detergent solution diluted to the manufacturer's instructions. Do not use abrasive cleaners or pads.

Do not allow the keyboard to become wet. Hold keyboards upside down when dusting.

3.4 Check that the line displays are showing the correct characters. Investigate any problems.

3.5 Incorrect displays can lead to misleading descriptions. Carry out 3.1 to 3.3 at all Fringe box or Gate box units.

SERVICE B

4. Equipment

4.1 Dust and clean the interior of the TD cubicle.

END

Includes:	Train Describer GEC/GE Micro Processor Based
Excludes:	All other Train Describers

SERVICE A

1. Signal Box (Equipment Room and C.I.S.)

1.1 Check the following LED indications:

Indication	**State**
PSU Failed	Extinguished
None 'Memory Read'	Illuminated

1.2 Check that the line driver/receiver LEDs are flashing at least once per second.

This does not apply to C.I.S.

1.3 Check that the following LED indications on the Borer modem:

Indication	**State**
Power	Illuminated
Carrier	Illuminated
Tx and Rx	Intermittent Flashing

1.4 Check that all the fans in the cabinet are working.

1.5 Withdraw the fan unit and check that the microswitch works correctly by stopping the fans running.

1.6 Clean the fan unit and refit, Check on replacement all the fans are working.

1.7 If a printer is available, Check there is sufficient paper available and that the print quality is satisfactory.

Reload with paper and replace the cartridge/ribbon if necessary.

1.8 If a printer is available, use the control 'R' and Check that the system is clear of faults.

Stored faults can be interrogated by using the following codes:

- T? For time.
- D? For date.
- C? For categories being printed.

1.9 Check that the EFA lamp is extinguished.

1.10 Using a suitable meter/oscilloscope measure the cubicle +5V DC supply and AC ripple to the computer rack at each end of the mircobin busbar are between:

- +5V and 5.2V
- Ripple <50mV.

Check the second busbar if provided.

1.11 If it is outside these limits, adjustment can be made via the ‘Set Volts’ potentiometer on the PSUs.

1.12 Using a suitable meter/oscilloscope Measure the other +5V PSU’s verifying they are between:

- +5V and 5.2V
- Ripple <50mV.

1.13 If any adjustments are made via the ‘Set Volts’ potentiometer on the PSU recheck that the mircobin busbar(s) levels are still within the limits stated in 1.12.

1.14 Using a suitable meter/oscilloscope Measure the DC voltages and AC ripple on the other PSUs. Check that they are within the limits stated in the table below:

Voltage	Limits	Ripple
+12V	+11.6V to 12.4V	<50mV
-12V	-11.6V to 12.4V	
+24V	+23.6V to 24.4V	
+50V (Not C.I.S.)	+48V to 54V	<75mV

1.15 Using a suitable meter Measure the voltage drop across the PSU reversionary diodes it should be:

- 0.7V

If the obtained value is not as stated, isolate the PSU, disconnect the diode and carry out a resistance test.

An open circuit reading should be obtained reading one way across the diode with a short circuit reading the other way.

2. Signal Box (Operating Floor)

2.1 Check that all the display PSU indications are illuminated.

2.2 Check that the line receiver LEDs are flashing at least once per second.

2.3 Check that the TD stepping is working correctly.

2.4 Using a suitable meter/oscilloscope Measure the DC output and AC ripple from the PSUs ensuring they are within the limits stated below:

Voltage	Limits	Measured At	Ripple
+5V	+5V to 5.25V	U33 & U35 of Node	<50mV
+12V	+11.6V to 12.4V	Display PSU	
-12V	-11.6V to -12.4V	Display PSU	

When using the extender cord to measure the voltages on the edge connectors, allow for a small additional volt drop on the 5V supply at the node.

SERVICE B

The tasks in this service require close liaison with the signaller or are undertaken with a system possession.

3. Signal Box (Equipment Room)

3.1 Clean and Dust the cubicles.

3.2 Check the condition of the printer head drive belt. Clean as necessary.

3.3 Using the printer ascertain by using 'Control R' which step node is on line, then by using the following instruction:

- IU(Loop Address)(Node Address)U.

e.g. IU@CU.

3.4 Check that the off line node goes on line. Re-enable the former node by using the following instruction:

- IU(Loop Address)(Node Address)A.

e.g. IU@CA.

3.5 Check that the stepping is still occurring and that 'No Faults' is the response to a 'Control R' command.

3.6 Restore the original step node back on line and repeat for each pair of step nodes.

3.7 Check that the fault detection is functioning correctly.

This can be achieved by failing a power supply and breaking the message-passing ring.

3.8 Check that the printer reports when faults are cleared.

3.9 Check that the alarms operate correctly by pressing the 'Test' button.

3.10 Insert the spare battery and main cards in rotation around the sub-systems. Check that no faults are reported before replacing the next card.

3.11 Check that the battery cards have had sufficient time to charge (at least 6 hours) before any planed power test.

4. Signal Box (Operating Floor)

4.1 Dust and examine the operating panel.

4.2 Remove and clean all the filter glasses in front of the operating panel and set up the panel LED display units.

4.3 Dust and Clean the keyboard.

5. Fringe Signal Box

5.1 Using a suitable meter Measure the 110V AC system supply voltage is between:

- 95V and 120V.

5.2 Clean and dust all the equipment.

5.3 Check that the monitor picture quality is satisfactory.

5.4 Check that all the equipment is undamaged and that all connections are secure.

5.5 Check that the TD stepping is functioning correctly.

5.6 Place the Fringe box/Main box modem link into back- to-back mode (AL).

5.7 Check that the VDU screen fills with character sets.

5.8 Check that each alpha-numeric keyboard letter when depressed effects a change in one character of the continuously filling screen set.

5.9 Place the modem back to normal operation. Check that the map re-appears or will do so when the 'Recall' button is depressed.

5.10 Check that a set-up is possible in the scratch pad area. Erase after test.

6. All Sites

6.1 Measure all cubicle and panel earth points for continuity to earth.

7. Spare Change

Appropriate Electrostatic precautions shall be taken before handling any electronic components.

7.1 Exchange all spare PSUs and PCBs into the system.

Check that no faults are reported before replacing the next unit.

All microprocessor boards (Mk.1 & 2) shall be patched where appropriate with correct EPROMS, address plugs, RAMS and where applicable baud rate switches'.

Most EPROMS are unique to position and site, therefore they cannot be interchanged between different card slots and signal boxes.

All spare units are to be stored in anti-static bags or boxes.

End

Includes:	GE PC based Small Train Describer
Exclude:	Other train describer equipment

Before working on system use appropriate ESD precautions

GENERAL

The PC Small Train Describer, PC-STD, comprises a fanless PC system fitted with a processor module incorporating graphics, mouse, keyboard, printer port and USB interfaces, serial Input/output module(s), digital Input/output module(s). Connections to the peripheral equipment, i.e. Signalman OCU's/Workstation's, Information display's (Map terminals), Display Distributors, and external systems SSI, TDM, TDMX, ATR, TRUST, SMART, adjacent box train describers, etc. are via the serial I/O module(s) fitted in the system. The PC unit can be shelf/desk mounted or housed in a 19inch cubicle.

RECORDS.

All activities carried out on the PC-STD are to be recorded in line with current maintenance standards.

A Discrepancy Report Form provides a method of logging equipment and system discrepancies/faults that have occurred on a commissioned system. A form should be completed and accompany any returned equipment In the event that it is not practical to return the faulty equipment due to its size or installation, the form should be returned to GE as a means of advice of a problem.

Any failures found should be reported to the supervisor/manager.

1 Service A

1.1 Check that the power supply indications are indicating correctly.

1.2 Check that the links to the PC-STD are reported as OK, rectifying any defect.

1.3 Check that the PC-STD keyboard and trackball (where provided) is functioning and that the display screen is working correctly. Check that there is a working spare keyboard on site.

2 Service B

2.1 Clean the display screen and housing using a proprietary anti – static screen cleaner, used in accordance with the manufacturer's instructions. Disconnect and clean the keyboard as required, then reconnect.

3. Periodic Task

3.1 Change out the PC-STD with the spare unit. Check that the detail of each unit location and serial number is recorded in the site log-book.

End

Includes:	GETS Dual TD at Birmingham New Street Signal Box
Excludes:	All other GETS Train Describers

General

The dual train describer (DTD) comprises of two identical train describer crates (CCA & CCB) operating in a control and standby mode.

Connections to the peripheral equipment, for example Signallers OCUs, information VDUs (map displays), display distributors and external systems (SSI, TDM, TDMUX, ATR, TRUST, SMART and adjacent signal box train describers etc) is via an auxiliary serial changeover system.

The controller crates and the auxiliary serial changeover system are housed in a 38U cubicle. System ‘A’ boots up first and is the default control system.

This system scans both its watchdog inputs and those of system ‘B’ which is in standby. If it has stopped pumping its own watchdog but ‘B’ system is still pumping an automatic changeover will occur.

The standby system will then be the control system and vice versa. To prevent continual switching between systems under certain fault conditions, further automatic changeovers are prevented until a manual reset has taken place.

There is also a signalling input system (SIS) in the equipment cubicle; this converts the local stepping inputs into serial data format for the TD.

This system is functionally the same as a TDMUX.

Data Logging (Archive) PC

This is fitted to store and log all train movement messages and signalling data on a daily basis. The data is logged over a seven-day period, on the eighth day the first day’s data is overwritten.

The archived data can be downloaded at any time for analysis at a later date.

Refer to the manual for instructions on how to correctly transfer and analyse the data.

DAILY SERVICES

1. Fault Logging Terminal (WYSE)

1.1 Check the terminal is operational and switches between the A and B control crates.

1.2 Check for any outstanding faults. Rectify as necessary.

1.3 Check that the area is clean and tidy, remove any debris or rubbish.

2. Data Logging (Archive) PC

2.1 Check that the link between the logger PC and the DTD is reported as OK. Rectify any problems as necessary.

3. Control Equipment Cubicle

3.1 Observe that all the power supply indications are showing correct for all the units. Investigate any problems.

REGULAR SERVICES

4. Control Equipment Cubicle

4.1 Check that the area is clean and tidy, remove any debris or rubbish.

4.2 Where fitted, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

5. Data Logging (Archive) PC

5.1 Download the previous days data to confirm that the Logger PC is correctly recording the data.

SERVICE A

6. System Changeover

6.1 Prior to carrying out a manual changeover, print a list of all the current system faults using the ‘EFAS’ and ‘FLTS’ commands on the engineering terminal. Several minutes after the changeover use the same commands to print another list of system faults and compare the two.

Rectify any differences between the two.

6.2 Force a manual changeover of the control and standby crates by use of the select pushbutton on the 3AC-AP. Check the system is working correctly. Leave the ‘control’ and ‘standby’ crates in this configuration.

This task shall be performed in liaison with the Signaller.

6.3 Force a manual changeover on the SIS system by using the control and fault monitoring panel.

Check the system is working correctly. Leave the SIS system in this configuration.

Check that the changeover switch is left in the centre (auto) position.

6.4 Record the results in the system logbook.

7. Power Supplies

7.1 Using a meter and/or oscilloscope, measure the DC voltages and AC ripple on the auxiliary changeover controller modules (3AC-AP/SP) using the monitoring points on the front panels. Check that they are within the limits shown below:

Supply	Limits	Ripple
12V Logic	10.8V to 13.2V	<50mV
+12V Interface	+10.8V to +13.2V	
-12V Interface	-10.8V to -13.2V	

Table 1 - Voltage Limits

Any module with readings outside this range shall be replaced.

7.2 Using a meter and/or oscilloscope, measure the DC voltages and AC ripple on the control equipment crate power supply modules (6PP-B) on the back connector of each PSU. Check that they are within the limits shown below:

Supply	Limits	Ripple
5V Logic	4.5V to 5.5V	<50mV
+12V Interface	+10.8V to +13.2V	
-12V Interface	-10.8V to -13.2V	

Table 2 - Voltage Limits

Any module with readings outside this range shall be replaced.

7.3 Using a meter and/or oscilloscope, measure the DC voltages and AC ripple on the SIS crate power supplies (6PP-C) using the monitoring points on the front panels. Check that they are within the limits shown below:

Supply	Limits	Ripple
5V Logic	4.5V to 5.5V	<50mV
7V Logic	6V to 8V	
12V Interface	10.8V to 13.2V	

Table 3 - Voltage Limits

7.4 Using a meter and/or oscilloscope, measure the DC voltages and AC ripple on the AP-H that provides power to the 6PP-C units. Check that it is within the limits shown below:

Supply	Limits	Ripple
48V	40V to 51V	<100mV

Table 4 - Voltage Limit

8. Equipment Inspection and Cleaning

8.1 Check the Anthorn (formally Rugby) clock unit on the front panel, confirm the correct date and time is being displayed.

Check the operation of the antenna symbol to confirm the clock is receiving a signal. Report any problems to your SM(S).

Note that the Anthorn clock is switched off on the first Tuesday of each month and for two weeks in the summer for maintenance.

8.2 Dust and clean the display screens and housings of all monitors using a proprietary anti-static 'dry' screen cleaner in accordance with the manufacturer's instructions.

Check that the displays are well focused and there is adjustment available on both the brightness and contrast. Check that the Signallers are satisfied with their displays.

8.3 Disconnect and dust and clean all keyboards. Hold the keyboard upside down when dusting. If the keyboard is damaged or cleaning if ineffective, report as corrective maintenance.

8.4 Visually check all connecting leads are secure and undamaged.

8.5 On each industrial PC, check that front and rear cooling fans are both running, and the fan covers are not obstructed. Check the air intake filters are clean, renew as necessary.

SERVICE B

9. Cubicle Cleaning and Inspection

9.1 With the front and rear doors closed, clean the outer surfaces using a dry lint free cloth.

9.2 Carefully dust the interior faceplates and blanking panels using a dry lint free cloth.

9.3 Check that on completion of cleaning that the cubicle doors are securely closed. The cubicle provides EMC protection, any signs of damage or deterioration should be reported to your SM(S).

9.4 Check that all the spare program and database proms are available and current for all systems.

PERIODIC TASKS

10. Industrial PCs

Technical support staff and/or equipment specialists may manage tasks 10.2 & 10.3 separately.

10.1 Change all working industrial PC's over to the spare units. Confirm that the details of each unit location and serial number are recorded in the site logbook.

10.2 Replace the following equipment cooling fans on each PC with new units of the same type. Check after replacement that each fan works correctly.

a) PC front air intakes.

b) Internal PC processor fan.

c) PC power supply.

10.3 Replace on each PC the internal clock and Bios chip battery with a new battery of the same type.

END

General

Electrostatic precautions shall be taken before handling any electronic components.

The Automatic Code Insertion (ACI) terminal automatically changes the descriptions of trains arriving at terminating locations to the timetabled outgoing descriptions.

It is a dedicated PC located on the Signalling Centre operating floor and connected via a serial link to the TD.

The PC is loaded with a database containing a definition of the berths at locations where ACI action is required and lists of linked incoming and outgoing trains for each location.

Records

Record all activities in the relative system log book.

SERVICE A

1. System Performance

1.1 Check that the link between the ACI Terminal and the Train describer is reported as OK. Rectify any defects or report via FMS as necessary.

1.2 Check the power supply indications are indicating correctly for all units.

1.3 Check that the ACI keyboard is functioning and that the display screen is working correctly. Check that there is a working spare keyboard on site.

SERVICE B

2. System Maintenance

2.1 Change out the ACI PC with the spare unit. Check that the detail of each unit location and serial number is recorded in the site log-book.

2.2 As provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

2.3 As provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

2.4 As provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

3. Equipment Cubicles

3.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

3.2 As provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

3.3 Check that the cubicle doors are closed when cleaning the exterior and check leads, and connectors are not disturbed during cleaning.

PERIODIC TASKS

4. Equipment Servicing

4.1 Arrange to send the PC to the supplier for service and replacement of PSU and processor fans, battery, and hard drive.

END

General

TPWS usually consists of two sets of track-mounted equipment (OSS & TSS) and the trackside equipment; including the TPWS control equipment, power supply, and signalling interface.

More information on TPWS systems can be found in NR/GN/SIG/19048.

1. Generic Layout of a TPWS Installation (Not to Scale)

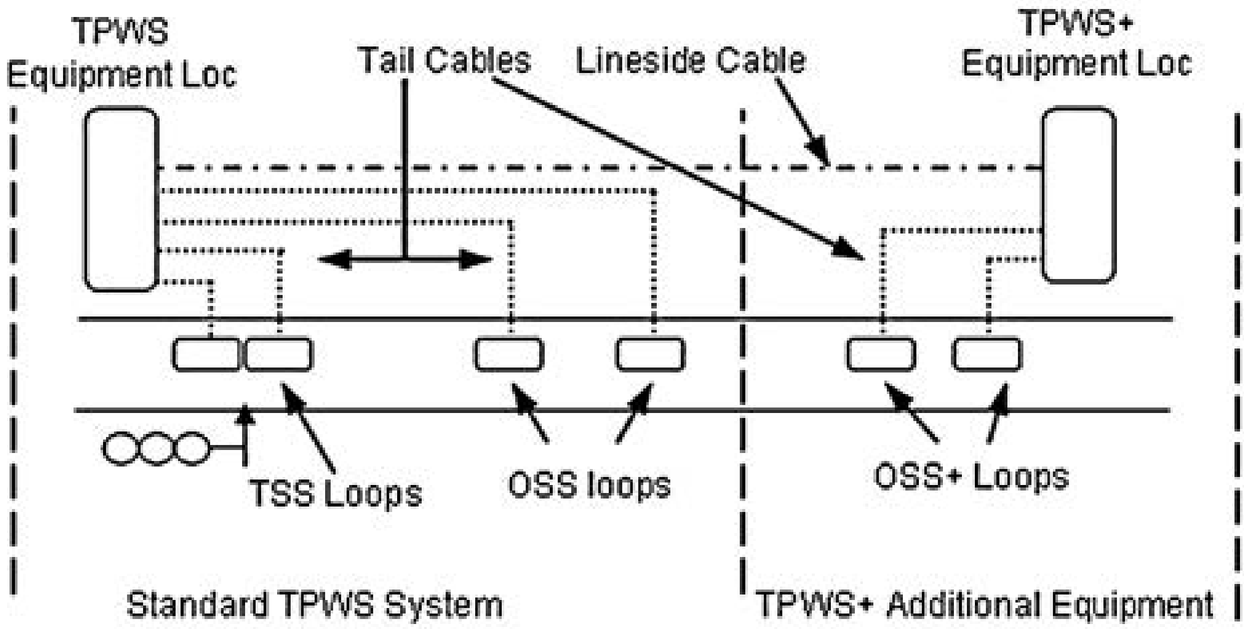


Figure 1 - Generic Layout

2. Principles of Operation

The track-mounted OSS & TSS loops transmit electromagnetic fields at defined frequencies, which are detected by a receiver on the train.

The TPWS will only be energised if the signal is at red.

3. Overspeed Sensors (OSS)

These are positioned a distance apart on the approach to the signal. If the TPWS is energised as the train passes over the arming loop a timer is started on the train.

If the train passes over the trigger loop with the timer still running a brake application will be automatically made.

4. Trainstop (TSS)

These are positioned together at the signal. If the TPWS is energised the train will first receive an arming frequency, then a trigger frequency whilst the arming frequency is still present. A brake application will then be automatically made.

5. OSS & TSS

TPWS OSS and TSS may be provided in various combinations. Some signals may only be fitted with a TSS, while some signals will have one or more OSS.

PSRs or buffer stops will only be fitted with an OSS and the TPWS will be permanently energised.

The exception to this is remote PSRs operated by a self-powered battery. The TPWS will only be energised when the associated treadle has been operated.

TPWS loops are energised whenever the controlling signal is displaying a stop aspect and no subsidiary aspect.

Some older installations may suppress the TSS and not the OSS for a proceed subsidiary aspect.

Some installations have OSS suppressed by the lie of points, these are known as complex approaches.

6. TPWS+ Systems

Conventional TPWS systems give protection against SPADs at approach speeds up to 120kph (75mph).

TPWS+ systems have an additional OSS loop (known as an OSS+ loop) fitted at approximately 750m (± 25m) on the approach to the signal.

This gives the TPWS+ system protection against SPADs at approach speeds up to 161kph (100mph).

The provision of the OSS+ loop at a greater distance than the conventional OSS loop entails an additional trackside apparatus case to house the control equipment.

7. TPWS Control Inputs

TPWS control modules have two inputs, the main input (‘Main I/P’) and the suppression input (‘Supp I/P’).

TPWS loops are energised by applying a voltage to the main input and suppressed by applying a voltage to the suppression input.

A voltage applied to the suppression input in the absence of a voltage applied to the main input will not cause the loops to transmit.

In normal operation the Main I/P is energised by either the relay controlling the signal main aspect (HR), or by a direct connection to the signal red aspect 110 V AC feed.

The Supp I/P is normally controlled by the relay controlling the subsidiary signal proceed aspect ((PL)GR), however, where self-reversion controls are required, the suppression input can be controlled by a ‘V(Supp)R’ or, in the case of complex approaches, by the lie of points indication or operating relays.

8. Position Light associated with Main Signal ((PL)GR)

With the main signal “On” a main signal input will be applied to the TSM and OSM and with the position light signal “Off” a suppression input will be applied to the TSM only.

9. Transmitter Loop Position

The position of the loops is critical to the designed operation of the system. The signalling record diagrams on site should show the combination of transmitter loops and frequencies for each signal, and the nominal distances.

The TSS loop distances are measured from the centre point of the two transmitter loops.

The OSS arming and trigger loop distances are measured from the leading edge of the loop, in the direction of travel.

The longitudinal centre of the loop shall be within +/- 10mm of the centre line of the track.

The loop fixing bars have a hole through the centre to assist in alignment. This is particularly important for bars Hilti bolted to concrete sleepers or screwed to timber sleepers.

Fixing bars designed to be secured by the rail fastening (e.g. Pandrol clips) will be automatically set to the correct position.

The distance below rail level from the top of the transmitter loop shall be between 60mm and 100mm.

Loops on concrete slab track shall be installed as stated in the Table 1.

Approx. Loop Feeder Cable Length	Distance Beneath Rail Head Level	
	Min	Max
0-50m & all Mini Buffer Loops *	20mm	60mm
50-150m	20mm	50mm
150-250m	20mm	40mm
250-350m	20mm	30mm
350-500m	20mm	20mm

Table 1 – Slab Track Loop Length's

* : The bottom of the Buffer Stop Mini Loop shall be at least 50mm above concrete slab track.

The maximum cable length shall be 500m.

For mini loops on steel sleepers, the bottom of the transmitter loop panel shall be separated by at least 70mm from the top surface of the steel sleeper.

The transmitter loop panel shall not overhang the steel sleeper by more than 50mm. Cable insulation testing shall not be undertaken with the cables connected to loops.

10. Self-Reversion

In some areas TSS loops have to be installed closer to the replacement block joint than the required 3.5m, or even ahead of it.

A TPWS fitted train passing over these loops would replace the signal to danger, and re-energise the TSS loops, before the train's antenna had passed over them causing the train's brakes to be applied.

This is known as Self Reversion. To avoid this situation additional signalling controls are included to suppress the energisation of the TPWS loops until the train borne antenna has passed over them.

11. VCPR

There is a risk that because the VCPR is permanently energised the front contacts could remain made when there is no current on the coil.

Where a VCPR is provided, the power supply shall be disconnected to check the front contacts break.

Disconnecting the TPWS power supply will cause the simultaneous activation of the Signaller's TPWS failure alarm.

12. Fault Reporting

For signals, failure of TPWS to transmit when required is reported in the signal's ECR circuit, or, for buffer stops, in the platform starter signal's EKR circuit.

TPWS at PSRs will not normally have remote fault reporting.

This does not apply to mechanical signals as a separate FIU is used.

On ex -WR sites the EKR may be known as G(M)ECR.

13. TPWS Equipment

Part number details for Thales TPWS equipment are listed in NR/GN/SIG/19048, Signalling Equipment Technical Advice Notice (SIGTAN 48) – Train Protection and Warning System (TPWS) Trackside Equipment.

Baseplate:

This is a purpose-built plug-board, which contains one signalling interface module (SIM) and one other TPWS module.

It can be fitted in a location or a relay room on standard relay racking. Some installations will avoid using the baseplate due to space constraints.

Trackside Enclosure:

This is a purpose-built housing, which contains either one, two or four TPWS functions. It is mounted track side, normally at the location of the fitted signal or PSR.

Any failure within a TPWS base-plate assembly, internal wiring, and terminations will require the entire unit to be changed. The units are not user serviceable.

Any failure within the wiring of a trackside enclosure can be rectified by replacement of the backplane of the failed function.

Siemans Rail Object Controller (Signal) [OC(S)]:

Within the OC(S) enclosure there is a bespoke TPWS baseplate.

This is an integral part of the OC(S) and mounts two TPWS functions, one TSS and one OSS. These are always provided in wiring and are used as shown on local site records.

This version of TPWS equipment is powered at 24Vdc. References in this SMS to power supplies at 110Vac [BX110] should be understood to mean 24Vdc [B24].

A separate MCB is provided to connect / isolate the TSS and OSS function as appropriate.

Any failure of the TPWS backplane in an OC(S) will require replacement as directed by your SM(S).

Transmitter loops:

This refers to the TPWS train-stop system (TSS) and overspeed sensor system (OSS) track mounted equipment.

Over-speed sensor:

This system has a function of demanding a brake application if a train passes the sensor above a pre-defined speed. It consists of a pair of loops on the approach to the signal, set a distance apart corresponding to the set speed.

Train-stop sensor:

This system has a function of demanding a brake application on a train that passes a signal at danger without authority. It consists of a pair of loops abutting each other, normally placed in line with the foot of the signal.

TSS or OSS modules:

These are plug-in electronic modules associated with the TSS and OSS, known as the train-stop module (TSM) and overspeed sensor module (OSM) respectively. Separate modules exist for normal and opposite directions of travel.

Failure Indication Unit (FIU):

This is an indication unit placed on the signal box block shelf for indicating TPWS failures where it is not appropriate to use the ECR circuit of the fitted signal.

The track mounted TPWS equipment is connected to the trackside equipment by means of feeder cables and tail cables.

The TPWS control equipment is wired into the existing signalling system as shown on local site records.

Where a separate TPWS housing is provided, there will be a 12-core signalling interface cable.

Many TPWS sites are wired within existing locations, using equipment that is mounted on a baseplate.

Some installations will directly connect to a plugboard and not use a baseplate due to space constraints.

14. System Reset

To reset the 'Fault' LEDs (red), isolate the BX110 supply for 5 seconds by removing the fuse in terminal no.1 or operate the MCB.

The fuse-holder should not become detached from the terminal block.

When you re-connect the fuse/MCB, the 'Power on' LEDs (green), on all modules should be lit and all 'Fault' LEDs should be unlit.

Voltages will still be present on the signalling inputs and fault outputs following isolation of the system at the TPWS trackside enclosure or apparatus case.

Do not attempt to reset the system by removing and replacing a module.

15. System Reset - Siemens Rail Object Controller (Signal) [OC(S)].

To reset the 'Fault' LEDs (red), isolate the B24 supply for 5 seconds by operating the MCB.

The MCB will then become tripped and should not become detached from the breaker. When re-operating the MCB, the 'Power on' LEDs (green), on all modules should be lit and all 'Fault' LEDs should be unlit.

Voltages will still be present on the signalling inputs and fault outputs following isolation of the system at the TPWS trackside enclosure or apparatus case.

Do not attempt to reset the system by removing and replacing a module.

16. Test Equipment

A 'Fluke TPWS' digital multi-meter shall be used.

A TPWS calibrated Mk.2 yellow test aerial with lead and integral 100Ω resister, and TPWS maintenance Jig is required.

To take measurements, position the aerial in the Maintenance Jig at the centre of and in the plane of the transmitter loop. Do not hold the meter directly above the loop so as not to affect the reading taken. See figure 2

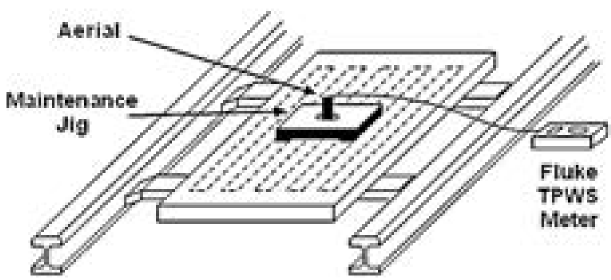


Figure 2 – Maintenance Jig Positioning

17. Component Changing

If any item of TPWS equipment is changed, comply with NR/SMTH requirements.

18. Fault Finding

Flow charts to assist finding faults within Thales TPWS trackside equipment can be found in NR/SMTH/Part10/FF12 (Faulting Guide: Train Protection Warning System (TPWS)) & NR/SMTH/Part10/FF13 (Faulting Guide: Train Protection Warning System (TPWS) Fault Finding Flow Charts).

TPWS IN RADIO ELECTRONIC TOKEN BLOCK (RETB) AREAS

To facilitate the use of TPWS in RETB signalled areas, a Trackside Radio Control Unit (TRCU) and associated subsystems are used.

TRCU is the term used to describe the whole system that include the Trackside Radio Module (TRCM), the Global Positioning System (GPS), the Radio Antennas, the Location Identity Device (LID) and the Trackside Functional Modules (TFMs).

It can be located in a Relocatable Equipment Room (REB) or in a suite of Trackside Apparatus Cases (Locations).

The TRCU also receives the electronic tokens issued from the Signaller to the driver. If a valid token is detected by the system, the TPWS loops are suppressed and a flashing indication to the driver via the lineside status indicator.

The TRCU will keep the TPWS suppressed until either:

a) The TRCU recognises the return of a token to the Signaller.

b) A pre-set suppression time period has elapsed.

c) Cancellation by a treadle on the departure side of the stop board.

d) When a shunt token is recognised by the TRCU, all TPWS equipment protecting the single line from the token exchange point (TEP) are simultaneously suppressed. All LSIs will change from an illuminated state to a flashing state.

Engineering tokens are not recognised by the TRCU therefore no TPWS will be suppressed.

The system operates independently of the main RETB system; it is for the operation of the TPWS system only.

19. Trackside Radio Control Module

The TRCM is a plug-in module at the heart of the system, it is a unique piece of equipment designed and built specifically for the fitment of TPWS to RETB lines.

It uses Alstom Mk3 TFMs to provide the input and output capability required for the site.

It has an event logging memory that can store the last seven days events (receipt of tokens, operations of the inputs and outputs etc). This information can be downloaded to a laptop computer that has the necessary software.

20. Lineside Status Indicator

The lineside status indicator is a blue single aspect light emitting diode (LED) indicator.

It is fitted to the ‘Stop and Obtain Token’ board and informs the driver of the status of the TRCU/TPWS system.

The LSI is illuminated when no valid token has been issued and flashing when a valid token has been issued.

21. Radio Antennas and GPS

There are three antennas within the TRCU, two for token reception that are located on a mast close to the locations or equipment room and one for the GPS mounted on one of the locations or equipment room.

The GPS system is to provide date and time information for the TRCM event logging memory.

22. TPWS

The TPWS loops and trackside equipment are identical to those fitted on ‘standard’ installations; therefore, the information in the previous section applies. The only difference is that the TPWS is driven by the output of the TRCU and not a signal.

23. Uninterruptible Power Supplies (UPS)

The TPWS UPS system is identical to that fitted in mechanically signalled areas.

24. TPWS at No Signaller Key Token (NSKT) Systems

These systems indicate to the driver in a very similar way to TPWS in RETB areas although the equipment is different.

When the driver stops at the ‘Stop and Obtain Token’ board in place of obtaining a token from the RETB, a physical token is obtained from a token machine in a trackside location.

The removal of the token as well as locking the machine deactivates the TPWS loop and activates lineside status indicator for a set period of time.

The driver is then able to proceed in the normal manner.

END

Includes:	All types of TPWS installations
Excludes:	n/a

The position of the transmitter loops is critical to the designed operation of the system. If you find that the position of loop(s) has been disturbed (relaying work etc), arrange for the loop positions to be re-checked.

You can find more information about TPWS systems and equipment in NR/SMS/PartC/TP00. (Train Protection Warning System (TPWS) General

SERVICE A

1. Track Sub-System Control Modules

1.1 Check the internal and external labelling. The labels shall clearly identify the correct system. Where the SIMs are part number 604366-00, arrange for these to be replaced with the latest part number.

1.2 Check the LED indications on all modules are as follows:

LED	Colour	State
Power On	Green	Lit
Fault	Red	Unlit

1.3 Invensys Rail Object Controller (Signal) [OC(S)].

In the OC(S), TPWS equipment has the following LED indications illuminated for any proceed aspect in an associated signal:

LED	Colour	State
Power On	Green	Lit
Main I/P	Yellow	Lit
SUPP I/P	Yellow	Lit

Record details on the record card. Investigate and rectify any fault that is indicated. If you cannot rectify the fault, advise the Signaller.

1.4 Check that the yellow signal status LED indications (“Main I/P” and “Supp I/P”) correspond with the signal aspects being displayed.

2. TPWS Enclosures (or base-plate)

2.1 Examine the assembly and fixings. Any failure within the internal wiring of a baseplate, modules, mountings, or connections requires a replacement unit.

Any failure within the internal wiring of a trackside enclosure requires replacement of the backplane for the failed function.

2.2 Examine the following items:

a) Module fixing and retaining clip.

b) Earth braids and terminations.

c) Terminal rail and terminations. Look for loose disconnection links, connections, wires, or wire strands.

d) Door, hinges, and locks.

e) Door seal.

2.3 Check the trackside enclosures for signs of moisture ingress.

2.4 Lightly lubricate the hinges and lock.

3. Cables and Disconnection Boxes

3.1 Examine tail cables, feeder cables, and disconnection boxes.

3.2 Cables shall not be kinked, trapped, or damaged. They shall be correctly routed, and securely terminated.

3.3 Dis-boxes, where provided, shall be secure, weatherproof, and structurally sound. Dis-box and feeder cable labels shall be fixed and legible.

3.4 Check the condition and security of the plug coupler on the tail cable at the loops.

3.5 Remove any accumulated debris from the vicinity of the transmitter loops and supporting structures.

3.6 Examine each of the transmitter loop and fixings. The loops shall be securely fixed to the fixing bars and undamaged. The fixing bars shall be securely fixed to the track.

The position of each loop, relative to the signal post and signal replacement IRJ is critical. The nominal positioning information can be found on the site wiring diagrams. If there is any obvious sign of movement from the specified position, arrange for a re- check.

4. Failure Indication Unit (FIU) – Where Provided

4.1 Examine installation, cables, and fittings for security and signs of deterioration or breaks. Renew or refit items requiring attention.

4.2 Check that the Power On (White) LED is illuminated and Measure the voltage between the B12 and N12 busbar:

- Between 9V and 15.6V.

4.3 Check that each unit is not excessively hot.

4.4 Press the "Test" button. Observe that all the lights flash at the correct frequency and that the audible alarm sounds.

If flashing rate or audible sound are distorted, change the Master FIU.

4.5 Clean the units and check equipment is correctly installed.

5. Self-Powered OSS Unit (SPOSS)

This task is only applicable if a SPOSS is fitted.

5.1 Examine the batteries and connections. Clean and Protect as necessary.

If damage or corrosion is present the batteries and/or connections/leads should be replaced.

6. VCPR Check (Where Provided)

6.1 This task shall be carried out with the agreement of and in liaison with the Signaller.

6.2 Disconnect the power supply to the TPWS equipment by removing the main BX110 feed fuse, or by operating the B24 MCB in an Invensys Rail Object Controller (Signal) [OC(S)]

6.3 Check that the VCPR front contacts have broken.

6.4 Restore the power supply and check that the VCPR has re-energised.

6.5 Check that the signaller's failure alarm has reset. Any problems shall be reported as corrective maintenance.

SERVICE B

7. Self-Powered OSS Unit (SPOSS)

This task is only applicable if a SPOSS is fitted.

7.1 Replace both batteries (unless new batteries have been fitted in the last 9 months).

7.2 Remove the SPOSS battery fuses F1 & F2 before replacing the batteries.

New batteries should be tested prior to installation, a 60Ω resistor (URL part number NRSP/000919) shall be connected across the terminals and using a suitable meter a voltage of at least 11.5V for 30 seconds should be observed.

7.3 Carry Out NR/SMS/PartB/Test/233 (TPWS Self-powered OSS (SPOSS) Trackside Equipment Test)

8. Full Test (If not a SPOSS)

8.1 Carry out NR/SMS/PartB/Test/230 (Train Protection & Warning System (TPWS) Tests)

PERIODIC TASKS

9. UPS Battery Replacement

This task is only applicable if a UPS is fitted.

9.1 Replace the UPS battery Check that the new battery pack is undamaged before installation.

Replacement battery pack cannot usually be charged before installation, check a few days after they have been installed so that they are charging correctly.

9.2 Carry Out NR/SMS/PartB/Test/057 (Uninterruptible Power Supply Test)

Reliability – Centred Maintenance

Includes:	All types of TPWS installations
Excludes:	TPWS without fault detection,TPWS with self powered OSS (SPOSS) or Lineside status indicators (LSI)

Service RA Carry out service A and B of this SMS.

END

Includes:	TRCM, GPS Sub-system, Interface TFMs, LID and Radio antennae.
Excludes:	All other Trackside Radio Control Units

SERVICE A

1. Trackside Radio Control Unit

1.1 Visually Examine the equipment, terminals, cables and cable connectors. Look for physical damage, overheating and arcing.

1.2 On the TRCM Check that the location identity device (LID) is securely fitted.

1.3 On the TRCM Observe that the indicators are showing as follows:

Indication	Colour	State
Power	Red	Illuminated
TRCM OK		
TRCU OK		

Table 1 - TRCM Indications

1.4 On each TFM Observe that the indicators are showing as follows:

Indication	Colour	State
Power	Red	Illuminated
System		
Rx Data		
Outputs		

Table 2 - TFM Indications

1.5 On the TRCM, turn up the volume on radio channel 1 and check that messages are being received. Turn the volume down & repeat for radio channel 2.

SERVICE B

2. Radio Antennae

2.1 Using a compass check that the radio antennae are orientated in the direction as shown on the site diagrams. Report any problems as corrective maintenance.

END

Includes:	LSI only. For signs see NR/SMS/SG20, For TRCU see NR/SMS/TP22
Excludes:	

Do not obstruct the sighting of the indicator to the driver of an approaching train during any maintenance activity.

SERVICE A

1. Operation

1.1 Observe that the LSI is steadily lit when no valid token has been issued.

1.2 If possible, Observe the operation of the LSI during the passage of a train. Check that the LSI is steadily illuminated when no valid token has been issued and flashing when a valid token has been issued.

2. Indicator Inspection

2.1 Check the following items:

a) Indicator Head.

b) Cable Entry, Check that glands are effective.

c) Lenses and lens hoods. Clean lenses as necessary.

2.2 Check that all the LEDs on the LSI are illuminated. If any are found not to be, replace the whole LSI unit.

3. Final Checks

3.1 Check the visability of the LSI, verify that the steady/flashing blue light is bright and clearly visible.

3.2 Check that the sighting is not obscured by vegitation, cut back as required.

End

TREADLES

They have an actuating arm made of high tensile stainless steel. This absorbs the energy produced by the shock of the wheel flange and controls the electrical contacts.

An oil dashpot has a damping effect and delays the return of the arm. The dashpot is adjustable between 0 – 13 seconds.

The damping makes sure that the reverse contacts are closed and also prevents the treadle arm from rising between each axle of a moving train.

Type 69 - "Cautor" Single Arm Treadles

These are bi-directional and can detect trains running in either direction.

These have a shorter operating arm and are available as the 'Cautor' single arm configuration only. See Figure 1.

Figure 1 - Type 69 "Cautor" – Single arm treadle

Type 69 "Forfex" Double Arm Treadles

These have a longer operating arm and are available as 'Cautor' single arm or 'Forfex' double arm treadles. See Figure 2.

These are available as either bi-directional (standard model) or uni-directional models.

The uni-directional model has the two reverse contacts mounted on one arm. This treadle can only detect trains running in one direction (e.g. A-B or B-A).

Figure 2 - Type 69 "Forfex" - Double arm treadle

The direction is indicated on the treadle using an arrow shaped label or metal label with an arrow point end. See Figure 3.

Figure 3 - An example of the direction indicating arrow

Figure 4 - Examples of treadle labels

Uni-directional treadles are often associated with level crossings and are indicated on the signalling plan with an arrow. See Figure 5.

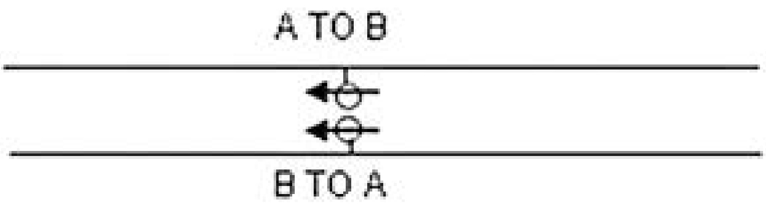


Figure 5 – Signalling plan symbol for a Uni directional model

The bi-directional model has two, independent reverse contacts, one on each arm, which correspond to the two directions of travel.

This can detect trains running in either direction.

When changing treadles check the correct direction is installed on each rail.

Where directional treadles are fitted to both rails, a pair of opposite handed treadles are required.

Dashpot Fluid

This shall cover the narrow lower portion of the dipstick and topped up as required.

Treadle Renewal

This shall be arranged before the treadle arm wears below 50% of its original diameter. The slot in the treadle arm gauge can be used to check this.

Treadle Arm Guards

These shall not be fitted and shall be removed if found on existing installations. Inform your SM(S) if any are found.

Integrated Treadle Gauge

The gauge has been designed for use on both standard rail brackets and euro brackets.

Each of the gauges described in this section are identified on the Integrated Treadle Gauge and have been engraved into the gauge.

Calibration is required every 5 years or if the gauge becomes damaged, it is recommended that all gauges are entered into the National Calibration Register. Drawings are available within the Product Acceptance file for calibration measurements and tolerances.

The gauge has been designed and tested to conform to BS 8020:2011 for use on Third Rail Traction areas.

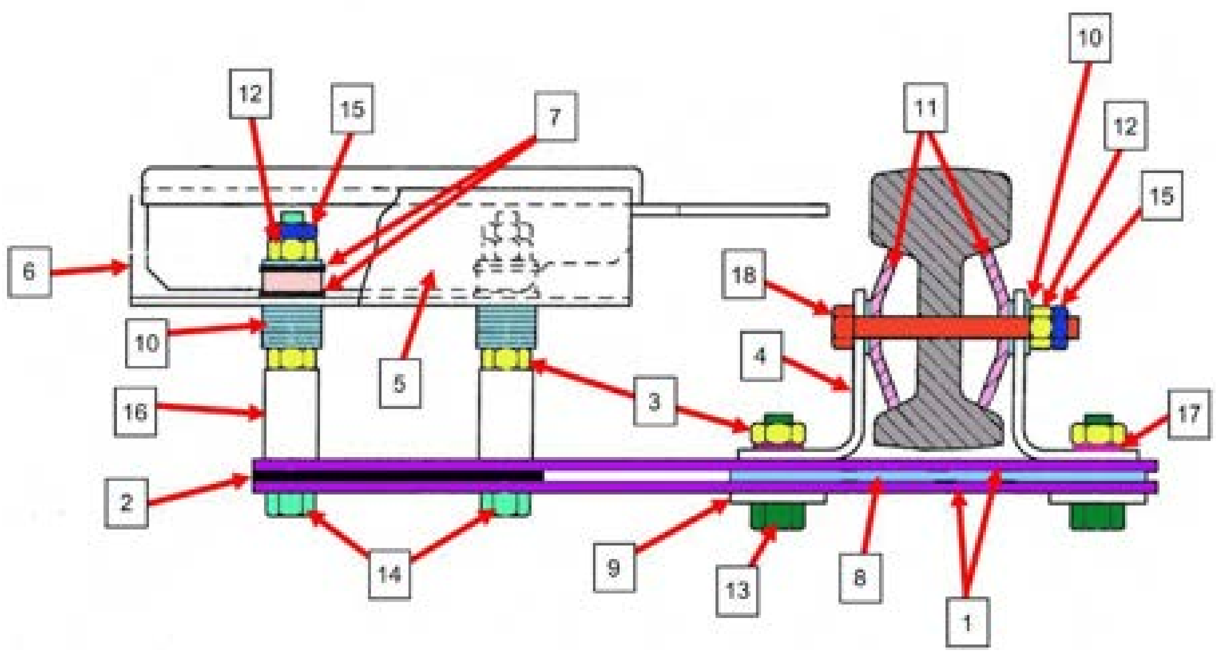
Users of the gauge are advised to operate and extend the gauge once the gauge end has been placed on the rail furthest away from any raised traction rail – this prevents the gauge coming into contact with the traction rail.

Installation

To minimise vibration, ideally treadles should not be installed within 3m of a rail joint. The exact position of a treadle can be critical and is often associated with a timing function.

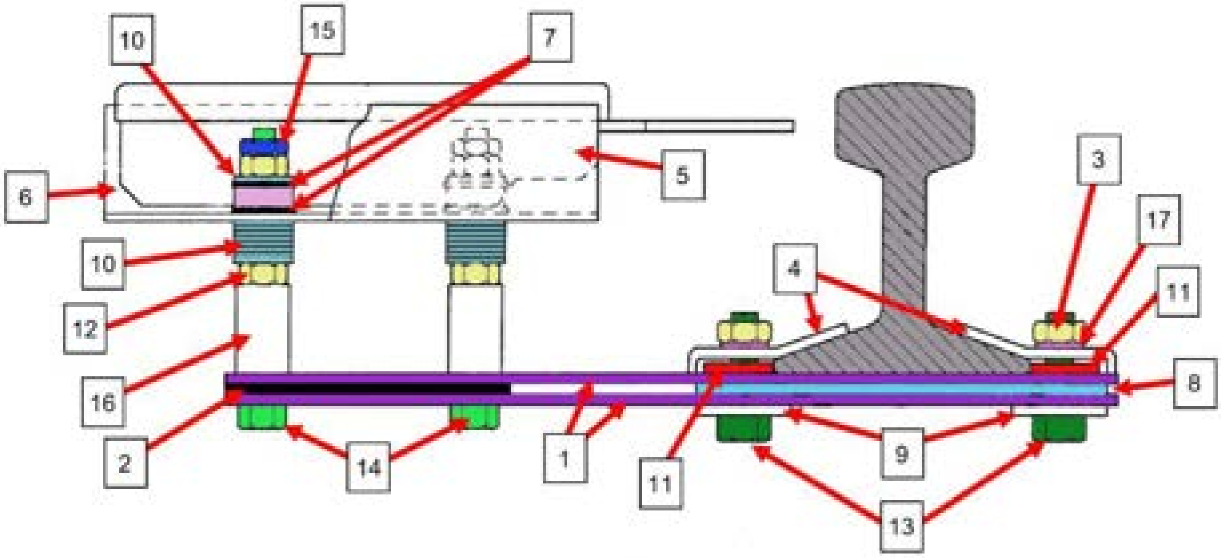
Treadles shall not be repositioned without the prior authority of a competent and authorised person.

APPENDIX A - Parts List – Bullhead Rail



No	Description	Quantity
1	Frame	4
2	Rubber Plate	2
3	Nut 16mm Hex Std	4
4	Bracket	2
5	Guard Plate	1
6	Guard Plate	1
7	Rubber Washer	8
8	Mounting Wedge	2
9	Tie Plate	2
10	Steel Washer 12mm	As Required
11	Web Plate	4
12	Nut 16mm Hex Std	10
13	Bolt 16mm dia *60mm long	4
14	Bolt 12mm dia *150mm long	4
15	Nut 16mm Hex lock	6
16	Spacer	4
17	Star Washer 16mm	4
18	Bolt 12mm dia *120mm long	2

APPENDIX B - Parts List – Flat Bottom Rail



No	Description	Quantity
1	Frame	4
2	Rubber Plate	2
3	Nut 16mm Hex Std	4
4	Rail Clip	4
5	Guard Plate	1
6	Guard Plate	1
7	Rubber Washer	8
8	Mounting Wedge	2
9	Tie Plate	2
10	Steel Washer 12mm	As Required
11	Butt Plate	4
12	Nut 12mm Hex Std	8
13	Bolt 16mm dia *70mm long	4
14	Bolt 12mm dia *160mm long	4
15	Nut 12mm Hex lock	4
16	Spacer	4
17	Star Washer 16mm	4

APPENDIX C - European Treadle Bracket

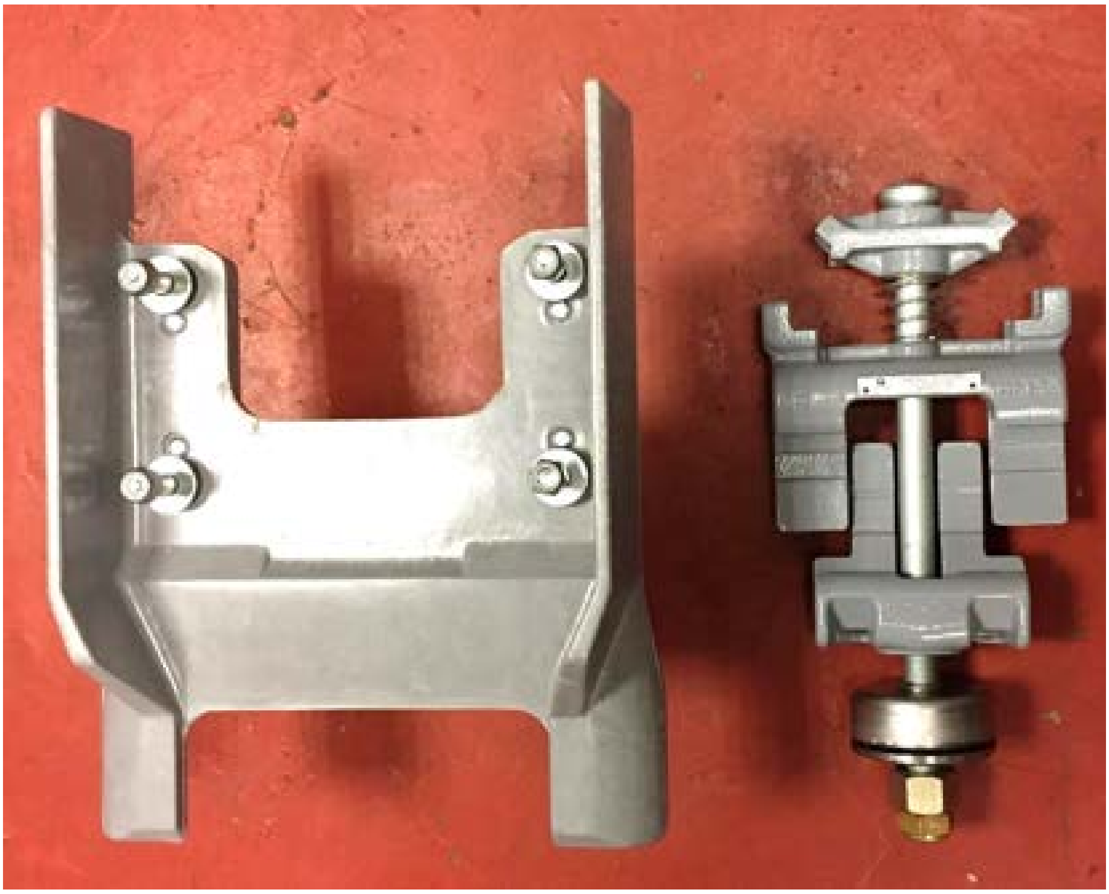


Figure 6 – European Treadle Bracket Parts

END

Includes:	Type 69 Single arm (Cautor) and Double arm (Forfex)
Excludes:	Electronic (Freddy Sensor), SEU/AzL and all other types

Any defects found during maintenance shall be dealt with as corrective actions and reported to your SM(S).

For more information refer to NR/SMS/PartC/TQ00 or the installation handbook.

SERVICE A

1. Inspection

1.1 Remove any rubbish, potential obstruction, and fire risks.

1.2 Check security of the treadle mounting baseplates, brackets, and fixings to rail (including locknuts). Report any voiding or wet spots.

Brackets are bolted through bull head rails. Brackets are clamped to flat bottom rails. Star washers are to be fitted to reduce vibration on the bracket securing bolts. (See Figure 2).

Figure 1 - Bracket

Figure 2 - Butt Plate & Star Washer

1.3 Check the security and condition of the rubber vibro washers which are provided to insulate the treadle from rail vibration. corrective maintenance is required if found perished or damaged. (See Figure 3).

Figure 3 - Examples of Damaged, Worn and Perished Vibro Washers

1.4 Examine the treadle assembly and cable entries. The treadle shall be secure and correctly aligned.

All cable entries shall be fitted with a gland and sealed.

The lid and fixings shall be secure and properly fitted.

1.5 Check that the treadle arm(s) is/are intact and have not worn below 50% (3.5mm) by using the treadle gauge.

1.6 Examine the actuating arm sealing grommet. This shall be replaced if found perished or missing. (See Figure 5)

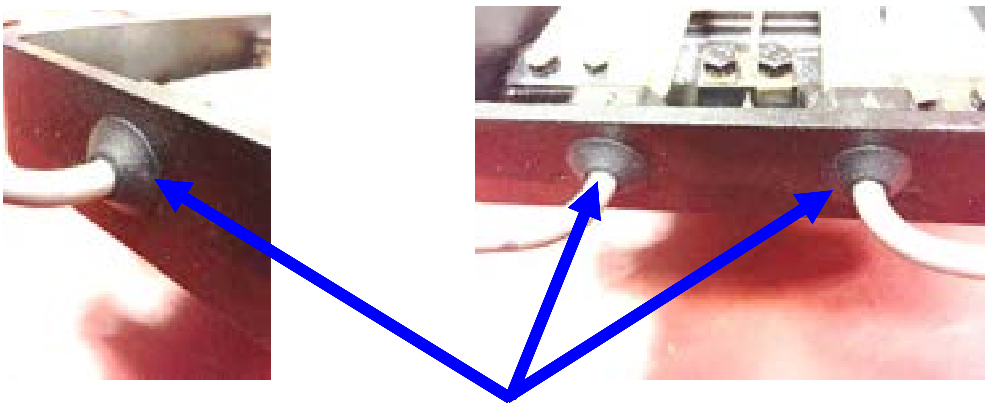


Figure 4 - Treadle Arm Rubber Gromets

1.7 Lubricate (lithium grease) the treadle lid fixing screws.

Latest version treadles are fitted with new spring clips and lithium grease is not required.

1.8 Check the visible tail cable, orange pipe and route for any damage.

1.9 Examine the dashpot, plunger, and fixings.

a) The plunger shall be securely attached to the torsion shaft.

b) Look for oil leakage around the gasket. (Refer to TQ00).

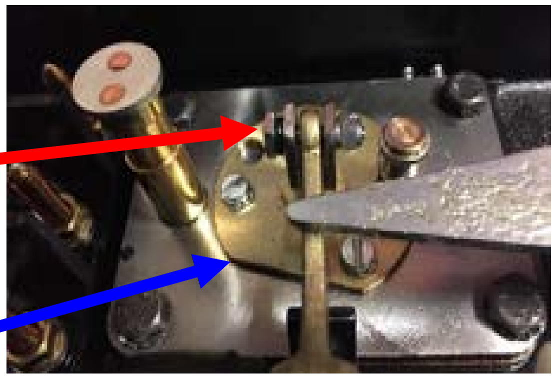


Figure 5 - Dashpot Area

1.10 Check the dashpot oil level; replenish as necessary. (refer to TQ00 for oil level)

1.11 Check and examine the letter stamped on the timing screw. (refer to TQ00)

If an X is found on the timing screw, replace the timing screw with one that has either a V or A stamped on the top.

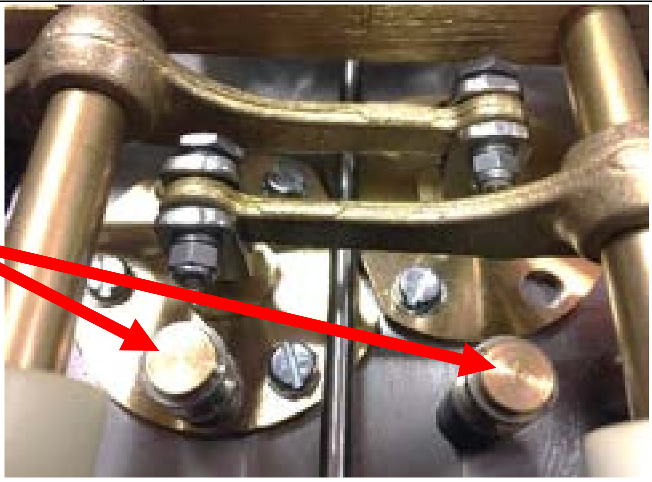


Figure 6 - Timing Screws

1.12 Clean and examine the exterior and interior of the treadle unit and lid. Do not disturb the timing adjusting screw.

1.13 Check visually that the actuating arm journal holes are free of manufacturers grease and apply a few drops of dashpot oil to each of the journal oil holes. See to Figure 7.

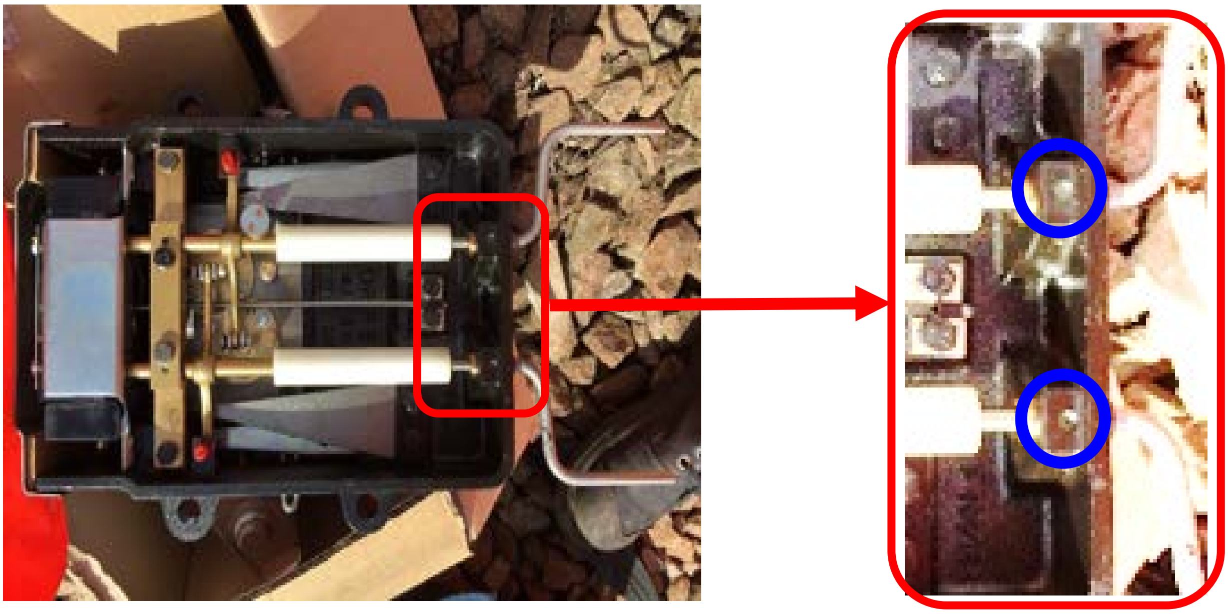


Figure 7 - The Location of Journal Holes Circled in Blue

1.14 Check the actuating arm grub screws are lubricated by applying a few drops of the dashpot oil to prevent corrosion issues which can lead to the inner brass collar moving away from its fix position. Refer to fig 2.

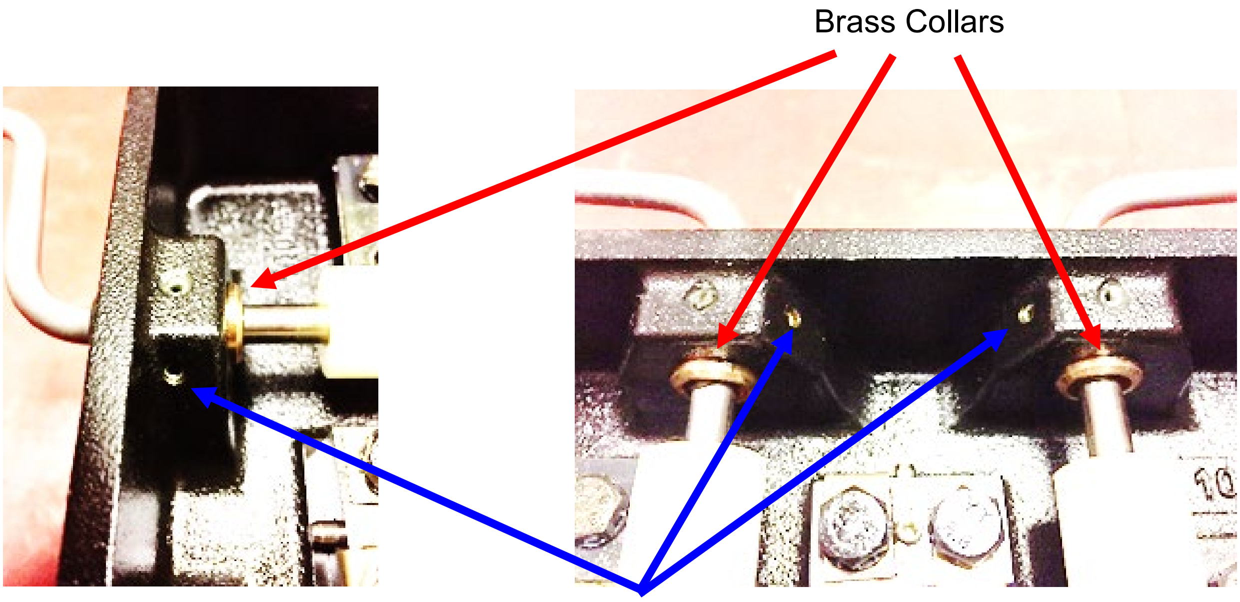


Figure 8 - Brass Collar and Grub Screw Locations

1.15 Check the brass collar situated within the treadle frame for signs of wear, replace if worn.

Verify it is secure by checking the position of the grub screw heads. (See Figure 8).

The grub screws should be 2-3mm below the level of the housing.

SERVICE B

2. Treadle Interior

2.1 Clean and examine the exterior and interior of the treadle unit and lid. Do not disturb the timing adjusting screw.

2.2 Examine the dashpot, plunger, and fixings (3). The plunger shall be securely attached to the torsion shaft. Look for oil leakage around the gasket.

2.3 Check the dashpot oil level; replenish as necessary.

NOTE: *HVI 13 oil should only be used as per RIA 66.*

2.4 Examine tail cable terminations; clean and protect as necessary.

2.5 Examine internal wiring. Check that the insulation is not degraded by oil. Advise your SM(S) of any degradation identified.

2.6 Examine contacts, contact assembly, and retaining clamp and seal.

2.7 Visually check the miniature relay base and internal contacts for Verdigris. Advise your SM(S) if any degradation is seen.

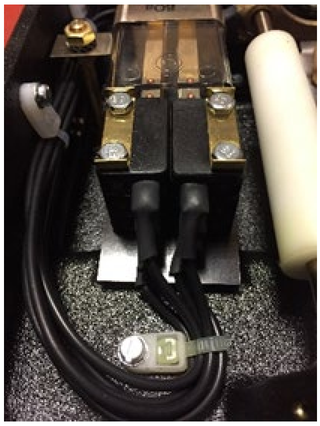


Figure 9 – Miniature Relay Base

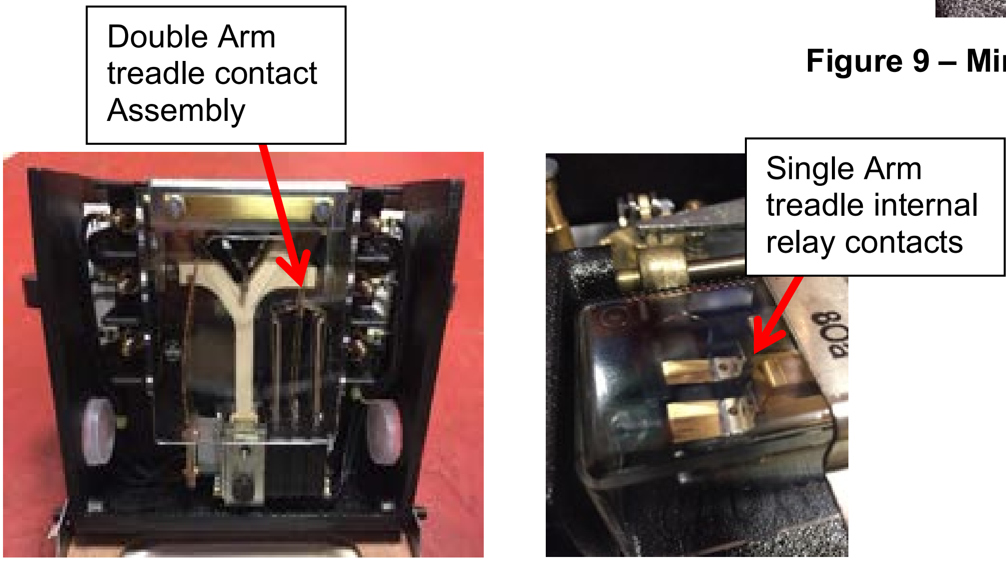


Figure 10 – Contact Assemblies

2.8 Examine return spring, seal and fixings; Wipe and smear with mineral oil.

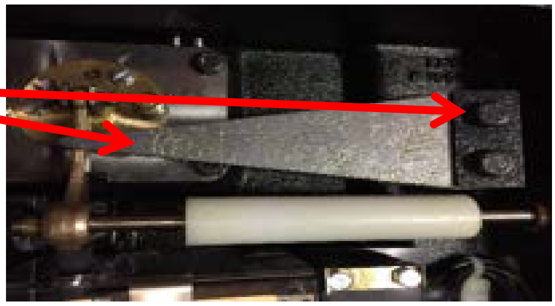


Figure 11 – Return Spring and Fixings

2.11 Carry out NR/SMS/PartB/Test/177 (Treadle Gauging Test).

2.12 Carry out NR/SMS/PartB/Test/044 (Treadle Timing and Adjustment Test).

Replace and secure the lid the correct way around, without trapping the internal wiring.

END

Includes:	FREDDY Sensors
Excludes:	All other treadle types

Freddy treadles are not approved for use on Network Rail Infrastructure and will be removed in due course.

This NR/SMS is provided only for maintenance of existing Freddy treadles, pending their removal.

Where the sensor and control unit are powered from a battery-backed supply, the battery shall not be disconnected without first disconnecting the AC feed.

The presence of any metallic object (tools, rings, watches, steel toe caps in boots etc) above and close to the sensor will be detected, and connected control systems will be activated.

The abbreviation ‘Freddy’ stands for Flange Reading Electronic Detector Designed at York.

SERVICE A

1. Inspection

1.1 Examine the Freddy for damage and check it is securely fixed to the mounting plate.

1.2 Check the mounting plate is securely fixed to the rail. If loose, tighten using a torque wrench to 60nm.

1.3 Measure the height from the top face of the sensor to the rail level.

- 48mm ±3mm.

1.4 Clean the whole of the Freddy with particular attention to the top.

On 1.2 to 1.4 no metallic object shall be brought close to the top of the sensor, if necessary arrange a disconnection of the system before any adjustments using tools are made. Remove rings and watches before cleaning the unit.

1.5 Examine the cable entry gland and check the cables are secure and undamaged. Check the security of the rail connections.

1.6 Check the disconnection box (where provided), the tail cable and any orange piping and/or route.

1.7 Check that the green LED on the side of the sensor unit is lit (for normally energised types) and is out (for normally de-energised types).

1.8 Check (if fitted) that the orange or yellow LED on the side of the sensor unit is illuminated.

SERVICE B

2. Operation

2.1 Measure the DC supply to the sensor.

- Between 22V and 30V

NOTE: *Voltages in excess of 30V might cause damage to the sensor.*

2.2 Measure the AC ripple voltage of the DC supply.

- <1.2V

If the value is higher the PSU shall be replaced.

2.3 Pass a metallic object over the top of the sensor and observe the following:

- The green LED is extinguished (for normally energised types) or is illuminated (for normally de-energised types).
- There is a 6 to 8 second delay after the LED is extinguished/illuminated before it illuminates/extinguishes (depending on type).
- The orange or yellow LED (if fitted) is extinguished during the sensor's normal operation.

Illumination indicates either low power supply or a sensor malfunction. This shall be investigated and rectified.

2.4 Check that any relays that the sensor unit operates (e.g. QNR, QRR) respond to the sensors operation. If the sensor is used to operate a track relay, check this relay de-energises.

If any items fail to respond correctly the cause shall be immediately determined and any faulty units replaced.

2.5 Check that after any operation of the sensor, controlled circuits are normalised.

END

Includes:	SEL/AzL Electronic Treadle
Excludes:	All other types of mechanical or electronic treadle

Always take possession of the equipment operated by the treadle before adjusting the rail contacts.

Metallic objects shall be kept away from the rail contacts as they can cause false operation.

This 'treadle' uses the same rail contacts and EAK (lineside junction box) as the axle counter systems.

The output from the EAK feeds relays (QNR/QRR) in place of an evaluator.

A single rail contact (SK11) or double rail contacts (SK30) may be used. An EAK30 is used (If a signal rail contact is used there will only be one SE card fitted).

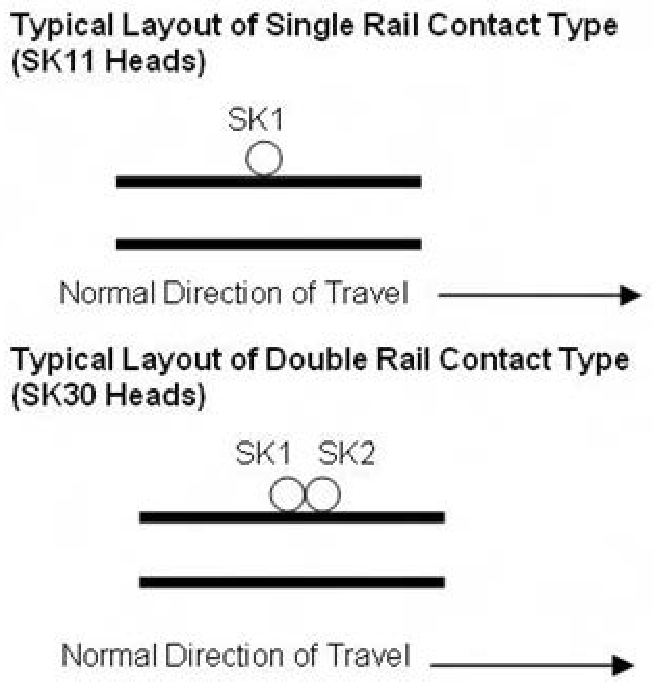


Figure 1 - Typical Layout of Single Rail Contact Type (SK11 Heads)

SERVICE A

1. Rail Contacts

1.1 Examine the rail contacts, rail insulations and bolts. The Tx head shall not touch the railhead. If a head or fixing is loose, check alignment NR/SMS/Test/PartB/045 (Thales Axle Counters Dummy Wheel Test (AxLM & AzLE)) and tighten bolts.

1.2 Examine all tail cables, connections, and clamps.

1.3 Check the protection plates and flux plates (if fitted) are tight.

2. Lineside Junction Box (EAK30)

2.1 Examine the lineside junction box including all cables and connections.

2.2 Check all terminals are tight.

SERVICE B

3. Rail Contacts

3.1 Check torque settings of fixings.

4. Lineside Junction Box (EAK30)

4.1 Remove and examine cover, interior and connections. Do not remove cover if it is raining.

4.2 Check terminals are tight.

4.3 Check the green LED(s) on the SE card(s) are lit. Single rail contacts only have one SE card.

4.4 Measure using the test switch box connected to the socket on the Rel As card (plug goes in with cable entry at bottom) and a meter the following voltages:

With the meter connected to LTG1 (yellow +ve, black –ve):

a) Incoming supply +55V to 115V DC.

With the meter connected to the switch position terminals (red +ve, black –ve):

b) Stabilised supply 1 (switch pos. 3) +22V to +25V DC.

c) Stabilised supply 2 (switch pos. 4) +22V to +25V DC.

d) MESSAB 1 (switch pos.10) +55mV to +200mV DC.

e) MESSAB 2 (switch pos.12) +55mV to +200mV DC. (Double rail contacts (SK30) only).

f) PEGUE 1 (switch pos.11) +55mV to +200mV DC.

g) PEGUE 2 (switch pos.13) +55mV to +200mV DC (Double rail contacts (SK30) only).

Measure using a meter the transmitter outputs at terms 19/20 for SK1 and 21/22 for SK2.

h) SK1 35V to 49V AC @ 30 to 31.3kHz.

i) SK2 35V to 49V AC @ 27.4 to 28.6kHz (Double rail contact (SK30) only).

4.5 Carry out NR/SMS/Test/PartB/045 (Thales Axle Counters Dummy Wheel Test (AxLM & AzLE)).

Single rail contact (SK11) use tasks applicable to SK1 only.

4.6 Influence the rail contact(s) with the dummy wheel. Check when influenced the correct QNR relay drops and the QRR relay picks.

After approximately ten seconds check that the QRR relay drops and the QNR relay picks. Remove the dummy wheel.

4.7 Disconnect the test switch box, grease fixing studs, and replace cover.

4.8 Check that after operation of the treadle that all controlled circuits are normalised.

END

Includes:	Siemens WSR Sensor used with FREDDY Control Unit
Excludes:	Any other use of the WSR Wheel Sensor

General

Always take possession of the equipment operated by the sensor before undertaking any intrusive maintenance.

Metallic objects shall be kept away from the rail contacts as they can cause false operation. Live mobile phones or similar radio systems shall not be taken within 2M of the units.

Report as corrective maintenance any voiding or wet spots in the vicinity of the unit.

Whenever the sensor is physically moved or adjusted, the operational test in this SMS shall be performed. If this test fails, then the wheel sensor shall be re-calibrated in accordance with Appendix A.

SERVICE B

1. Fixing to Rail

1.1 Clean the wheel sensor and examine the sensor and its fixings to the rail for damage and security.

1.2 Remove any metallic debris within 1m of the wheel sensor.

1.3 Check the height from the top face of the wheel sensor to the rail surface is 45 mm +/- 1 mm. (See Figure 1) Adjust height as necessary. Tighten bolts using a torque wrench to 70-80 NM.

Whenever the sensor is physically moved or adjusted, Appendix A shall be carried out followed by the operational test.

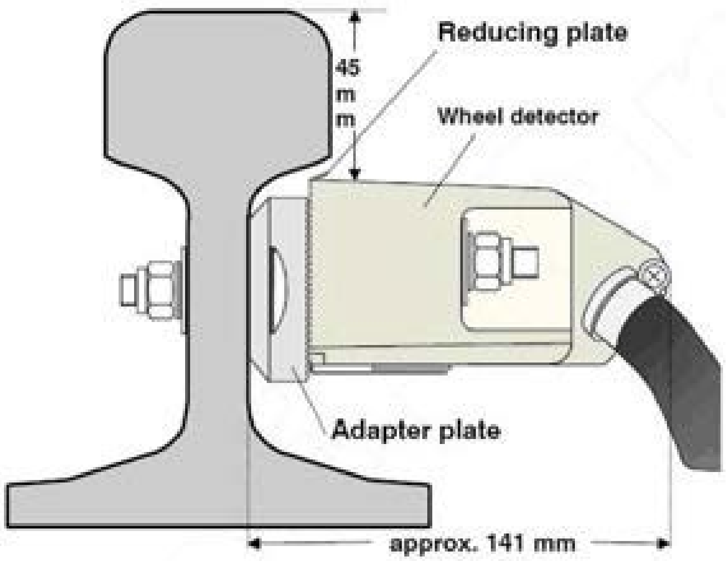


Figure 1 – Wheel Sensor Mounted on Rail

1.4 Examine the cables for damage. Check that the connections are secure.

1.5 Check the disconnection box and tail cable connections for security.

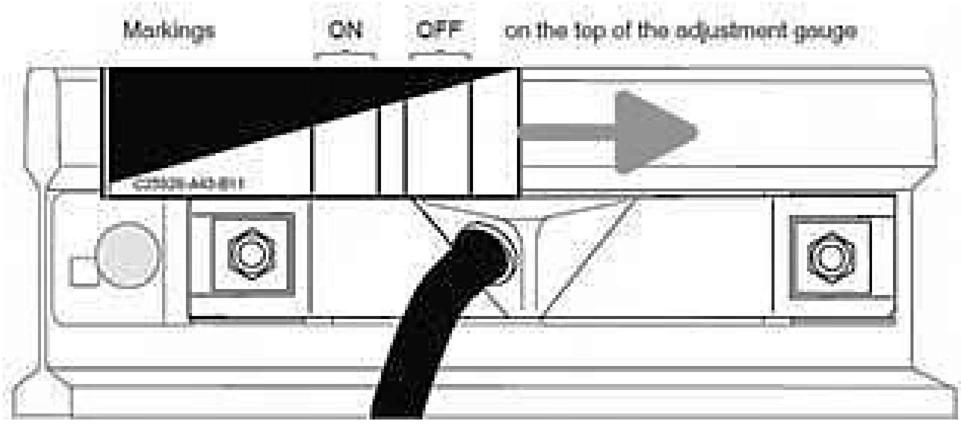


Figure 2 – Placement of Gauge on the Rail

2. Operational Test

2.1 Place the adjustment gauge on the wheel sensor so it is in contact with the rail head and then slide it along the rail over the wheel sensor. In the direction of the arrow (as shown in Figure 2). Check the follower relay operates when the centre marking on the wheel sensor housing is within the ‘ON’ section markings on the adjustment gauge.

2.2 The sliding movement shall take place within 30 seconds of the gauge being placed on the rail. Otherwise remove the gauge and try again after a delay of 1 minute.

2.3 Slide the gauge back along the rail to its original position. Check the follower relay returns to its original state, when the centre marking on the wheel sensor housing is within the ‘OFF’ section markings of the gauge.

2.4 If the relay fails to respond correctly, re-calibrate in accordance with Appendix A, and repeat this test as necessary.

2.5 Where practical, observe the passage of a train over the sensor. Report any excessive deflection in the rail due to track issues as corrective maintenance.

2.6 Excessive deflection in the rail might damage the sensor.

APPENDIX A - Calibration

NOTE: *The wheel sensor shall be calibrated to match the site conditions. This is necessary whenever a new sensor is installed, or an existing sensor is moved or physically adjusted for height or position.*

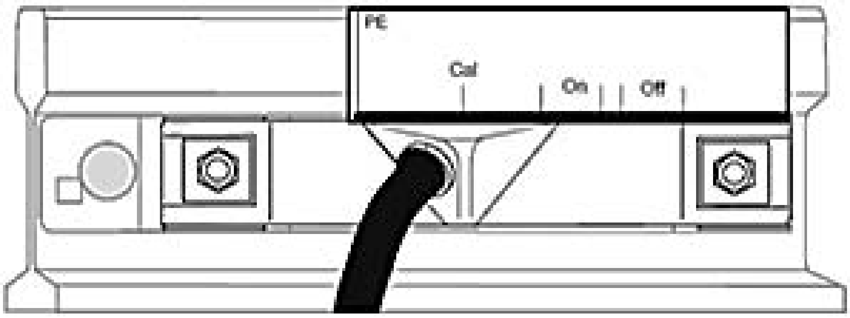


Figure 3 – Placement of Gauge on Rail for Calibration

1. Remove power to the unit. Wait at least 15 seconds and then restore power.

2. Within 15-20 seconds after restoring power, place the adjustment gauge on the wheel detector and in contact with the rail head. With the “Cal” marking on the adjustment gauge over the centre marking on the wheel detector housing. (As shown in Figure 3). Observe that the follower relay operates.

3. Leave the adjustment gauge on the wheel sensor for 15-40 seconds.

4. Remove the gauge. After approximately 25 seconds the wheel detector adopts its calibration value. Observe that the follower relay returns to its original state.

END

Includes:	GETs Treadle Unit
Excludes:	All other types of Treadle

Always take possession of the equipment operated by the sensor before undertaking any intrusive maintenance.

Metallic objects shall be kept away from the rail contacts as they can cause false operation. Live mobile phones or similar radio systems shall not be taken within 2 meters of the units.

Report as corrective maintenance any voiding or wet spots in the vicinity of the unit.

This 'treadle' uses the same rail contacts and junction box as the GE (SCA2) axle counter systems. See Figure 1.

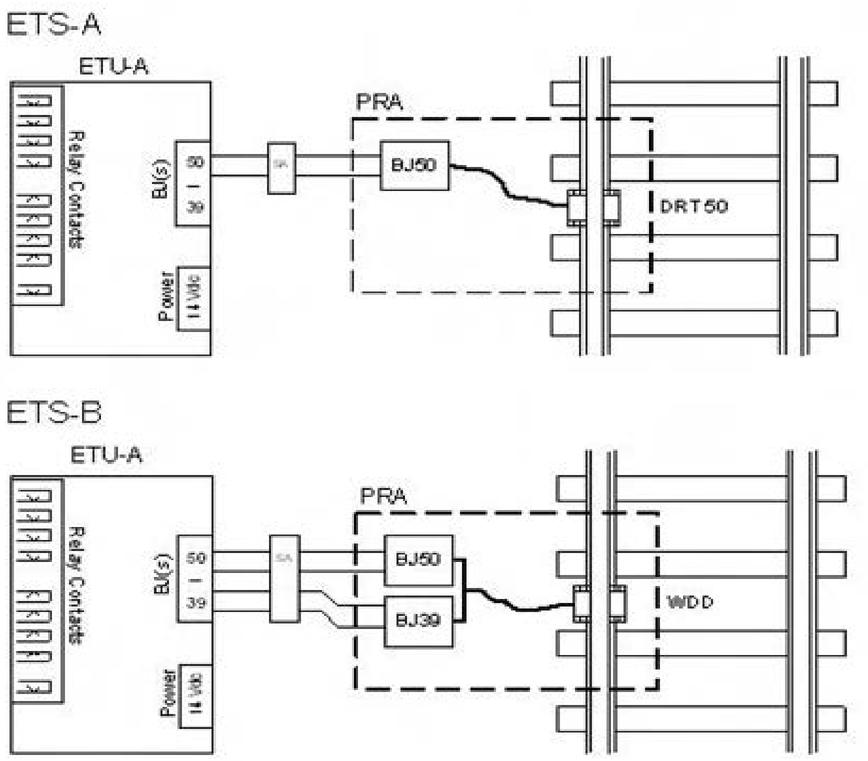


Figure 1 – Equipment Layout

SERVICE B

1. Rail Contacts

1.1 Examine the rail mountings, detector heads, and bolts. Once the GE detector heads are mounted correctly there is no further adjustment required.

1.2 Check that all the fixings are secure. See datasheet 99EH038-A-SPE4.

1.3 Examine all the tail cables, connections, and clamps.

2. Lineside Junction Box (BJ39 BJ50)

2.1 Examine the lineside junction box (BJ) including all cables and connections.

2.2 Remove and examine the cover, interior, and connections. Do not remove the cover if it is raining.

2.3 Check that all the terminals are tight.

2.4 Measure using a True RMS multimeter (TPWS meter) the DC Voltage present on pin 8 (+) with respect to pin 7 (-). This voltage should be greater than 8.35V.

2.5 Measure using a True RMS multimeter (TPWS meter) measure the mVAC between TP11 and TP12 (See Figure 2) the readings should fall between 26.5 – 29mV for an existing installation.

2.6 Voltage below 26.4mV immediate action shall be taken to rectify.

NOTE: *Voltage above 31mV on TP11 & TP12 have potential to cause WSF*

If readings are found to be out of spec refer to Appendix A: Set up of a new or replacement wheel sensor section f) installation of shim. If adjustment is not possible to 27 – 29mV a new wheel sensor should be installed

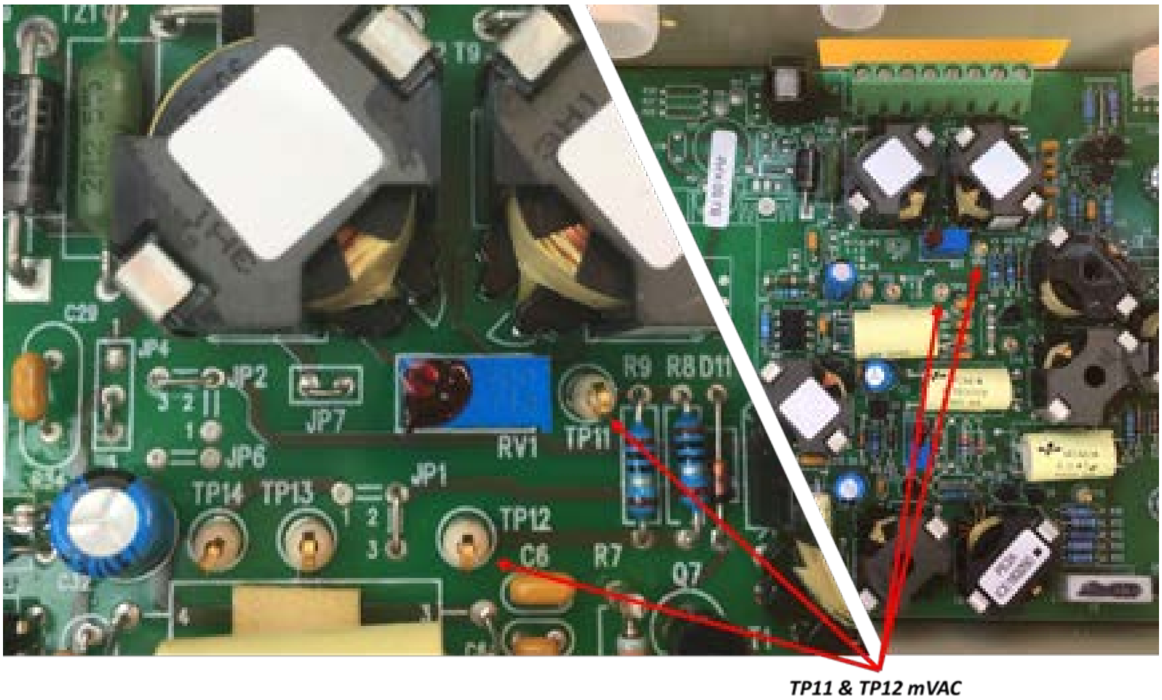


Figure 2 - BJ Unit TP11 & TP12

3. ETU

3.1 Examine the connections, check that they are secure.

3.2 Check all the terminals are tight.

3.3 On the terminal connection side of the ETU measure the voltage of the local PSU terminals (PSU A IN and PSU B IN). The measured voltage should be between 11.2 – 14.4 VDC.

3.4 Check the indications on the ETU. Check that the TRU and PWR FAULT LEDs are extinguished. If a fault indication is lit press the RST button, if this does not clear the fault or the fault recurs within 1.5 seconds the unit requires replacing.

Replacing the unit shall be classed as corrective maintenance

4. FINAL FUNCTION TESTS (ETU)

4.1 As a final function test of the ETS the output relay shall be proven to be operating correctly in conjunction with the operation of the treadle by following these steps:

4.2 Swipe the electronic treadle with the test block for the normal direction of travel.

4.3 Check that the ETU indication shows occupied.

4.4 Check that the relevant relay driven by the ETU output (QNR or other) deenergises.

4.5 Check that the ETU indication reverts to not occupied after the relevant time expires.

4.6 Check that the relevant relay driven by the ETU output (QNR or other) energises.

5. Dual Surge Arrestor

5.1 Measure the voltage across each signal connector on both the line and clean sides, these should measure greater than 11V.

A fault on the Surge Arrestor can cause a permanent occupation indication.

APPENDIX A - SET UP OF A NEW OR REPLACEMENT WHEEL SENSOR.

The following steps shall be followed for each BJ in the system. Where WDD wheel sensors are used the test block should be placed over the end of the wheel sensor whose frequency corresponds to that of the BJ under adjustment.

When installing new wheel sensors, they shall be symmetrically installed either side of the rail this has a direct correspondence to the setup, check mounting blocks are of the correct type and from the same batch checked by ensuring the branding on the blocks is of the same font and size.

This is shown by the label on the top of the WDD sensor.

a) Unplug the 8-way connectors at the BJ(s).

b) Power up the system and check that the voltage present at pin 8 of the BJ connector(s) is positive with respect to pin 7, measuring 8 to 15V.

c) Disconnect the power from the system, reconnect the BJ(s).

d) Power up the system.

e) Monitor the DC voltage between TP1(+) and TP2(-), adjust T9 transformer core until the largest peak voltage is found. This should be greater than 13.5VDC.

f) Using a True RMS multimeter monitor the mVAC between TP11 & TP12, for a new wheel sensor the reading should be between 27 – 29mV, if adjustment is required make a minor adjustment to the position of the internal wheel sensor, if this doesn't work insert a chamfered 1-3mm or 1-4mm shim (see figure 3) between the mounting bracket and base of the INNER wheel sensor, angle the wheel sensor away from the railhead to increase voltage or toward to reduce. The external wheel sensor requires NO adjustment

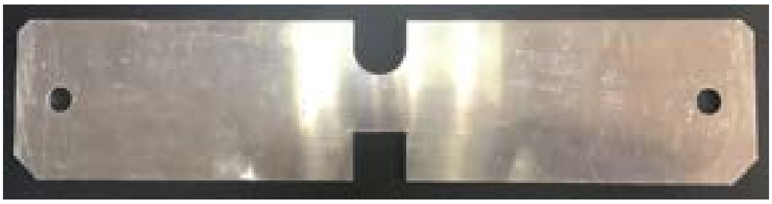


Figure 3 - 1-3mm chamfered shim

g) Check that the ETU ‘OCP’ LED illuminates when the test block is swiped across the internal detector, and the ‘CLR’ LED is illuminated after the time delay set by the configuration unit.

h) Check that when the test block is placed on the external detector the ETU does not indicate ‘OCP’, the green ‘CLR’ LED should remain illuminated.

i) Replace the BJ(s) lids and close and secure the mushroom lid.

END

Includes:	Electro-Pneumatic Trainstops
Excludes:	All other types of Trainstop

SERVICE A

1. Pump Unit

1.1 Check that the unit is secure on base.

1.2 Check the hydraulic fluid level, top up as necessary.

1.3 Examine the cable entry, cable gland, and tail cable sheath.

1.4 Check the terminations, clean and protect as necessary.

1.5 Examine the internal wiring.

1.6 Examine the actuator hoses and connections. Pay particular attention to:

a) Signs of leakage.

b) Chafing and damage.

c) Security.

Do not over tighten

1.7 Check the locking wires on hose connectors are intact.

1.8 Check the cover and unit and lubricate the padlocks.

1.9 Observe correct operation.

2. Trainstop Mechanism

2.1 Isolate the hydraulic mechanism by removing the fuse.

2.2 Remove all fire risks and potential obstructions from on or near the mechanism; e.g. oily waste, paper and ballast.

2.3 Where possible, observe the vertical movement of the track during passage of a train.

A movement of more than 25mm (1") shall be reported as corrective maintenance.

2.4 Clean and examine the cover, trainstop spring unit, stop arm, stop screw, journals, hydraulic actuator, mechanical connections, split pins, fixing bolts, microswitch and termination boxes, base assembly and sleeper packing.

2.5 Check that, when raised, top of trainstop arm is 76mm (± 5mm) above rail level.

2.6 Check that centre-line of train stop arm is 228mm (± 5mm) from running edge and observe that the trainstop is parallel to the track.

2.7 Check that both stop screws bear equally against the stop arm that tab washers are closed and locking wires are in place.

2.8 Examine the rubber gaiter for signs of damage and perishing.

2.9 Clean and lightly lubricate with lithium-based grease the main journal pin and detection return unit (enclosed spring unit).

2.10 Liberally apply adhesive grease the trainstop return spring.

2.11 Lubricate (oil) the remaining journals and pins.

2.12 Observe operation by manually depressing the stop arm and allowing the spring to return the arm to the 'ON' position.

2.13 Examine the tail cable, cable entry, cable gland, and check that the cables are not chafing.

3. Internal Connections

3.1 Examine wiring and terminals, clean and protect as necessary.

3.2 Examine microswitch assemblies and carriage for security and damage.

4. Tests

Carry out NR/SMS/PartB/Test/026 (Trainstop Calibration Test).

SERVICE B

5. Pump Unit Service

5.1 Carry out NR/SMS/PartC/PB11 (Clamp Lock Hydraulic Points) - Section 2 (excluding references to Power/ Manual Switch).

END

Includes:	Tripcock Tester located at Finsbury Park
Excludes:	All other Tripcock Testers

SERVICE A

1. Tripcock Tester

1.1 Remove all fire risks and potential obstructions from or near the Tripcock tester and associated equipment.

1.2 Examine the Tripcock tester for security and wear. Report any voiding.

1.3 Examine Tripcock tester springs for damage and wear.

1.4 Check the security of the treadle mounting base plates, brackets, and fixings.

1.5 Clean Tripcock ramps.

1.6 Test by operation of the ramps that they do not bind or catch during their travel back to the normal position.

1.7 Examine the treadle assembly, cable entries and cable glands for security and damage

1.8 Check that the treadle arm is intact and aligned and has not worn below 50% of original thickness.

1.9 Gauge Tripcock ramps to correct height using calibrated height gauge and adjust if necessary.

1.10 Check that when a 2mm gauge is placed between ramp and the height gauge that the bottom contacts of the treadle are made. Adjust the height of the treadle if necessary.

1.11 Clean and examine the exterior and interior of the treadle unit and lid. Do not disturb the timing screw.

1.12 Check the oil level and replenish as necessary using approved oil only (HVI-13).

1.13 Examine tail cable terminations. Clean and protect as necessary.

1.14 Examine internal wiring.

1.15 Test by operation of the ramps that the treadle timing is 3.5 to 4.5 seconds.

1.16 Apply lubrication (lithium grease) to the lid securing screws.

1.17 Replace and secure the treadle lid, taking care not to trap any wiring.

1.18 Apply lubrication to the ramps.

END

Includes:	Trainstops on the Northern City Line (NCL), Trainstop style "J" (self-lubricating), Trainstop style "HO", Trainstop fixed, Glass enclosed (GE) valve, separately attached (SA) valve
Excludes:	Electro-hydraulic Trainstops

General

The principle of operation of the Trainstop is by a head fitted to a moving arm which is fitted to the permanent way in such a manner, that when the signal is at danger (red) the arm is raised and when the signal clears the arm is moved down.

A Tripcock in the train braking system pipe work (train-pipe) below each driver's cab has its arm positioned downwards, and in this position isolates the train-pipe from atmosphere.

This Tripcock is aligned with the Trainstop arm so that when the arm is raised the Tripcock on a passing train will strike it and be rotated backwards, opening the train-pipe to atmosphere and so applying the train's brakes.

The Tripcock remains open to the atmosphere until reset by the train operator. The control circuits of the train are arranged so that motoring cannot take place if the emergency brake is being applied.

When the arm is down (signal clear) it does not obstruct the path of the Tripcock which consequently passes over unaffected.

The Trainstop is positioned in the track in line with the signal and the train Tripcock is fixed just rear of the driving position. This allows a train to draw up to the signal without being tripped.

The Trainstop is fixed outside the running rail on the right-hand side in the direction of traffic.

When in the danger or ON position the top of the arm is above the running rail level and when in the clear or OFF position the arm is lowered against the direction of traffic so that its highest point is at rail level or below.

The ON/OFF positions of the Trainstop arm are electrically detected by an integral circuit breaker box.

Every Trainstop is operated by a compressed air motor or cylinder. The compressed air is supplied from the air main via an EP Air Valve.

When the signal clears, air operates the motor thus depressing the arm to the lowered position (OFF).

When the signal goes to danger (red) the air is exhausted to atmosphere and the arm is returned to the up position (ON) by the integral spring(s) of the Trainstop.

SERVICE A

1. Trainstop Exterior

1.1 Isolate the train stop by operation of the main air cock. With the Trainstop arm in the lowered position, remove all retained air pressure by manually depressing the GE valve EP magnet to open the exhaust ports.

This causes the Trainstop head to rise and any associated signal to be replaced to danger.

1.2 Remove all fire risks, debris, and surplus ballast from the immediate area around the Trainstop.

1.3 Examine the Trainstop holding down bolts and tighten where necessary.

1.4 Examine the Trainstop casting for cracks and evidence of oil leaks.

1.5 Examine the blanked off cover on the casting for condition and security.

1.6 Examine the cover holding down screws.

1.7 Examine the Trainstop head and fixing bolts together with all connections to the Trainstop head including all split pins. Renew the split pins as necessary.

1.8 Lubricate the turn pins at the oil nipples provided.

1.9 Examine the filter cap for tightness and check the security of the retaining chain.

1.10 Examine the drain plug and tighten if necessary.

1.11 Examine the flexible air hose connections and plugs including the hose clips.

1.12 Examine the air hose between the Trainstop and the GE valve.

1.13 Examine the cable entry and the cable to the disconnection box. Tighten the retaining plates as necessary.

1.14 Examine the Trainstop packing for security and condition.

1.15 Examine the Trainstop ramp(s) and retaining plates and check the fixing bolts and screws for tightness.

1.16 Examine the earth bonding connections and cables for condition and security.

1.17 If the Trainstop is installed on bullhead rail, check that all adjacent rail keys are present and secure.

1.18 Check the setting of the Trainstop head in the raised position using a calibrated gauge (drawing N° CS 49901) as follows:

a) The top of the Trainstop head shall be 3 inches ± 1/8 inch (76mm ± 3mm) above a straight line joining the tops of the running rails.

b) The middle of the Trainstop head nearest the running rail shall be 6 inches ± 1/8 inch (152mm ± 3mm) from the inside edge of the running rail.

c) The width of the top of the Trainstop head shall not be less than 5 ½ inches (140mm).

1.19 Check that the air motor/cylinder is free from water and foreign bodies.

1.20 Check all cable terminations.

1.21 Check the interior of the Trainstop casting and remove any accumulated water and debris.

1.22 Check that the detection rod adjuster seal is intact.

1.23 Check all sealing gaskets and gaiters for condition.

1.24 Check all visible contact faces for cleanliness, flaking burning or excessive wear. Clean or replace contacts where necessary.

1.25 Check the Trainstop head return mechanism and springs for condition and correct operation.

1.26 Examine all split pins for security and condition. Replace where necessary.

1.27 Check the oil filter for cleanliness and condition.

1.28 Check the oil reservoir for cleanliness and correct level. Top up, if necessary, via the filter cap/filter with Shell “Tonna” T220 oil or equivalent.

Under no circumstances shall oil be added direct into the Trainstop casting.

1.29 Examine the turn pin connections to the detection box operating rod and the main shaft piston actuating roller and lubricate with Shell “T220” oil or equivalent.

1.30 Reconnect the air supply at the main air cock.

1.31 With the Trainstop head lowered, check all the hose connections for air leaks.

1.32 When all work is complete and covers replaced and locked, check the Trainstop for correct operation and confirm that the Trainstop head moves freely and smoothly between its full limits of travel.

<u>For fixed Trainstops only:</u>

1.33 Examine the fixed Trainstop head for condition and security. Check the fixing bolts for condition and security.

2. Glass Enclosed (GE) Valve

2.1 Brush and clean the outside of the valve and check for damage.

2.2 Clean the glass and check for ingress of water.

2.3 Clean the interior of the terminal box.

2.4 Check the security of the mountings and fixings.

2.5 Check the security of the locking device.

2.6 Check the cable entry for condition and security.

2.7 Clean and lightly lubricate the armature, valve stem, and magnet face. Check for damage or overheating.

2.8 Check that the exhaust ports are not obstructed.

2.9 Check and clean the air filters.

2.10 Check the air connections for tightness and leaks.

2.11 Check all electrical connections for condition and security.

2.12 Clean terminals and protect if required.

2.13 Check the wiring insulation for condition where visible.

2.14 Clean the terminal block and check for damage.

2.15 On completion of all work, confirm that the cap is replaced and secured correctly.

2.16 Test for correct operation.

3. Separately Attached (SA) Valve

3.1 Brush and clean the outside of the valve and check for damage.

3.2 Check the security of the mounting.

3.3 Clean and lightly lubricate the armature, valve stem, and magnet face. Examine for damage or overheating.

3.4 Clean and check the gauze filters.

3.5 Check that the exhaust ports are not obstructed.

3.6 Check the air connections for tightness and leaks.

3.7 Check all electrical connections for security and tightness.

3.8 Check the wiring insulation for condition where visible.

3.9 Check the condition of the insulating washers.

3.10 On completion of all work, confirm that the cap is replaced and secured correctly.

3.11 Test for correct operation of the mechanism.

SERVICE B

4. Trainstop Interior

4.1 Check that the 'ON' contracts in the detection box are broken when the Trainstop arm is depressed by 3/8 inch ±1/16 inch (11mm ±1.6mm), from the fully 'ON' position.

4.2 Check that the 'OFF' contracts in the detection box are made when the Trainstop arm is depressed by between 2 1/16 inch (52.5mm ±1.6mm) from the fully 'ON' position.

4.3 Check that with the "on" contracts of the Trainstop broken, the signal next in rear is held at danger until the Trainstop has returned fully to the "on" position.

4.4 Examine all paddle connections and electrical terminations.

4.5 Open the "Blower-Off" cock adjacent to the air motor and operate the Trainstop to the lowered position for 2-3 seconds by operating the GE valve.

4.6 When all work is complete and covers replaced and locked in position, check for correct operation of the mechanism.

NOTE: *To prevent failures due to freezing, Anti-Freeze (Ethylene Glycol) can be introduced into the air system and into the oil sump of self-lubricating types.*

APPENDIX A - J Style Trainstop

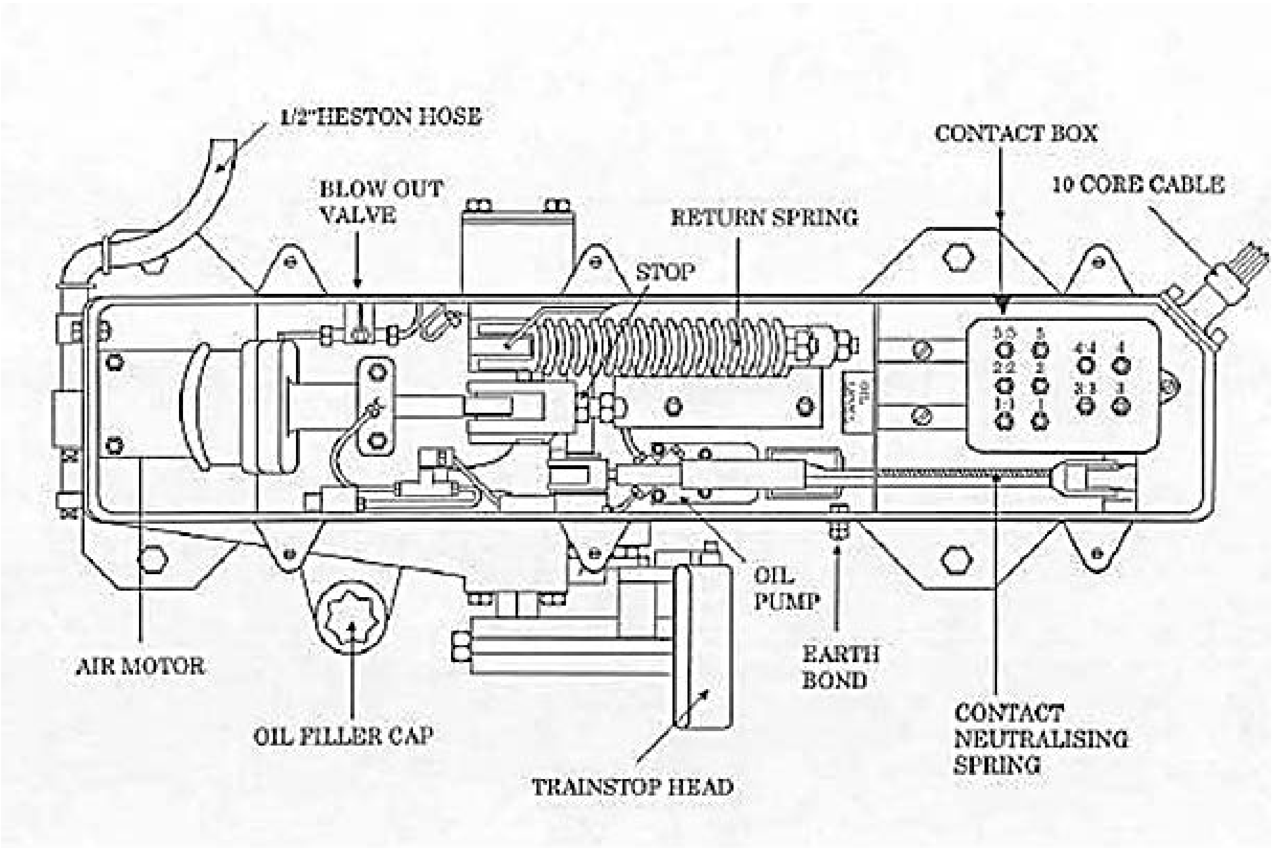


Figure 1 – J Style Trainstop

END

Includes:	Indusi train stop system used in the Pelaw-Sunderland-South Hylton area
Excludes:	All other types of Trainstop

General

Indusi is a German acronym of Induktive Signalsicherung, which means Inductive Signal Protection in English.

The system was first introduced on German railways in 1934 as a train control system with functionality similar to that of TPWS.

The German trackside equipment consists of passive resonant circuits using frequencies of 500Hz, 1000Hz and 2000Hz.

On the Tyne-Wear Metro the Indusi system is configured purely as a train stop and only the 1000Hz and 2000Hz frequencies are used.

Indusi trackside units are passive resonant circuits, referred to as Indusi Trackside Magnets, which can resonate at either 1000Hz or 2000Hz or be “inactive”.

A VR is provided to operate the Indusi train-stop via a voltage free contact and a contact of the VR is proved in the aspect of any associated stop signal, this prevents the signal from clearing before the Indusi train-stop has cleared.

There is no means of proving the ‘position’ of an Indusi train-stop itself.

Indusi Train Stops Associated with a Stop Signal.

a) With VR energised, the train-stop is active at 1000Hz and the train stop is Off.

b) With VR de-energised, the train-stop is active at 2000Hz and the train stop is On.

Indusi Train Stops Associated with Speed Control Train-Stops

a) With VR energised, the train-stop is inactive.

b) With VR de-energised, the train-stop is active at 2000Hz and the train stop is On.

Train-born ‘magnets’ continuously emit simultaneous AC magnetic fields at 1000Hz and 2000 Hz. When the train born magnet passes a trackside magnet, the trackside magnet resonates at either 1000Hz or 2000Hz absorbing energy from the train-born magnet.

The voltage in the associated resonant circuit on board the train drops, causing an associated train-born relay to de-energise. The trains response is determined by which relay de- energises.

When a Metro-train is authorised to pass a signal at danger, the driver of the Metro-train operates an override button on his console whilst passing the signal at danger, this imposes a 30kph speed restriction on the train until the train detects the next "green" Indusi trackside magnet.

If the 30kph speed limit is exceeded for 5 seconds, then an emergency brake application is imposed.

If a Metro-train passes a signal at danger without the use of the driver's 'override' button, the train-born train-stop system automatically applies magnetic track-brakes (located on the train's bogies) when the train passes over the trackside Indusi train-stop.

The magnetic track-brakes 'magnetically clamp' the train to the rails and bring the train to a stand within 150m.

The driver of the metro-train cannot then release the brakes until the speed of his train has reduced to below 3 kph.

After resetting the train stop following a red signal application, or when overriding a red signal (and when the Metro- train is first powered up) a 30kph speed limit is imposed until a green magnet is passed.

A white indicator light, 'the train-stop test/monitor indicator light', is provided on the metro-trains driver's console, this indicator light is continuously lit except when passing over active train-stop magnets.

The change of state of this indicator light whilst the train passes over the trackside magnet proves the presence of the Indusi train-stop trackside magnet. The yellow speed limit indicator lamp illuminates momentarily when passing over a 'green' trackside magnet.

REGULAR CHECK

1. Operational Check by Cab-Ride

1.1 Arrange to travel by Metro-train. Stand in a position to view the operation of the driver's train- stop test/monitor lights at the leading drivers cab. This shall be done without causing distraction to the driver.

1.2 As the train passes over each Indusi trackside magnet train-stop associated with a stop signal observe the operation of the driver's train-stop test/monitor lights and confirm that they are briefly extinguished as the train passes over each Indusi train stop.

Appendix A lists the action to be taken if the Test/Monitor lights fail to extinguish.

SERVICE A

This service shall also to be carried out after Pway work, or if Pway on-track machines (tampers etc) have been working in the area of the trackside magnets.

A test of all train-stops in the area affected by the work shall be carried out before Metro services are permitted to run again.

Particular care shall be taken to examine the Indusi Tail cable for damage where it passes under the rail.

2. All Indusi Trackside Magnets

2.1 Remove all fire risks from or near the Indusi Trackside Magnets Oily waste, paper etc.

2.2 Check that the Indusi Trackside Magnet and its fixings are clear of ballast.

2.3 Check that all cables are correctly located, secured and free from damage, check particularly where the cable passes under rails.

2.4 Check for physical damage to the Indusi Trackside Magnet and its mountings.

2.5 Check fixing lugs adjacent to the rail web for signs of fracture.

2.6 Gauge and Record the Indusi train-stop.

a) Running edge to longitudinal centre line of magnet: 220mm ±5mm.

b) The top of the Indusi train stop should be level with crest of the rail, or up to 10mm below crest of rail level.

It is vital to the safety critical operation of the train stop that the height of the Indusi Trackside Magnets is no more than 10mm below crest of the rails. The 10mm is to allow for rail wear.

It is recommended that a treadle line / bob weights and associated gauge or rule are used in to measure the height of the Indusi Trackside Magnet.

2.7 Check that all fixings are secure and that spring washers and locknuts are fitted where required.

2.8 Check that the Indusi train stop is mounted centrally in the ballast bay, or near the fastening first approached by normal traffic, Rectify as necessary.

2.9 Clean the Indusi Trackside Magnet.

2.10 When required, sparingly Lubricate threaded mounting components with grease This is to prevent corrosion and to assist with the future removal of components.

3. Indusi Trackside Magnets Associated with Stop Signals

3.1 With the associated signal at red, Test the Indusi train-stop trackside magnet (Appendix E). Record the obtained values on the record card.

3.2 With the associated signal displaying a precede aspect: Test the Indusi Train Stop trackside magnet (Appendix E).

Record the obtained values on the record card.

Information on the operation of the available testers are given Appendixes B, C and D.

Tables of results are given in Appendix E.

4. Indusi Trackside Magnets Associated with Speed Control

4.1 Using the Indusi Trackside Magnet Tester set to 2000Hz, operate the treadle or track circuit and measure the time to the change in the 2000Hz reading occurring.

Record the time on the record card and confirm it is in agreements with the other times recorded.

4.2 Using the Indusi speed control train stop trackside magnet set at 2000Hz, Test the Indusi Trackside Magnet. Record the obtained values on the record card.

4.3 With the Indusi speed control train-stop trackside magnet under test set to Inactive, Test the Indusi Trackside Magnet. Record the obtained values on the record card.

Information on the operation of the available testers are given Appendixes B, C and D.

Tables of results are given in Appendix E.

5. All Indusi Trackside Magnets

5.1 Where possible observe the vertical movement of the track in the vicinity of the Indusi trackside magnet during the passage of a train. Any vertical movement greater than 12mm (0.5") shall be reported as corrective maintenance.

SERVICE B

6. Cables

6.1 Carry out NR/SMS/PartB/Test/054 (Cable insulation Test) on all tail cables.

APPENDIX A - Actions if the Test/Monitor lights fail to extinguish

If the Trains Test/Monitor Indicator Lights Fail to Extinguish or If a train stop fails to extinguish the drivers train-stop test/monitor indicator lights in the metro-trains cab then the following actions are to be undertaken:

1. The Signaller at Tyneside IECC shall be informed and signals in rear reading towards the suspect train stop shall be signed out of use until the suspect train-stop is retested using the train stop tester.

2. The following details shall be recorded and details forwarded via fault control for attention of the Tyne- Wear System Controller at Gosforth:

   a) Metro-train number.

   b) Leading cab designation.

APPENDIX B - Use of the Indusi Trackside Magnet Instruments

Indusi Trackside Magnet test current (Strom) values should be to a maximum value of 27mA for a new Indusi Trackside Magnet. However, due to aging of the Indusi Trackside Magnet components, these test values can rise gradually between maintenance visits up to maximum permissible value of 35mA.

Provided this rise is gradual, readings up to a maximum value of 35mA are acceptable. However, if a sudden rise of greater than 5mA occurs between maintenance visits and the new value is now above 27mA, the train stop is to be treated as defective.

Should a defective train stop be found using the train stop tester, then all stop signals reading up to the defective train stop shall be signed out of use until the defective train stop magnet is replaced.

APPENDIX C - Description of Indusi Trackside Magnet Test Instruments Manufactured by Siemens

There are currently two versions of Indusi Trackside Magnet Tester manufactured by Siemens One instrument has a push-button marked pruef-T and the other instrument has a two-way toggle switch (Toggle one way to set up the instrument and the other way to perform the test).

The Siemens trackside magnet testers are contained within a metal yellow enclosure with all the controls and indications on the top panel.

An internal rechargeable battery powers the unit; a socket provided for the power lead is located on the front panel.

Spacers on the base of the unit maintain the correct air gap between the Indusi trackside magnet and the tester for test purposes.

At the bottom left are two displays and to the right of them is a selector switch and variable frequency switch.

German Legend	English Meaning
Aus	Off
SPG	Battery Charge Level
Laden	Charge
Strom	Current
Pruef	Test

Table 1 - Operation of the Siemens Trackside Magnet Tester

1. Check that the Indusi trackside magnet tester is fully charged: by selecting SPG on the selector switch and reading the value in the Strom display: The current value should be between 110mA and 150mA.

A current value below 110mA indicates the Indusi trackside Magnet Tester requires re-charging.

To recharge the Battery, set the selector switch to SPG and plug the unit into the mains.

A green LED illuminates to indicate when the charging has ceased and the unit is fully charged.

Charging can take up to 7 hours depending upon the state of the charge in the battery. Fully changed battery will allow 100 tests to be performed.

With the tester is at least one metre away from any metallic objects, select either 1000Hz or 2000Hz.

Depending on the type of Indusi trackside magnets tester press and hold the 'pruef' button or select and hold the calibrate toggle switch.

After 1-2 seconds the frequency is displayed.

Adjust to the correct frequency using the variable frequency adjustment.

The current display 'Strom' should show a reading of 90mA (+1mA).Figure 1

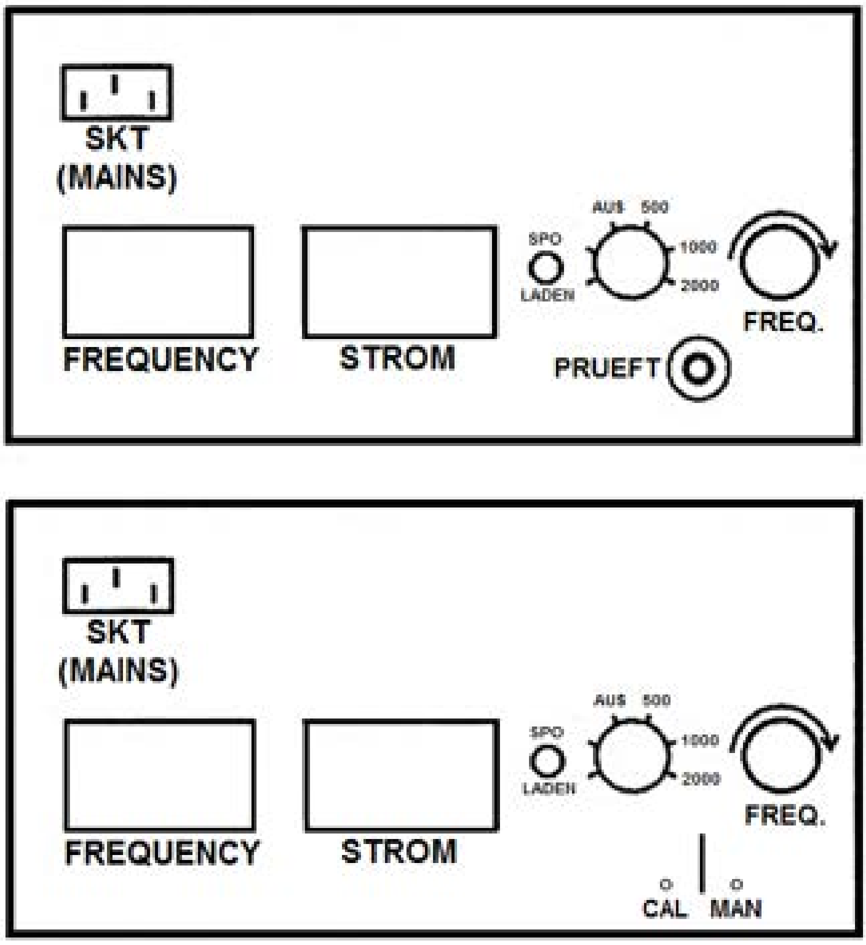


Figure 2 - Trainstop Magnet Testers Front Panel

APPENDIX D - Description of Indusi Trackside Magnet Test Instruments Manufactured by IPM Systems Ltd

This tester has been reversed engineered by IPM Systems Ltd for use on the Indusi system.

The IPM Systems trackside magnet tester is contained within a metal yellow enclosure with all the controls and indications on the top panel.

An internal rechargeable battery powers the unit; a socket provided for the power lead is located on the front panel.

A single overnight charge fully recharges a depleted battery. An icon in the top left of the screen displays the battery condition at all times.

There are four blue operation push buttons and a red power on/off button positioned to the right of the screen.

The blue buttons are unnumbered as their function is listed on the screen, but for clarity purposes button one is at the top and button four at the bottom.

Spacers on the base of the unit maintain the correct air gap between the trackside magnet and the tester for test purposes.

Figure 3 - IPM Systems Trackside Magnet Tester

1. Operation of the IPM Systems Trackside Magnet Tester

Figure 4 - Start Screen of Tester

1.1 At switch on the screen shown above is displayed. The relevant frequency is selected via button 1 or 2. Once the operating frequency has been selected, the unit should be held clear of any metal objects and the display checked to confirm the current reading is circa 80mA.

Figure 5 - Display with 2000Hz selected

1.2 Button 3 from the start screen displays the information page. Button 4 exits the last selected test or information screen and returns you to the start screen.

Figure 6 - Display showing information page (battery being charged)

1.3 The unit automatically switch off 60 seconds after the last button operation to save power.

APPENDIX E - Indusi Trackside Magnet Test

Signal Aspect	Frequency Selected	Frequency in Display	Current Reading
Stop	1000Hz	993Hz to 1019Hz	>60mA <80mA
	2000Hz	1988Hz to 2035Hz	>0mA <27mA
Proceed	1000Hz	993Hz to 1019Hz	>0mA <27mA
	2000Hz	1988Hz to 2035Hz	>60mA <80mA

Table 2 – Frequency and Current Indications

Indusi Trackside Magnets associated with Speed Control:

Trainstop Condition	Frequency Selected	Frequency in Display	Current Reading
Active at 2000Hz	1000Hz	993Hz to 1019Hz	>60mA <80mA
	2000Hz	1988Hz to 2035Hz	>0mA <27mA
Inactive	1000Hz	993Hz to 1019Hz	>60mA <80mA
	2000Hz	1988Hz to 2035Hz	>60mA <80mA

Table 3 - Frequency and Current Indications with Speed Control

END

Includes:	Siemens - JE Style Trainstops
Excludes:	All other types of Trainstop

Trainstops contain moving parts which can cause severe personal injury.

Protection / Possession arrangement shall be taken before commencing work on any Trainstop.

Additional Maintenance equipment

- Trip arm gauge

SERVICE A

1. Routine Maintenance

1.1 Isolate the supply to the Trainstop.

1.2 Check the area surrounding the machine and remove any debris that could affect the operation of the machine, particularly in the area under the Trip Arm.

1.3 Check the interior of the Trainstop is free of accumulated water.

If water is found, remove it (drain plugs are provided in the base).

1.4 Check the condition of the sealing strip around the inside of the top cover.

1.5 Check the machine casing shows no evidence of cracks.

If cracks are suspected, report this should be reported to the SM(S).

1.6 Check the four fixings securing the machine to the bearer are secure. Tighten if necessary.

1.7 Check that any ramps are secure and undamaged. Tighten fixings if necessary.

1.8 Check that the Trainstop casing is bonded to the specified earth and that the bonding cable is protected where it passes under any rail.

1.9 Check that the electrical cable linking the Trainstop to the disconnection box is undamaged - Look particularly for cuts through the insulation and for crushing. Report any damaged cable.

1.10 At the Dashpot, unscrew the cover and check the oil level. If necessary top up to the fill mark using 20W-50 engine oil (see Figure 1).

1.11 Clean up any spilt oil using a clean cloth.

1.12 Replace the dashpot cover and screw up finger tight.

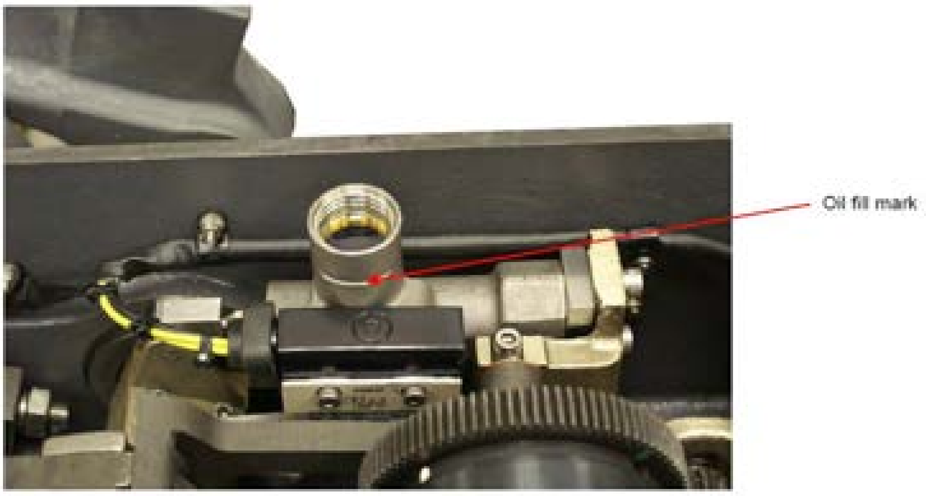


Figure 1 – Dashpot Oil Fill Mark

1.13 Check the operation of the damper as follows:

- Manually lower the Trip Arm (firm push required);
- Release the Trip Arm and check it returns to the raised position, taking more than one second. It should not slam back up, causing mechanical shock to the machine.

1.14 Carry out SMS Test 028 - JE Style Trainstop Positioning Check.

1.15 Carry out SMS Test 027 - JE Style Trainstop Detection Test

PERIODIC TASK

2 Full Overhaul

2.1 The Trainstop shall be removed from service and sent for re-servicing.

End

Includes:	Train Stops at Manchester Metro
Excludes:	All other Types of Train Stops

Equipment Identification

SERVICE B

1. Inductor between Rails

1.1 Remove debris from the area of the inductor between the rails.

1.2 Examine inductor for damage.

1.3 Examine fixings are undamaged and secured to the sleepers.

1.4 The inductor must have its transversal axis in the axis of the track with a tolerance of ± 1 cm.

1.5 The top of the inductor must be at the level of the rail top with a tolerance of +0, -5cm.

2. Test

2.1 In the location case, with the signal off, measure and record the voltage across the links W1/V1 feeding the Trainstop:

The expected voltage range is 4.5v to 7.5v (Results are generally 4.9v to 5.0v)

2.2 In the location case, with the signal off, measure and record the current at the links W1/V1 feeding the Trainstop:

The expected current range is 110mA to 190mA.

If the current is outside the 100 to 200mA range then advise the SM(S).

All result should be recorded on either paper or digital record card.

END

Includes:	Wheel Stops (Trainstops) located at Battersea Pier and Slade Green
Excludes:	All other types of Wheel Stop and Trainstops.

SERVICE A

1. Pump Unit (all types)

1.1 Check the concrete base, power unit mounting and fixings. The pump unit should be reasonably level (to the eye) and secure.

1.2 Check the visible tail cable and route.

1.3 Remove the pump unit cover.

1.4 Check that the pump unit cover opens freely, Lubricate as necessary.

1.5 Check the manual control selection mechanism and solenoid valve block is secure.

1.6 Check that the normal / reverse selector cannot be operated with the switch turned to ‘Power’.

1.7 Turn pump to “Manual” Position.

1.8 Check that the switch cannot be turned to power whilst operating the normal/reverse selector.

1.9 Examine cable entry, cable gland and tail cable sheath.

1.10 Clean and examine terminals, terminal block assembly and fixings. Protect as necessary.

1.11 Examine internal wiring.

Hydraulic fluid can cause degradation of insulation.

1.12 Clean and examine the pump unit, motor assembly and all fixings.

Look for leaks, particularly around the base of the hand pump mechanism, the cover plate gasket and at the base of the motor.

Unused ports shall be sealed to prevent fluid from being expelled from the reservoir. Check for leaks.

Power packs are labelled:

- MN, MR – Main Normal, Main Reverse
- BN, BR – Supplementary Normal,

Supplementary Reverse Power packs fitted with Snorkel Valves have a label saying ‘Snorkel Valve Fitted’ or a blue patch fixed to the power pack body.

1.13 Examine the motor brushes. Brushes shall slide freely in the holders and seat fully on the commutator. Brushes shall be replaced when worn to 10mm in length.

This task does not apply to brushless motors.

1.14 Check the hydraulic fluid level and (where fitted) the level indicator. If a top up greater than 0.5 litres is required check for leaks in the hydraulic system, Rectify as required.

If a leak cannot be found, advise the SM(S) before the end of the shift.

If more than 1 litre is required, carry out TEST FOR AIR (015).

1.15 Examine hydraulic ram hoses and connections. Pay particular attention to: Signs of leakage.

- Chafing and damage.
- Security.
- Significant corrosion.

Do not over tighten hose connections.

1.16 Check that the hose length does not exceed the requirement for purpose.

Beware of excess length of hose being wrapped around the power pack.

1.17 Check the locking wires on hose connectors are intact.

1.18 Examine the manual override pins for signs of contamination / corrosion. Clean the manual override pins and apply mineral oil to the pins.

1.19 Operate the normal/reverse selector a number of times and Check that they do not stick or remaining depressed following operation.

1.20 Refit the cover to the unit. Check that a RKB222 padlock is fitted to the local control unit hinged lid.

2. Exterior (All Types)

2.1 Examine and Dust exterior casing.

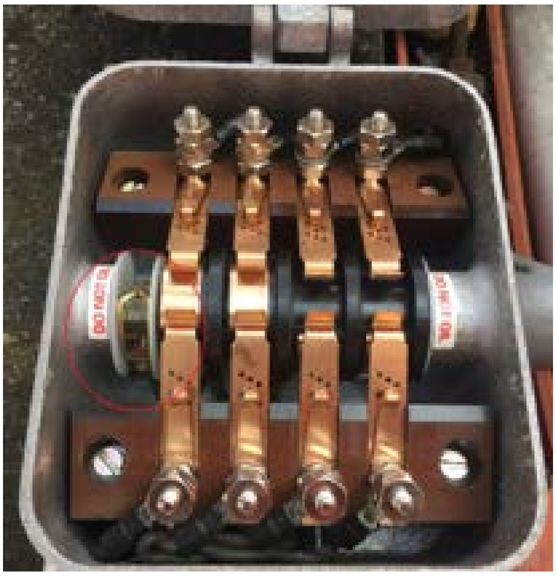
2.2 Examine fixing screws and bolts.

2.3 Check the linkage to the circuit controller. Lubricate as necessary.

2.4 Examine cable entry, cable gland and tail cable sheath.

2.5 Check that all terminal shrouds are fitted.

2.6 Check the spreading clamp screw is tight on the circuit controller's cam shaft. (circled in red)



3. Internal (All Types except Allen Bradley)

3.1 Examine interior and cover. Look particularly for contamination by metallic dust, dirt, or particles.

If any is found, carefully clean and report the condition to your SM(S). More details on this can be found in NR/SMS/LV00.

3.2 Check the lid gasket is undamaged and effective.

3.3 Examine drive, pivots, studs, rollers, spiral pins, split pins and drive lock locknuts. Check they are not seized.

3.4 Lightly Lubricate (wipe away excess) pivots and pins.

4. Wiring (All Types except Allen Bradley)

4.1 Examine cables and wires. Look particularly for:

a) Degraded or damaged (chafing) insulation.

b) Trapped wires.

c) Unsupported wires.

d) Risk of short circuit (electrical contact with adjacent terminals, casing or metal parts).

e) Fouling by moving parts.

f) Contamination.

4.2 Examine terminations clean and protect as necessary.

5. Contact Finger Type Circuit Controllers

5.1 Examine contact bands/ segments and contact fingers. If any are worn, damaged, or loose, report as corrective maintenance.

- Clean with a lint free cloth moistened with switch cleaner.
- Apply a protection agent as required (except contact faces).
- Apply an approved contact lubricant to the contact bands / segments.

6. Bearings (All Types except Allen Bradley)

6.1 Check and Lubricate bearings.

Caution: Bearings made from OILITE or nylon shall not be oiled (see NR/SMS/LV00).

7. Wheel Stop

7.1 Check the Wheel Stop and rail bracket for obvious signs of cracking on castings.

7.2 Check locking wire is installed on the hydraulic hose to actuator where suitable.

7.3 Check that the Wheel Stop is visibly painted yellow.

7.4 Check and Clean wheel stop number plate.

7.5 Remove any potential fire risks and obstructions.

7.6 Clean, check and examine all linkages, Pivots and split pins for security.

7.7 Lubricate all linkages and pivots.

7.8 Check torque (200Nm) wheel stop assembly to rail.

Indicated by the red circles on the picture to the right.

7.9 Grease pivots via grease nipples located above the actuator on the casting and adaptor block to wheel stop.

7.10 Check that the locking nut is tight connecting the actuator to adaptor block and the actuator end stop.

Indicated by the red circles on the picture to the right.

8. Final

8.1 Check for any slackness or maladjustment and that the equipment operates correctly. If any defects are found, the equipment shall be treated as faulty and the signaller informed.

8.2 Check and carefully replace cover/ gasket and secure/ lock. Lubricate padlock where fitted.

8.3 Protect exposed external screw threads with adhesive type grease.

8.4 Operate equipment and observe correct operation.

SERVICE B

9. Pump Unit (all types)

9.1 Renew the motor brushes. Check that they slide freely and seat fully on the commutator.

This task does not apply to brushless motors.

9.2 If not monitored by ELD, carry out DYNAMIC EARTH TEST (052).

Where this is not practical or safe to do, it can be undertaken as part of the location or equipment room tasks (NR/SMS/EL21 or NR/SMS/EL31).

10. Circuit Controllers

10.1 If a circuit controller is found to be operating incorrectly or is incorrectly adjusted, it shall be treated as faulty and taken out of service immediately.

11. Wheel Stop Detection Test

11.1 Carry out NR/SMS/Test 006 – Wheel Stop Detection Test.

END

Includes:	Marconi V322 and V327 (with separate or combined CCU), Pye SuperLynx, Rediffusion Link 109 and associated equipment
Excludes:	All CCD (digital) cameras and associated equipment

General

The camera column, winch gear, and safety devices shall be inspected by a competent person.

High voltages are present in the camera housing; extreme caution shall be taken (See NR/SMS/PartC/EL00 (Electrical Equipment - General) - Hazards Associated with Electrical Supplies).

SERVICE A

1. CCTV Location

1.1 Maintain the trackside apparatus case or equipment room in accordance with NR/SMS/PartC/EL21 (Trackside Apparatus Case) or NR/SMS/PartC/EL31 (Equipment and Relay Rooms).

1.2 Switch the CCTV over to the standby power supply and check that the Signaller receives a satisfactory picture. Switch the main power on again and check that the cameras operate correctly.

2. Analogue Cameras

2.1 Ask the Signaller for permission to work on one of the two cameras. Lower the camera that is not in use to the bottom of the column.

2.2 Clean and examine the wiper blades. Replace degraded wipers or rubber inserts.

2.3 Lightly lubricate the wiper arm hinge and bearing.

2.4 Wipe and open the camera housing. Carefully wash both sides of the glass window

Use a clean lint free cloth moistened with isopropyl alcohol or a proprietary glass cleaner. Remove any smearing.

2.5 Check that the heater, thermostat, and fan are working. This depends on the ambient conditions. Lightly lubricate fan bearings.

2.6 Dust the inside of the housing as required.

2.7 Carefully clean the camera lens. Use a special lens cleaning tissue or camel-hair brush. Do not scratch the lens.

2.8 Examine all plugs and connections.

2.9 Check that the lens iris and shutter correctly operate.

2.10 Examine the inside of the camera housing for water leaks. Report any leaks as corrective maintenance.

2.11 Close up the camera housing; Check that all seals and electrical connections are intact. Check the camera and wiper operation. Check that the wiper parks out of sight of the camera.

2.12 Repeat 2.1 to 2.11 for the other camera.

2.13 Raise the camera and examine the camera cable outer sheath. Look particularly for cracking and water penetration.

3. Level Crossing Monitoring Point

3.1 Maintain the CCTV apparatus to NR/SMS/PartC/EL31 (Equipment and Relay Rooms).

3.2 Clean and examine the level crossing monitors and control panel. Check that each camera provides a satisfactory picture:

a) During daylight, and

b) During darkness (this might be arranged separately).

The crossing picture shall be clear and cover the whole of the crossing area between the road STOP lines (the LC ground plan shows the area to be covered).

Do not do anything that reduces the picture coverage.

c) Image: Check that the image of the level crossing is not excessively burned onto the screen.

d) Focus: It is particularly important to check the focus during darkness because focus adjustment is more critical when the lens iris is wide open

e) Picture Quality: If you need to adjust the picture quality, use the brightness and contrast controls.

If there are external controls available, you might also adjust the vertical hold, horizontal hold, focus, scan, synchronisation, and height.

If the picture quality is bad, you should also check that the bridge / terminate switches on the back of the monitors are set correctly (‘Terminate’ for one coaxial cable, ‘Bridge’ for two coaxial cables).

If you cannot obtain a satisfactory picture, report it as corrective maintenance.

3.3 Repeat 3.2 for the spare / standby monitor:

3.4 Confirm with the Signaller that all camera and wiper functions are working; confirm that they have a good picture and good view of the crossing.

SERVICE B

4. Full System Test

4.1 Carry out NR/SMS/PartB/Test/046 (Level Crossing CCTV Camera Test).

4.2 If provided, carry out NR/SMS/PartB/Test/047 (CCTV Transmission System Tests).

4.3 If provided, on the HF Tx system NR/SMS/PartB/Test/062 (Line Protection Unit Test).

END

Includes:	Panasonic CD20; Philips LD0702, LD0502; Grundig FA85, Mk2H, FA878 and associated equipment
Excludes:	All Analogue (Vidicon) cameras and associated equipment

General

The camera column, winch gear, and safety devices shall be inspected by a competent person.

There should be a record on site. Tell your SM(S) if this record is missing or out of date.

SERVICE A

1. CCTV Location

1.1 Maintain the trackside apparatus case or equipment room in accordance with NR/SMS/PartC/EL21 (Trackside Apparatus Case) or NR/SMS/PartC/EL31 (Equipment and Relay Rooms).

2. CCD Cameras

Where the cameras are a CCD type mounted in a modern housing designed specifically for CCD cameras, then there is usually no requirement to lower the cameras at this service. if in doubt, ask your SM(S).

2.1 In liaison with the Signaller, check that:

a) They are satisfied with the quality of pictures from both cameras.

b) That all functions on both cameras operate correctly. Investigate and rectify any problems found.

2.2 From ground level, visually check the camera housings, column, cable, and fittings.

Investigate and rectify any problems found.

3. Level Crossing Monitoring Point

3.1 Maintain the CCTV apparatus to NR/SMS/PartC/EL31 (Equipment and Relay Rooms).

3.2 Clean and examine the level crossing monitors and control panel. Check that each camera/monitor combination provides a satisfactory picture:

a) During daylight, and

b) During darkness (this may be arranged separately).

The level Crossing ground plan shows the area to be viewed by the cameras.

The crossing picture shall be clear and cover the whole of the crossing area between the barriers and normally out at least as far as the road STOP lines.

Do not do anything that reduces the picture coverage below that in the ground plan.

c) Image: Check that the image of the level crossing is not excessively burned onto the screen.

d) Focus: It is particularly important to check the focus during darkness because focus adjustment is more critical when the lens iris is wide open.

e) Picture Quality: If you need to adjust the picture quality, use the brightness and contrast controls.

If there are external controls available, you may also adjust the vertical hold, horizontal hold, focus, scan, synchronisation and height.

If the picture quality is bad, you should also check that the bridge/terminate switches on the back of the monitors are set correctly (‘Terminate’ for one coaxial cable, ‘Bridge’ for two coaxial cables).

If you cannot obtain a satisfactory picture, report it to your SM(S).

3.3 Repeat step 3.2 for the spare/standby monitor:

SERVICE B

4. CCD Cameras

4.1 Ask the Signaller for permission to work on one of the two cameras. Lower the camera that is not in use to the bottom of the column.

4.2 Clean and examine the wiper blades. Replace degraded wipers or rubber inserts.

4.3 Lightly lubricate the wiper arm hinge and bearing.

4.4 Wipe and open the camera housing. Carefully Wash both sides of the glass window. Use a clean lint free cloth moistened with isopropyl alcohol or a proprietary glass cleaner. Remove any smearing.

4.5 Check that the heater and thermostat are working. This depends on the ambient conditions.

4.6 Dust the inside of the housing as required.

4.7 The camera should be sited as far back in housing as it can go without the sides or top of housing, or the wiper appearing in the field of view.

This is to give the camera lens maximum shading from direct sunlight, which can otherwise cause a problem at certain times of the day.

4.8 Carefully clean the camera lens as required. Use a special lens cleaning tissue or camel-hair brush. Do not scratch the lens.

4.9 Examine all plugs and connections.

4.10 Examine the cable gland for security and tightness.

4.11 Examine the inside of the camera housing for water ingress. Report any leaks to your SM(S).

4.12 Carry out NR/SMS/PartB/Test/046 (Level Crossing CCTV Camera Tests).

4.13 Close up the camera housing; Check the camera and wiper operation; make sure that the housing lid is seated correctly on the seal; Check that the wiper parks out of sight of the camera.

4.14 Raise the camera; Examine the camera cable outer sheath for problems. Look particularly for cracking and water penetration.

4.15 Confirm with the Signaller that all camera and wiper functions are working; confirm that they have a good picture and good view of the crossing.

4.16 Repeat 4.1 to 4.15 for the other camera.

4.17 If provided, carry out NR/SMS/PartB/Test/047 (CCTV Transmission System Tests).

4.18 If provided on the HF Tx system, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/TV03		
Tail Lamp CCTV Digital Systems		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Plettac FAC858NRF cameras, TEW LCD TFT monitors and associated equipment
Excludes:	All other types of CCTV digital systems

General

Tail lamping cameras and associated monitors in signal boxes are usually provided to allow the Signaller to check that a train is complete, after it has traversed a section of track that might not be fully track circuited.

Installations can vary using only one camera and monitor or a duplicated system as in level crossing CCTV systems.

SERVICE A

1. CCTV Location

1.1 Maintain the trackside apparatus case or equipment room in accordance with NR/SMS/PartC/EL21 (Trackside Apparatus Case) or NR/SMS/PartC/EL31 (Equipment and Relay Rooms).

2. CCD Cameras

Where the cameras are a CCD type mounted in a modern housing designed specifically for CCD cameras, (PADS number: 089/12743) then there is usually no requirement to lower the cameras at this service. If in doubt, ask your SM(S).

2.1 In liaison with the Signaller, check that:

a) They are satisfied with the quality of pictures from both cameras.

b) That all functions on both cameras operate correctly.

Investigate and rectify any problems found.

2.2 Visually check the camera housings, column, cable, and fittings. Investigate and rectify any problems found.

3. Camera Monitoring Point

3.1 Maintain the CCTV apparatus to NR/SMS/PartC/EL31 (Equipment and Relay Rooms).

3.2 Examine and the Tail Lamp observation monitors and control panel. Clean as required. Use approved cleaning materials.

3.3 Check that each camera/monitor combination provides a satisfactory picture during daylight, and during darkness (this may be arranged separately).

At night, moving trains appear to have a ‘jerky’ motion, this is normal.

a) Image: Make sure that the image is not excessively burned onto the screen (with the monitor turned OFF).

b) Focus: It is particularly important to check the focus during darkness because focus adjustment is more critical when the lens iris is fully open.

c) Picture Quality: If you need to adjust the picture quality, use the brightness, contrast and sharpness controls (via the on-screen menu system).

If the picture quality is bad, check that the bridge/terminate switches on the back of the monitors are set correctly (‘Terminate’ for one coaxial cable, ‘Bridge’ for two coaxial cables).

If you cannot obtain a satisfactory picture, report it to your SM(S).

3.4 Check that the tail lamp of a passing train is clearly visible.

3.5 If provided repeat 3.2 and 3.3 for the spare/standby monitor/camera.

SERVICE B

4. Camera(s)

4.1 Ask the Signaller for permission to work on the camera. On systems with two cameras, ask for permission to work on one of the cameras.

4.2 Clean and examine the wiper blades. Replace degraded wipers or rubber inserts.

4.3 Lightly lubricate the wiper arm hinge and bearing.

4.4 Wipe and open the camera housing. Carefully wash both sides of the glass window.

Use a clean lint free cloth moistened with isopropyl alcohol or a proprietary glass cleaner. Remove any smearing.

4.5 Check that the heater and thermostat are working. This is dependent on the ambient conditions.

4.6 Dust the inside of the housing as required.

4.7 Check that the camera is sited as far back in housing as it can go without the sides or top of housing, or the wiper appearing in the field of view.

This is to give the camera lens maximum shading from direct sunlight, which can otherwise cause a problem at certain times of the day.

4.8 Carefully clean the camera lens as required. Use a special lens cleaning tissue or camel-hair brush. Do not scratch the lens.

4.9 Examine the following:

a) All plugs and connections.

b) Cable gland for security and tightness.

c) The inside of the camera housing for water ingress. Report any leaks as corrective maintenance.

4.10 Carry out NR/SMS/PartB/Test/048 (Tail Lamp CCTV Camera Tests).

4.11 Close up the camera housing. Check the camera and wiper operation. Check that the housing lid is seated correctly on the seal. Check that the wiper parks out of sight of the camera.

4.12 Examine the camera cable outer sheath for problems. Look particularly for cracking and water penetration.

4.13 Confirm with the Signaller that all camera and wiper functions are working, have a good picture and good view of train tail lamps.

4.14 If provided, repeat 4.1 to 4.13 for the other camera.

4.15 If provided, NR/SMS/PartB/Test/047 (CCTV Transmission System Test).

END

Includes:	All Airport Tripwires, Also Bank-Slip Detectors using similar principles
Excludes:	All other types of Tripwires and Airport Trip wires in Scotland (TW02)

Airport tripwire systems are required where airport runways have railway lines nearby.

They detect planes overrunning the runway and sound an alarm in the Signal box and replace protecting railway signals to danger.

They are either based on a mechanical wire holding off a weighted circuit controller or an isolated 50V electrical wire circuit holding up a standard signalling relay.

Whichever system is used, the wire is supported on telegraph poles or similar posts approximately 8-12 feet high parallel to the railway across the line that an aircraft could overrun.

There might be arrangements for degraded working provided in the Signalling system that in the event of a failure of the Tripwire system.

These often restrict aspects of signals over the protected section to single yellow.

SERVICE A

1. Mechanical Wire Systems Only

1.1 From Ground level inspect all posts. Check for rot in wooden posts, especially at or near ground level. Check any guy ropes are tight.

1.2 Visually check the wire throughout its length for corrosion. Check pulleys appear to be supporting the wire correctly.

1.3 Carry out NR/SMS/PartC/LV31 (Circuit Controllers), on the circuit controller.

1.4 In conjunction with the Signaller, function test the system by releasing the wire at the end furthest from the circuit controller and check with the Signaller that the alarms operate, and the protecting signals return to Red or cannot be cleared from Red.

1.5 Re-terminate the mechanical wire and restore the Tripwire system to normal use.

2. Electrical Wire Systems Only

2.1 From Ground level inspect all posts. Check for rot in wooden posts, especially at or near ground level. Check any guy ropes are tight.

2.2 Visually check the wire and any insulators throughout its length for problems.

2.3 In conjunction with the Signaller, function test the system by removing a fuse or a link at the power supply end of the circuit and check with the Signaller that the alarms operate, and the protecting signals return to Red or cannot be cleared from Red.

2.4 Replace the fuse/link and restore the Tripwire system to normal use.

3. Degraded Working (Where Provided)

3.1 In conjunction with the Signaller, function test any signalling controls provided for degraded working in the event of a failure of the Tripwire system.

3.2 This shall normally include protecting signals being restricted to single Yellow

END

Includes:	Airport Trip wires in Scotland
Excludes:	All Airport Tripwires, Also Bank-Slip Detectors

GENERAL

Airport tripwire systems are required where airport runways have railway lines nearby. They detect planes overrunning the runway and sound appropriate alarms in the Signal box and replace protecting railway signals to danger.

They are either based on a mechanical wire holding off a weighted circuit controller or an isolated 50V electrical wire circuit holding up a standard signalling relay.

Whichever system is used, the wire is supported on telegraph poles or similar posts approximately 8-12 feet high, parallel to the railway across the line that an aircraft might overrun.

There may be arrangements for degraded working provided in the Signalling system that in the event of a failure of the Tripwire system. These often restrict aspects of signals over the protected section to single yellow.

SERVICE A

1. Mechanical Wire Systems Only

1.1 From Ground level inspect all posts. Check for rot in wooden posts, especially at or near ground level. Check any guy ropes are tight.

1.2 Visually check the wire throughout its length for corrosion. Check pulleys appear to be supporting the wire correctly.

1.3 Carry out NR/SMS/PartC/LV31 (Circuit Controllers) on the circuit controller.

a) At Prestwick a ladder shall be required to reach this equipment.

b) At Glasgow, also inspect the balance weight arm, check cotter pins and grease bearings.

1.4 With agreement from the Signaller, test the system as follows:

a) At Prestwick, removal of the tension at the far end of the rope activates the circuit; this can be achieved by raising the balance weight at the opposite end from the circuit controller.

b) At Glasgow, release the shackle for the wire rope on the balance weight arm. This simulates the trip wire breaking, permits the balance weight to fall and thus operates the circuit controller.

c) At Edinburgh, slip the relevant link in the location case to disconnect the current carried by the aerial conductor wire and thus simulate the wire breaking.

d) For Prestwick and Glasgow, check that the Signaller in Paisley Signalling Centre confirms that the indications for the relevant signals in rear on both Up and Down lines have changed to "on", the audible alarm is functioning and the alarm cancel button is illuminated. In addition, confirm that when the alarm cancel button is pushed the audible alarm (buzzer) ceases and the button remains lit. This applies separately for the Prestwick and Glasgow alarms.

e) For Edinburgh, check that the Signaller in Edinburgh Signalling Centre confirms that the indications for the relevant signals in rear on both Up and Down lines have changed to "on", the audible alarm is functioning and the alarm cancel button is illuminated. In addition, confirm that when the alarm cancel button is pushed the audible alarm (buzzer) ceases and the button remains lit.

1.5 Re-terminate the mechanical wire and restore the Tripwire system to normal use.

2. Electrical Wire Systems Only

2.1 In the location case, examine the fuse holder(s), fuse(s), internal wiring, terminals and relay dedicated to the "trip wire" circuit for arcing, overheating, contamination, or other signs of deterioration. Clean these components as necessary.

2.2 Inspect the tail cable(s) connecting from the location case to the circuit controller or aerial conductor wire for good condition and protection.

2.3 From Ground level inspect all posts. Check for rot in wooden posts, especially at or near ground level. Check any guy ropes are tight.

2.4 Visually check the wire and any insulators throughout its length for problems.

2.5 In conjunction with the Signaller, function test the system by removing a fuse or a link at the power supply end of the circuit and check with the Signaller that the alarms operate, and the signals return to Red or cannot be cleared from Red.

2.6 Replace the fuse/link and restore the Tripwire system to normal use.

3. Degraded Working (Where Provided)

3.1 In conjunction with the Signaller, function test any signalling controls provided for degraded working in the event of a failure of the Tripwire system.

NOTE: *This might normally include protecting signals being restricted to single Yellow*

END

Includes:	Vehicle Identification System used in the Sheffield Tram-Train Project Network Rail mainline infrastructure, between the Sheffield Supertram network and Parkgate Tram Stop.
Excludes:	Vehicle Identification System used on the Sheffield Supertram Network

GENERAL

For information on Loop Tuning see NR/SMS/PartB/025 (Vehicle Identification Loops (VIS) Loop Tuning Setup).

ROUTINE TASKS

1. VIS OTU Cubicle Equipment

1.1 Check relevant LEDs to confirm health status of the equipment, these are as follows:

a) Microcontroller Module – 3.3V LED illuminated. Note the 3.3V, LINK, 10, 100, COL, STAT, RXD, and TXD relate to ethernet communications and are therefore only applicable to the Tinsley OTU equipment.

b) Loop Module – COM flashing with all other LEDs illuminated.

c) Power Supply Module - +V, 24V and 5V LEDs illuminated.

d) Relay Module – Loop Fault and Watchdog LEDs illuminated

NOTE: *See the table in Appendix D for further information.*

1.2 Visually confirm that there is no damage to the tail cable connections and no degradation of the VIS relay module output wiring.

1.3 Use Orion test probes on rack output to confirm values are within the parameters specified in Table 1.

Reading	Approx. Output Volts (pp)
10	1.7
20	3.3
30	5
40	6.7
50	8.3
60	10
70	11.7 (Normal Setting)
80	13.3
90	15
100	16.7

Table 1 – Rack Output Voltages using Test Probes

1.4 Check the output from the loop in the four-foot using the Test Box and Table 2.

Reading	Comment
25	Borderline
26 - 50	Acceptable
51+	Good

Table 2 – Box on the Loop

SERVICE B

2. External Checks

2.1 Examine the tail cable for damage where it passes under the rail.

2.2 Remove all fire risks from or near the VIS loop antenna.

2.3 Check that the VIS loop antenna and its fixings are free from ballast.

2.4 Check that all cables are correctly located, secured and free from damage.

2.5 Check that tuning unit is correctly located, secured and free from damage.

2.6 Check for physical damage to the VIS loop antenna, its mountings and fixings.

2.7 Check that the VIS loop antenna is mounted centrally in the 4ft, rectify as necessary.

2.8 Clean the VIS loop antenna.

2.9 Test the VIS loop antenna field strength using Orion test meter and record the values in the relevant documentation.

APPENDIX A - Orion Test Meter

The Orion Test Meter comprises a moving coil meter with drive circuit, pickup antenna and battery located in a plastic housing.

This unit can be used to measure the voltage at the rear of the OTU cubicle using test leads or the loop radiated voltage by placing the unit at the centre of the loop.

Figure 1 - Orion Test Meter

APPENDIX B - Orion Tram Simulator

This Tram Simulator is used to simulate a tram over a trackside loop to allow the phase setup of the Loop cards to be checked and for commissioning checks in the absence of a test tram.

The equipment is comprised of a cut-down tram rack, fitted with reduced size backplane, standard tram Operator Interface, Antenna, and PSU cards plus integrated battery support. A standard tram Antenna (mounted on a stainless steel backplate) and incorporating a short length of antenna cable is also provided. A wooden pole is also supplied, with a 350mm height marking, to be used as an antenna mount during phase testing.

Figure 2 - Orion Tram Simulator

END

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Note: All other activities can be safely undertaken unless disturbing paper gaskets and rope seals for which non-licenced asbestos work rules are to be followed. HW & Style 63 machines do not have paper gaskets or rope seals and the full range of asbestos-containing materials are captured in the archetypal reports for point machines.

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Stephen Dapre

Stephen Dapre
I am approving this document as Regional Head of Eng (S&T) Southern Region
2023-11-16 12:03Z

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NOTE: *The IMC040/IMC040A boards are used to process the information received from the strike-out wheel sensors. The Vamos crossing system uses the output from these boards to determine when to start displaying a green aspect to level crossing users.*

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NOTE: *When the IMC040A boards have been accepted for use by NR, there will be separate communications regarding the arrangements for rolling these out to existing Vamos crossing systems and provision of them for use with new Vamos crossing systems.*

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[illegible]	[illegible]
[illegible]	[illegible] ***NOTE:*** *Clause 3 of Appendix A sets out an additional process to support Routes in determining whether it is appropriate to bring a new Vamos crossing system into service at a particular level crossing in advance of the modified components being available.* *Clause 4 of Appendix A contains additional controls which apply should it be decided to bring a new Vamos crossing system into service at a particular level crossing in advance of the modified components being available.* *These controls align with current good practice as implemented on existing Vamos crossing systems in response to NR/SIN/211 and NR/SIN/212.*
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[illegible]	[illegible] NOTE: *There is no change to the Service B frequency for LC71.*
[illegible]	[illegible] NOTE: *There are no changes to the tasks within Service B of LC71.*

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[illegible] – *variations permitted subject to approved risk analysis and mitigation*

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[illegible] – *to be used unless alternative solutions are followed*

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Rationale: To provide an audit trail of decision making.

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Rationale: To confirm that key accountable roles for asset and risk management at the level crossing are supportive of the intended actions.

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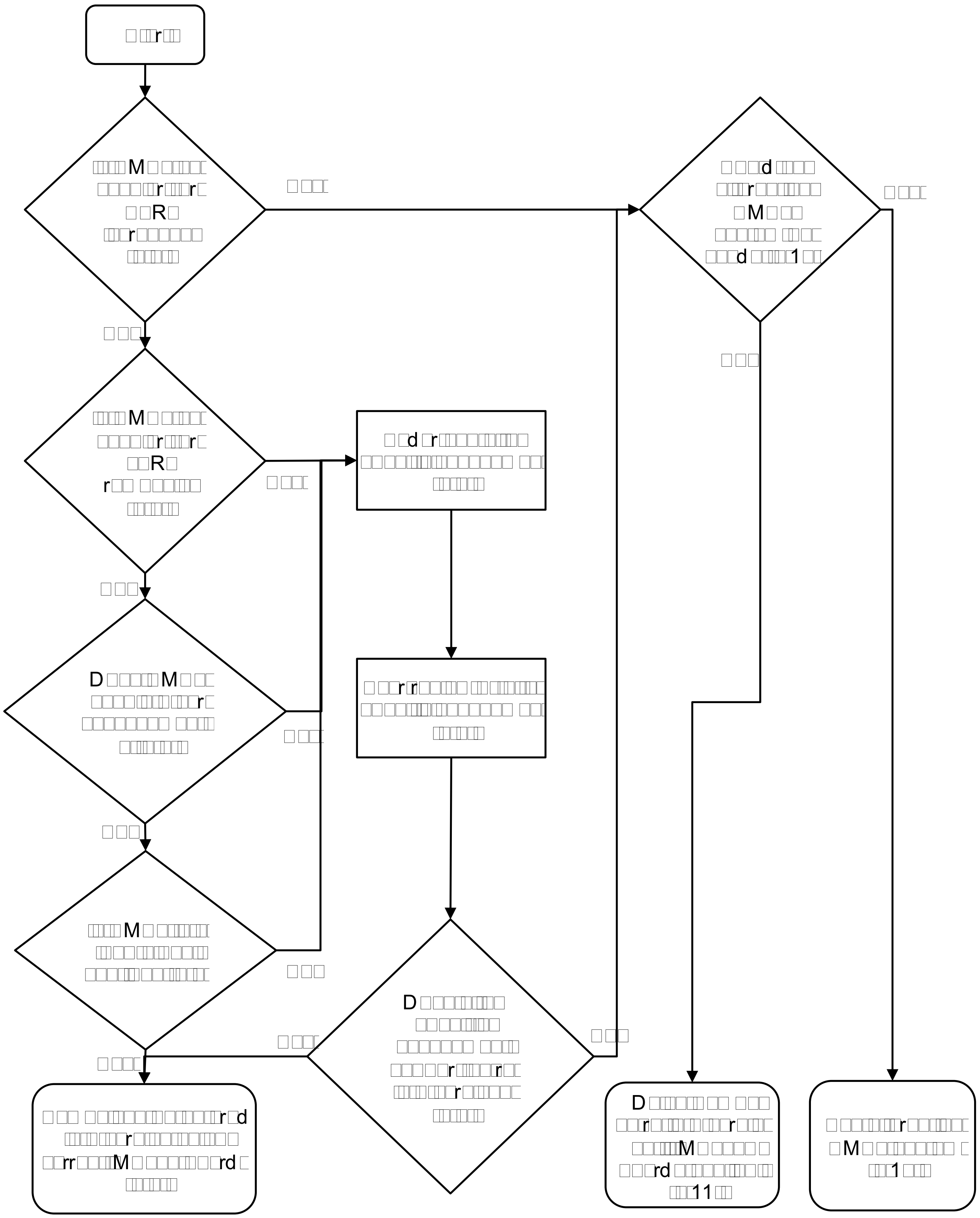

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Rationale: To avoid introducing a wrong side failure risk in situations where there is no existing safety hazard to be mitigated. Hazard review by a group of subject matter experts from across the Regions has concluded that it is not appropriate to bring a Vamos crossing system into service with the current IMC040 boards in situations where the provision of an OMSL solution is driven by a need to mitigate elevated hazards arising from a proposed increase in PSR.

Note: For the purposes of this process the current IMC040 boards are those referenced on product acceptance certificate PA05/05850 issue 8 (or earlier).

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Rationale: To allow a more detailed consideration of the risks and benefits associated with the potential introduction of a Vamos crossing system.

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Note: The circumstances described in sections 3.4 and 3.5 may also be relevant at a particular level crossing. Where this is the case, these circumstances are also considered as part of the site-specific assessment.

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Rationale: To allow a more detailed consideration of the risks and benefits associated with the potential introduction of a Vamos crossing system.

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Note: The circumstances described in sections 3.3 and 3.5 may also be relevant at a particular level crossing. Where this is the case, these circumstances are also considered as part of the site-specific assessment.

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Rationale: To allow a more detailed consideration of the risks and benefits associated with the potential introduction of a Vamos crossing system.

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Note: The circumstances described in sections 3.3 and 3.4 may also be relevant at a particular level crossing. Where this is the case, these circumstances are also considered as part of the site-specific assessment.

Note: It is possible for more than one of the above circumstances to apply at a level crossing. The site-specific assessment undertaken for such a level crossing should consider all relevant circumstances and the factors which are applicable to them.

Rationale: To reduce the risk of the site-specific assessment failing to consider factors which influence hazards at the level crossing.

“window of opportunity” for the wrong side

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Rationale: To reduce the risk of the site-specific assessment failing to consider factors which influence hazards at the level crossing.

Note: For guidance on items c) and d) in this requirement, refer to sections 3.6.5 and 3.6.6.

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a) [illegible]

b) [illegible]

c) [illegible]

d) [illegible]

Rationale: To reduce the risk of the site-specific assessment failing to consider factors which influence hazards at the level crossing.

Note: For guidance on items c) and d) in this requirement, refer to sections 3.6.5 and 3.6.6.

The signaller's workload,

Rationale: To provide an audit trail of decision making.

Rationale: To achieve a consistent approach to the judgements which underpin the site-specific assessment activity and share good practice across NR.

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Rationale: To provide a record of the discussion, any recommendations identified and the support (or otherwise) of the panel for audit purposes and to inform the Route's subsequent decisions on how to proceed.

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Rationale: To confirm that the key accountable roles for asset and risk management at the level crossing are satisfied with the outcome of the site-specific assessment activities.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]	[illegible]
[illegible]	1
[illegible]	[illegible]
[illegible]	[illegible]

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[illegible]

[illegible]

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[illegible]

Note: Signage changes associated with the introduction of the Vamos crossing system cannot be implemented until the Vamos crossing system itself is brought into service. Covering over visual and audible warning devices avoids their presence misleading crossing users to expect a visual or audible warning.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Rationale: These requirements are to mitigate the risk of a wheel sensor becoming loose on the rail, which is a known precursor to a wrong side failure mode. They also contribute to an installation which is consistent with the existing Vamos crossing systems as modified through the actions specified in Special Inspection Notices (SINs) NR/SIN/211 and NR/SIN/212 and the good practice set out in Notice Board 215.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Rationale: To support future visual inspections of the security of the rail claw fastenings. This also contributes to an installation which is consistent with the existing Vamos crossing systems as modified through the actions specified in NR/SIN/211 and NR/SIN/212.

[illegible]

[illegible]

Rationale: To mitigate the risk of a damaged or insecure cable being brought into service as these may be precursors to a wrong side failure mode.

[illegible]

[illegible]

[illegible]

[illegible]	[illegible]
[illegible]	1
[illegible]	[illegible]
[illegible]	[illegible]

Rationale: The temporary Service A inspection regime is a mitigation for the hazard of the wrong side failure mode of the IMC040 boards.

[illegible]

[illegible]

[illegible]

[illegible]

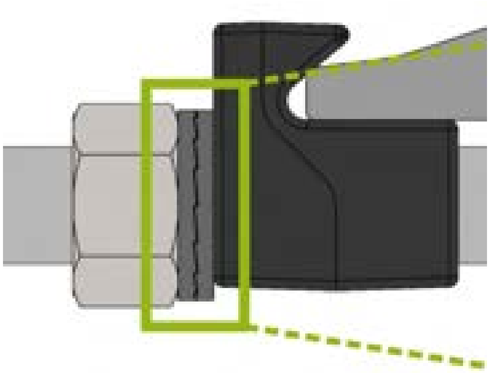
[illegible]

Rationale: The regular monitoring of remote monitoring information from the Vamos crossing system by appropriate personnel is a mitigation for the hazard of the wrong side failure mode of the current IMC040 boards.

[illegible]

[illegible]

NOTE: *Washers are considered to be damaged if the inner cam faces or outer serrations are rusted, partially damaged or significantly worn.*



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INDEX

The level crossing annual tests (Service B in NR/SMS/Test/070-076, 80-81, and NR/SMS/LC10) are produced in an A4 format only for use of the person(s) conducting the annual test of the level crossing. They are formatted to provide a tick box next to each item that requires to be tested so that an auditable record of the test is produced.

These test documents are only available electronically and can be downloaded from Connect (on Network Rails Intranet) from the 'Network Rail Standards' link and use the search function to call up document NR/L3/SIG/10663.

The index of these documents is as follows:

Annual Test	Crossing Type
LX70	Automatic Half Barrier Crossing (AHBC)
LX70/1	Automatic Half Barrier (AHBC) - RCM
LX71	Automatic Barrier Crossing Locally Monitored (ABCL) and Automatic Full Barrier Crossing Locally Monitored (AFBCL)
LX72	Automatic Open Crossing Locally Monitored (AOCL)
LX73	Automatic Open Crossing Remotely Monitored (AOCR)
LX74	Miniature Stop Light Crossing (MSL)
LX75	Manually Controlled Barriers (MCB)
LX76	On Call Barriers (OCB)
LX77	EBI Gate 200 Level Crossing System
LX78	VAMOS Level Crossing System
LX79	Flex Level Crossing system
LX80	Automatic Half Barrier (AHBC) - With Level Crossing Predictor
LX81	Miniature Stop Light Crossing (MSL) - Using A Level Crossing Predictor
LX83	Automatic Open Crossing Locally Monitored + Barriers
LX94	Miniature Stop Light Crossing (MSL) - (RCM)

END

LEVEL CROSSING TESTING

AUTOMATIC HALF BARRIER CROSSING

NR/SMS/LX70

Published & Issued by: Network Rail Kings Place 90 York Way, London N1 9AG

GENERAL

This test plan covers the requirements of NR/SMS/PartC/LC10 (Level Crossings Operational Sequences), NR/SMS/PartB/Test/070 (AHB Operational Sequence Test). It is for use of the person conducting the annual test of the level crossing and has relevant 'tick boxes' by each task so that the particular item of the test can be correctly recorded as per the index in "crossing defects".

a) The crossing ground plan.

b) The level crossing order.

c) The crossing control tables.

d) The signalling plan.

Missing documentation shall be listed as a defect.

TEST SUMMARY

Test Summary
Name of Level Crossing:
Level Crossing Type:
Name of Monitoring Signal Box(es):
Date of Full Test:
Time Full Test Commenced:
Time Full Test Completed:
Tested By:
Signature:
Date of Signature:
Grade and Title:

CROSSING DEFECTS

On the test plan each item shall be recorded with the following letters in the box provided:

X: Found Incorrect, Action Required.
R: Found Incorrect, Rectified on Day of Test.
C: Correct.
N: Not Applicable to this Installation.

Any items found incorrect (X or R) are to be listed on the summary pages. On items requiring action, list the party(s) responsible for rectifying them.

SUMMARY OF ITEMS FOUND INCORRECT (1)

List in the table below all sites found incorrect and rectified on the day of the test (code letter R).

Description of Items Found Incorrect and Rectified

SUMMARY OF ITEMS FOUND INCORRECT (2)

List in the table below items found incorrect and requiring action (code letter X).

Description of Items Found Incorrect and Requiring Action	Responsible Party (s)

1. Road Arrangements

1.1	Check that the road markings are in accordance with the section order and plans.	
1.2	Check that the road markings on the approaches to the crossing (up to the stop line) are complete and visible.	
1.3	Check the condition and the sighting of the road signs on the crossing approaches. See NR/SMS/PartC/SG00 (Signals : General) for details on reflective boards and signs.	
1.4	Check (if provided) the condition and security of any pedestrian guardrails.	
	Any defects found in 1.2 to 1.4 shall be reported to the appropriate council via the SM(S).	
1.5	Check the condition of the road surface over the crossing.	
1.6	Check that the road markings between and including the stop lines are complete and visible.	
1.7	Check (if provided) that the cattle/anti-trespass guards are complete and securely fastened down.	
1.8	Check (if provided) the condition and security of any wicket gates.	
1.9	Check the condition and the security of any fencing on the approach to equipment room or locations.	

2. Barrier and Machine BR Standard Mk1 (Penguin)

Is This Section Applicable to the Crossing Under Test?	Yes	No

2.1	Examine the exterior of the pedestal unit; Check the concrete is not excessively cracked or crumbing. Report as corrective maintenance if any of the concrete re- enforcing bars are visible.	Y	Z
2.2	Check that the pedestal unit and foundation are stable and correctly aligned.	Y	Z
2.3	Check that the cement plug at the top of the pedestal unit is intact and secure. If missing secure the hole with a wooden plug and arrange for a more permanent fixture.	Y	Z
2.4	Remove the pedestal covers and anti-guillotine shields.	Y	Z
2.5	Check the condition of the rubber up and down stops; replace any that have become soft or damaged.	Y	Z
	With the barriers on manual operation, lower and check the following:		
2.6	The boom takes 6 to 8 seconds to lower.	Y	Z
2.7	The boom is horizontal when fully lowered.	Y	Z

2.8	The boom is the correct length.	Y	Z
	Design: Y / Z		
	Actual: Y / Z		
2.9	The boom saw cuts for signs of splitting.	Y	Z
2.10	Condition of the boom.	Y	Z
2.11	The security of the boom.	Y	Z
2.12	The reflective strips are undamaged, clean and are in the correct position.	Y	Z
2.13	The boom lamps, hoods, brackets, and fastenings are undamaged, free from corrosion and correctly aligned.	Y	Z
2.14	The boom wiring, plugs, clamps, and terminations are undamaged.	Y	Z
	Check the height of the boom from the road surface.		
2.15	Top of barrier at the centre of the road (0.9m Minimum).	Y	Z
2.16	Underside of barrier at any point (1m Maximum).	Y	Z
2.17	Check the counter balance weights are secure and are the correct weight by Measuring with a weight measuring device the tip weight by using the following method:	Y	Z
	• At the tip end slowly lift the boom until it is approximately 4° to 5° from the horizontal.		
	• Connect the weight measuring device to the tip end of the boom.		
	• Release the boom onto the measuring device ensuring that the boom has not fully lowered then take a reading.		

Boom Length	Tip Weight
3.99m to 6.02m	2.3Kg (Min) to 2.5Kg (Max)

2.18	Check that the boom can be lifted by hand to the fully raised position.	Y	Z
2.19	Check the interior of the pedestal for water ingress and contamination. Clean as necessary.	Y	Z
	Check the following on the hydraulic pack assembly:		
2.20	The pack is secure to the carrier.	Y	Z
2.21	There are no signs of a fluid leak.	Y	Z
2.22	The hose connections are tight.	Y	Z
2.23	The pack, hoses, and ram are clean and undamaged.	Y	Z

2.24	The fluid level is correct. Just visible in the filter strainer or to the max mark on the indicator.	Y	Z
2.25	The motor brushes. They shall be of sufficient length, slide freely in their holder and seat fully on the commutator.	Y	Z
2.26	The motor commutator (where accessible). It shall be undamaged and a light coffee colour.	Y	Z
2.27	Record the pack details (Mk and serial number).		

Unit	Mk	Serial Number
Y		
Z		

2.28	Check that the modifications to the top ram pin (the fitting of the clamp to prevent it turning) have been carried out. Any installations that do not have this modification shall be reported to the S&T Maintenance Engineer immediately.	Y	Z
2.29	Check that the turned pins are lubricated and free from wear.	Y	Z
2.30	Check that the pedestal wiring and terminations are undamaged, secure and positioned so that they will not be trapped by the boom movement. Wiring to the boom lamps through the spindle is especially prone to damage Protect as necessary.	Y	Z
2.31	Check the spindle is lubricated and free from wear. If fitted with PTFE bearing do not lubricate.	Y	Z
2.32	Unfasten the lid of the circuit controller and check the following items:		
2.33	The spindle and control arm are lubricated and free from wear. Do not lubricate the spindle if fitted with Oilite bearings. This can be identified by a P or an R stamped on the controller lid.	Y	Z
2.34	Terminations and wiring.		
2.35	Contact fingers. Replace any fingers that are worn or have lost their spring tension.	Y	Z
2.36	Bands. Check they are clean and not worn (copper dust in the bottom of the casting). If worn the complete controller shall be renewed.	Y	Z
2.37	Measure by use of an inclinometer and digital voltmeter (on resistance) the setting of the bands whilst raising the boom on ‘hand’ operation. Adjust if necessary (Appendix A).	Y	Z
2.38	Close and fasten the circuit controller. Check if any adjustments have been carried out that all the terminations have been correctly tightened.	Y	Z
2.39	Raise the boom under ‘power’ operation and check the following:		
2.40	The booms are between 80° and 85° when fully raised.	Y	Z
2.41	The booms do not excessively oscillate when they come to rest in the raised position.	Y	Z

2.42	The booms do not 'hunt' when fully raised. This is a sign of an internal fluid leak inside the hydraulic pack.	Y	Z
2.43	Check the condition of the anti-guillotine shields and covers. Replace and secure shields and covers. Arrange for replacements to be fitted if any are damaged.	Y	Z

3. Barrier and Machine (BR Spec. 843)

Is This Section Applicable to the Crossing Under Test?	Yes	No

	Check the following on the barrier pedestal unit:		
3.1	The pedestal is correctly aligned and stable.	Y	Z
3.2	The locks and hinges are undamaged.	Y	Z
3.3	With the boom in the raised position there is adequate clearance between the side arm/counter balance weights and the ground/base.	Y	Z
3.4	The main shaft to side arm fastenings. Check that there is not any excessive play in the keyway.	Y	Z
3.5	Lower the barriers on local control and leave the LCU switch in the lower position. Open the front and rear doors of the pedestal units and fully extend the manual pump handle. Pump the booms to the fully raised position and observe they remain raised.	Y	Z
3.6	On each barrier in turn raise the pump handle until the boom begins to lower. Check that the pump handle roll pin has not reached an alignment where its top is above the bottom edge of the handle guide slot.	Y	Z
	Allow the boom to fully lower and check the following:		
3.7	The boom takes 6 to 8 seconds to lower.	Y	Z
3.8	The boom is damped during the last 10° to 15° of movement.	Y	Z
3.9	The boom is horizontal when fully lowered.	Y	Z
3.10	The boom is the correct length.	Y	Z
	Design: Y / Z		
	Actual: Y / Z		
3.11	Condition of the boom.	Y	Z
3.12	The security of the boom.	Y	Z
3.13	The boom fixing bolt 'E' clips are undamaged and the whole shear bolt assembly has had grease applied.	Y	Z
3.14	The reflective strips are undamaged, clean and are in the correct position.	Y	Z

3.15	The boom lamps, hoods, brackets, and fastenings are undamaged, free from corrosion and correctly aligned.	Y	Z
3.16	The boom wiring, plugs, clamps, and terminations are undamaged.	Y	Z
3.17	(If Fitted) the strainer wire, support bracket and fastenings are effective.	Y	Z
	Check the height of the boom from the road surface.		
3.18	Top of barrier at the centre of the road (0.9m Minimum).	Y	Z
3.19	Underside of barrier at any point (1m Maximum).	Y	Z
3.20	Check the counter balance weights are secure and are the correct weight by Measuring with a weight measuring device the tip weight by using the following method:	Y	Z
	• At the tip end slowly lift the boom until it is approximately 4° to 5° from the horizontal.		
	• Connect the weight measuring device to the tip end of the boom.		
	• Release the boom onto the measuring device ensuring that the boom has not fully lowered then take a reading.		

Boom Length	Tip Weight
3.6m to 4.1m	7.6Kg ±0.5Kg
4.6m to 9.1m	6.1Kg ±0.5Kg

3.21	Check that the boom can be lifted by hand to the fully raised position.	Y	Z
3.22	Check the interior of the pedestal for water ingress and contamination. Clean as necessary.	Y	Z
	Check the following on the hydraulic pack assembly:		
3.23	The pack fastenings.	Y	Z
3.24	The top and bottom pack trunnion block mountings and lock washers.	Y	Z
3.25	Bolts through the trunnion to the operating lever are the correct length and spiral pins are fitted correctly.	Y	Z
3.26	The ram adjusting screw and lock washer. Do not adjust the screw.	Y	Z
3.27	The auto/manual valve is set in the auto position and the split pin and seal are intact.	Y	Z
3.28	The wiring and terminations to the pack. The movement of the pack can cause the B24 feed wire to break internal strands, disconnect the wires to check for this type of damage.	Y	Z
3.29	The fluid level is correct. Just visible in the filter strainer or to the max mark on the indicator.	Y	Z
3.30	The motor brushes. They shall be of sufficient length, slide freely in their holder and seat fully on the commutator.	Y	Z

3.31	The motor commutator (where accessible). It shall be undamaged and a light coffee colour.	Y	Z
3.32	Record the pack details (Mk and serial number).		

Unit	Mk	Serial Number
Y		
Z		

3.33	Check that the shock absorber plunger cannot be depressed more than 3mm by finger pressure.	Y	Z
3.34	Check the up and down stop block striker pads. Replace if worn.	Y	Z
3.35	Unfasten the lid of the circuit controller and check the following items:		
3.36	The spindle and control arm are lubricated and free from wear. Do not lubricate the spindle if fitted with Oilite bearings. This can be identified by a P or an R stamped on the controller lid.	Y	Z
	Terminations and wiring.		
3.37	Contact fingers. Replace any fingers that are worn or have lost their spring tension.	Y	Z
3.38	Bands. Check they are clean and not worn (copper dust in the bottom of the casting). If worn the complete controller shall be renewed.	Y	Z
3.39	Measure by use of an inclinometer and digital voltmeter (on resistance) the setting of the bands whilst raising the boom on ‘hand’ operation. Adjust if necessary (Appendix A).	Y	Z
3.40	Close and fasten the circuit controller. Check if any adjustments have been carried out that all the terminations have been correctly tightened.	Y	Z
3.41	Check the circuit controller cam, cam slot and roller assembly.	Y	Z
3.42	Check the earth-bonding strip is secure and undamaged.	Y	Z
3.43	Check the main shaft bearings and fastenings. Check that sufficient grease has been applied to the bearings	Y	Z
3.44	Check the bearing end cap seals are effective. Water ingress into the end caps can freeze and prevent the booms from lowering.	Y	Z
3.45	Check that the pedestal fixing bolts are all fitted and correctly tightened.	Y	Z
3.46	Check the operator’s door (rear) micro switch assembly, fastenings and wires. Check that they are secure and undamaged.	Y	Z
3.47	Raise the boom by hand pumping, check that the boom does not lower between pumping strokes.	Y	Z
3.48	Lower both the booms; stow the pump handles and close and lock the operator’s doors (rear). Raise the boom under ‘power’ operation by switching the LCU to raise and check the following:	Y	Z

3.49	The booms are between 80° and 85° when fully raised.	Y	Z
3.50	The booms do not excessively oscillate when they come to rest in the raised position.	Y	Z
3.51	The booms do not 'hunt' when fully raised. This is a sign of an internal fluid leak inside the hydraulic pack.	Y	Z
3.52	Close and lock the front pedestal door.	Y	Z

4. Local and Manual Control

Is This Section Applicable to the Crossing Under Test?	Yes	No

NOTE: *The LCU control unit is normally fitted to the Y pedestal but on some installations it may on the Z pedestal.*

4.1	On the pedestal with the LCU unit, unlock the local control access door.	Y	Z
4.2	Check when unlocked the key is retained in the lock and cannot be withdrawn unless the door is locked again.	Y	Z
4.3	Pull the control arm to the lowered position and operate the raise button. Check that on pressing the raise button the auto button is released.	Y	Z
4.4	Check that two buttons cannot be depressed at the same time. The pressing of a button will release the button already depressed, the button interlocking shall prevent two buttons locking down at the same time.	Y	Z
	Operate the lower button and allow the booms to lower. Observe the following items:		
4.5	All the amber road signals illuminate and the audible warnings commence concurrently (Yodalarms at normal warbling rate).	Y	Z
4.6	After 3 seconds (5 seconds at older installations) all the amber signals extinguish and all the red flashing road signals start to flash.	Y	Z
4.7	After approximately a further 4 seconds (8 seconds at older installations) the booms commence to lower.	Y	Z
4.8	The booms take 6 to 8 seconds to reach the fully lowered position.	Y	Z
4.9	Red flashing road lights continue to be illuminated. Audible warnings may continue to sound depending on design (check diagrams).	Y	Z
	Press the hand button then operate the control valve to the raise position and hand pump the LCU side boom to the raised position. Observe the following items:		
4.10	The boom does not lower between pumping strokes.	Y	Z
4.11	The red flashing road signals are illuminated.	Y	Z
4.12	The audible warnings are silent.	Y	Z

4.13	On the other pedestal unlock the local control access door and check when unlocked that the key is retained in the lock and cannot be withdrawn unless the door is locked again.	Y	Z
	Operate the control valve to the raise position and hand pump the boom to the raised position. Check the following items:		
4.14	The boom does not lower between pumping strokes.	Y	Z
4.15	The red flashing road signals stay illuminated until the boom is above 80° from the horizontal.	Y	Z
4.16	The audible warnings are silent.	Y	Z
4.17	On the LCU pedestal operate the control valve to the lower position and allow the boom to fall sufficiently to illuminate the red flashing road signals.	Y	Z
4.18	Operate the control valve to the raise position and check that the boom movement is arrested.	Y	Z
4.19	Check that the audible warnings are silent. Pump the boom to the raised position.	Y	Z
4.20	Observe that the red flashing road signals are extinguished when the boom is above 80° from the horizontal.	Y	Z
4.21	Repeat 4.17 to 4.20 for the other boom.		
4.22	Check that the blocks are fitted to the inside of the local control access doors on both the Y and Z pedestals. The blocks prevent the local control access door being closed and locked with the control valve in the raise position.	Y	Z
4.23	Operate the control valve on both the Y and Z pedestals to the lower position and allow both booms to fully lower.	Y	Z
4.24	Close and lock the local control access door in the non LCU pedestal.	Y	Z
4.25	Operate the raise button on the control unit in the LCU pedestal and Observe the following:		
4.26	Both booms rise together.	Y	Z
4.27	The audible warnings sound, if designed to operate when the booms are lowered (check diagrams).	Y	Z
4.28	The red road lights extinguish and the audible warnings (depending on design) cease before the booms have reached 45° from the horizontal.	Y	Z
4.29	Check that the local control access door on the LCU pedestal cannot be closed with the control arm in the lowered position		
4.30	Press the lower button, allow the booms to lower then operate the auto button. Check that the same sequence of events occur as listed in 4.6 to 4.10.	Y	Z
	When the booms are fully raised, stow the control arm and close and lock the access door.		

5. Local and Manual Control BR Spec. 843

5.1	Open the local control unit door. Check when unlocked that the key is retained in the lock and cannot be withdrawn unless the door is locked again.		
5.2	Operate the control switch to the lower position and Observe the following items:		
5.3	<u>All</u> the amber road signals illuminate and the audible warnings commence concurrently (Yodalarms at normal warbling rate).	Y	Z
5.4	After 3 seconds (5 seconds at older installations) all the amber signals extinguish and all the red flashing road signals start to flash.	Y	Z
5.5	After approximately a further 4 seconds (8 seconds at older installations) the booms commence to lower.	Y	Z
5.6	The booms take 6 to 8 seconds to reach the fully lowered position	Y	Z
5.7	Red flashing road lights continue to be illuminated. Audible warnings may continue to sound depending on design (check diagrams).	Y	Z
5.8	Open the operator's door (rear) of Y pedestal. Check that if the audible warnings are designed to continue to operate when the booms are fully lowered they are silenced.		
	Extend the pump handle and hand pump the boom to the raised position. Observe the following items:		
5.9	The boom does not lower between pumping strokes.	Y	Z
5.10	The red flashing road signals are illuminated.	Y	Z
5.11	The audible warnings remain silent.	Y	Z
5.12	Open the operator's door (rear) of Z pedestal. Extend the pump handle and hand pump the boom to the raised position. Observe the following items:		
5.13	The boom does not lower between pumping strokes.	Y	Z
5.14	The red flashing road signals stay illuminated until the Z boom is above 80° from the horizontal.	Y	Z
5.15	The audible warnings remain silent.	Y	Z
5.16	On Y pedestal lift the pump handle and allow the boom to fall sufficiently to illuminate the red flashing road signals.	Y	Z
5.17	Release the pump handle and check that the boom movement is arrested.	Y	Z
5.18	Check that the audible warnings are silent. Pump the boom to the raised position.	Y	Z
5.19	Observe that the red flashing road signals are extinguished when the boom is above 45° from the horizontal.	Y	Z
5.20	Repeat 5.16 to 5.19 for Z pedestal.		

5.21	On Y pedestal lift the pump handle and allow the boom to fully lower	Y	Z
5.22	Check that the operator's door cannot be closed and locked unless the pump handle is in the stowed position.	Y	Z
5.23	Check that the guide pin is seated in the bottom of the guide slot when the pump handle is fully stowed.	Y	Z
5.24	Check that the spiral pin is not bent and the spiral pin guide is not worn or does not have a 'step'.	Y	Z
5.25	Close and fully lock the operator's door ensuring that the audible warnings remain silent. When locking the operators' door check that the key is turned a further 90° clockwise then back again to the removal position to correctly operate the door proving micro switch.	Y	Z
5.26	Repeat 5.21 to 5.25 for Z pedestal ensuring that when the operator's door is fully locked the audible warnings (if designed to operate when the booms are lowered) begin to sound.		
	Operate the switch in the local control unit to the raise position and Observe the following:		
5.27	Both booms rise together.	Y	Z
5.28	The red road lights extinguish and the audible warnings cease before the booms have reached 45° from the horizontal.		
5.29	Check that the guide on the inside of the local control unit door prevents the door being closed and locked unless the switch is in the auto position.		
5.30	Operate the switch to the lower position and observe that the sequence of events occurs as listed in 5.3 to 5.7.		
5.31	Operate the switch to the auto position and observe the sequence of events occur as listed in 5.27 to 5.28. On modern installations the switch can be put straight to the auto position, which will cause the booms to perform a lowering sequence then rise. Check the diagrams for the correct mode of operation applicable to the crossing.		
5.32	Close and lock the local control unit door.		

6. Road Traffic Light Signals

If auxiliary road traffic light signals are fitted (in addition to YO, YN, ZO and ZN), list the additional signal identification below:

Signal Number	Signal Identification
Aux 1	
Aux 2	

	On each of the road traffic light signals check the following items:						
6.1	The signal structure is stable.	YO	YN	ZO	ZN	Aux 1	Aux 2
6.2	The signal light units are undamaged and the hoods are securely fitted.	YO	YN	ZO	ZN	Aux 1	Aux 2
6.3	The signal lenses are undamaged, clean and correctly orientated.	YO	YN	ZO	ZN	Aux 1	Aux 2
6.4	Signs and notices attached to the signal post are undamaged, clean, and legible. See NR/SMS/PartC/SG00 (Signals : General) for details on reflective boards and signs.	YO	YN	ZO	ZN	Aux 1	Aux 2
6.5	Cables and conduit are undamaged and secure.	YO	YN	ZO	ZN	Aux 1	Aux 2
6.6	Check that if the signals are fitted with 50-watt Quartz Halogen lamps, the road traffic light signal backboard is fitted with a red/white border. White only and red/white border backboards shall not be mixed together at the same crossing.	YO	YN	ZO	ZN	Aux 1	Aux 2

7. Audible Warnings

7.1	Check that the audible warning device and any exposed cables and conduit are undamaged and secure. Check that the device is correctly aligned.	YO	YN	ZO	ZN
7.2	Check that there has been no water ingress into audible warning device. Rectify or replace as necessary.	YO	YN	ZO	ZN
7.3	Check that the sound output of the audible warning is sufficient for the crossing circumstances and (if applicable) is reduced for the night time. Some crossings have had the sound output of audible warning device reduced because of local conditions, check the diagrams.	YO	YN	ZO	ZN

7.4	Check (if applicable) that the audible warning time clock is set to the correct time and the day/night settings are correct. Some time clocks have a control to 'skip' the set controls on certain days, check this is not activated.	YO	YN	ZO	ZN

8. Pedestrian Signals

Is This Section Applicable to the Crossing Under Test?	Yes	No

If auxiliary pedestrian signals are fitted (in addition to YO, YN, ZO and ZN), list the additional signal identification below:

Signal Number	Signal Identification
Aux 1	
Aux 2	

8.1	Check that the sign is securely fixed to the post, the post is stable; the sign is undamaged and correctly aligned	YO	YN	ZO	ZN	Aux 1	Aux 2
8.2	Check that the hood is securely fitted and the signal face is clean and undamaged	YO	YN	ZO	ZN	Aux 1	Aux 2
8.3	If a sun screen is fitted, check this is undamaged and securely fitted.	YO	YN	ZO	ZN	Aux 1	Aux 2

9. Telephone System

The majority of installations usually have two emergency phones and an LCU phone. There are also some installations that have 'lay-by' phones because of the road conditions. The crossing section order will state the telephone system that is required at the crossing.

Identify telephones at the installation under test in the grid below:

No.	Telephone Identity
1	
2	
3	
4	
5	
6	
7	

		Telephone Identity (see Grid)						
9.1	Check the telephone and cord is undamaged.	1	2	3	4	5	6	7
9.2	Check the correct labels and symbols are fitted inside and outside the case and they are legible.	1	2	3	4	5	6	7
9.3	Check that any associated signs are stable, undamaged and legible. Emergency telephones require having the yellow telephone symbol visible on three sides of the telephone case or on a separate plate above the telephone.	1	2	3	4	5	6	7
9.4	Check that the correct crossing name is stated on any telephone labels and signs.	1	2	3	4	5	6	7
9.5	Check that telephone numbers given on any sign are correct. The site plan will give information on the correct names/numbers that shall be displayed.	1	2	3	4	5	6	7
9.6	If betalights are fitted, check they are lit. Betalights are usually fitted to older style telephones units that the public have access to.	1	2	3	4	5	6	7
9.7	On emergency telephones, check that an ETD number is given for the public to call in case they cannot contact the monitoring point. Ring this number and check that the recipient uses the correct procedures for the call.	1	2	3	4	5	6	7

Public Telephone Numbers	**Checked**

9.8	Ring the monitoring point and check that the call is received correctly. Ask the monitoring point to ring back.	1	2	3	4	5	6	7

9.9	Check the telephone rings correctly. Check that the quality of speech and hearing is clear and not distorted. On Whitely PETS telephone systems there is a short time when answering a call at either end of the line where the system 'handshakes' During this period transmission and reception of speech is not possible.	1	2	3	4	5	6	7
9.10	If lay-by and/or pedestal telephones are fitted Check that there is a ring differential at the monitoring point between them and the emergency telephones.	1	2	3	4	5	6	7
9.11	Check that if a lay-by or pedestal telephone is in use a call from the emergency telephone is still received correctly at the monitoring point	1	2	3	4	5	6	7
9.12	Check that with one of the emergency telephones left 'off the hook' calls on the other telephones can be made and received correctly. Whitely PETS systems will indicate a fault at the monitoring point.	1	2	3	4	5	6	7
9.13	If a block switch is fitted Check that when operated 9.8 to 9.12 operate correct at the alternative monitoring point.							
9.14	Check that at the normal monitoring point any audible devices do not sound.							
9.15	Repeat 9.13 to 9.14 for any other alternative monitoring points.							
9.16	If an absent switch is fitted to the telephone system operate it and Check that if an emergency call made this is indicated by a low level of illumination of the telephone unit and any audible devices do not sound. Operate the absent switch is back to normal operation and check that a normal emergence call is received.							
9.17	Switch off the mains power to the telephone system. After a period of time equal to the crossing sequence testing repeat tasks 9.8 to 9.16. Switch the mains power to the telephone system back on.							

10. Barrier Proving

Check that a cut-out is provided in the motor contactors before proceeding with 10.2 to 10.4.

The booms can be lowered and raised by local control or train simulation.

10.1	Turn the mains power off.		
	Allow the booms to lower. Restrain the tip of one of the booms then allow the barriers to rise.		
10.2	Check that the motor cut-out for the restrained boom operates within 25 seconds. This time relates to a SPX Contactor only, if a different contactor is fitted refer to site diagrams and report to Section Manager.	Y	Z
10.3	Release the boom and check that the motor cuts in again within 3 minutes and the boom fully rises.	Y	Z
10.4	Repeat 10.2 and 10.3 for each of the other booms.		
10.5	Allow the booms to lower. Disconnect the Up KR link in the equipment room/location from one of the booms. Allow the booms to rise.	Y	Z
10.6	Check that the red flashing road lights signals have extinguished when the booms reach 45° from the horizontal.	Y	Z
10.7	Check that the road signals re-illuminate 6 seconds after the booms have started to rise.	Y	Z
10.8	Reconnect the Up KR link and check that the road signals extinguish.	Y	Z
10.9	Repeat 10.7 to 10.8 for the other boom.		

11. Red Flashing Road Traffic Light Signal Proving

The booms shall be lowered and raised by train simulation.

Some early installations only require one red road light to be working on each side to allow the booms to rise. (RECR modifications have not been carried out).

Check the diagrams for circuit design. Report any of these crossings to the S&T Maintenance Engineer.

If auxiliary road traffic light signals are fitted (in addition to YO, YN, ZO and ZN), list the addional signal identification below:

	Signal number	Signal Identitication
	Aux 1	
	Aux 2	

11.1	Simulate a train striking in and allow the booms to lower. Check that all the red road signals are illuminated (flashing).	YO	YN	ZO	ZN	Aux 1	Aux 2
11.2	Measure the rate of flashing (Between 70 and 90 flashes per minute).			FPM			

11.3	Disconnect the left and right lamps on one of the light units by slipping the links in the equipment room/loc	YO	YN	ZO	ZN	Aux 1	Aux 2
11.4	Operate the exit function and remove the train simulation. Check that the booms remain lowered.	YO	YN	ZO	ZN	Aux 1	Aux 2
11.5	Re-connect the right hand lamp and Check that the booms raise.	YO	YN	ZO	ZN	Aux 1	Aux 2
11.6	Disconnect again the right hand lamp and simulate a train striking in. Check that approximately 2 seconds after the amber lights extinguish the booms begin to lower.	YO	YN	ZO	ZN	Aux 1	Aux 2
11.7	Operate the exit function and remove the train simulation. Check that the booms remain lowered.	YO	YN	ZO	ZN	Aux 1	Aux 2
11.8	Re-connect the left hand lamp and check that the booms raise. Re- connect the right hand lamp	YO	YN	ZO	ZN	Aux 1	Aux 2
11.9	Repeat 11.1 to 11.8 for the other red road signal units. The flashes per minute rate only requires to be measured on one light unit.						

12. Local Control Sequence

12.1	Operate the LCU to the LOWER position and check the following:	
12.2	All the amber road signals illuminate, and the audible warnings commence concurrently (Yodalarms at normal warbling rate).	
12.3	After 3 seconds (5 seconds at older installations) all the amber signals extinguish and all the red flashing road signals start to flash.	
12.4	After approximately a further 4 seconds (8 seconds at older installations) the booms commence to lower.	
12.5	The booms take 6 to 8 seconds to reach the fully lowered position.	
12.6	Red road lights and any pedestrian lights continue to be illuminated. Audible warnings continue to sound depending on design (check diagrams).	
12.7	Operate the LCU to the RAISE position and check the following:	
12.8	The booms begin to rise.	
12.9	The red road lights extinguish, the lineside headlights extinguish and the audible warnings cease before the booms have reached 45° from the horizontal.	
12.10	The boom lights extinguish when the booms have reached approximately 81° from the horizontal.	
12.11	The booms do not take more than 7 seconds to reach the fully raised position of between 81° and 85° from the horizontal.	

12.12	Operate the LCU to the LOWER position, allow the lowering sequence to take place and then operate the LCU switch to the AUTO position. Check that the lowering sequence is as 12.2 to 12.6 and the raise sequence is as 12.8 to 12.11. On modern installations the switch can be put straight to the auto position, which will cause the booms to perform a lowering sequence then rise. Check the diagrams for the correct mode of operation applicable to the crossing.	
12.13	Close and lock the LCU door.	

13. Automatic Control Sequence

- Check in the crossing control tables for any special controls that affect the automatic control sequence.
- On early designs of crossings ATC and Strike in treadle reverse proving is required in the automatic sequence and the crossing sequence will start as soon as the strike in treadles are operated. Check the diagrams.
- Where the word EXIT occurs, the strike out treadle shall be operated.
- On single lines or where bi-directional controls exist, the leaving track circuit shall also be operated.
- Where directional proving controls exists the bi-directional strike out treadle shall also be operated in the correct sequence.

13.1	Simulate an approaching train by shunting a controlling track circuit and or treadle operation. Observe the following:				
13.2	On double lines 10 seconds elapse before the crossing sequence commences. On single lines the sequence starts immediately.	Up	Up X	Dn	Dn X
13.3	All the amber road signals illuminate and the audible warnings commence concurrently (Yodalarms at normal warbling rate).	Up	Up X	Dn	Dn X
13.4	After 3 seconds (5 seconds at older installations) all the amber signals extinguish and all the red flashing road signals start to flash.	Up	Up X	Dn	Dn X
13.5	After approximately a further 4 seconds (8 seconds at older installations) the booms commence to lower.	Up	Up X	Dn	Dn X
13.6	The boom lamps illuminate at approximately 80° from the horizontal. Check the sighting of the boom lamps.				

13.7	The booms take 6 to 8 seconds to reach the fully lowered position.	Up	Up X	Dn	Dn X
13.8	Red road lights and any pedestrian lights continue to be illuminated and flash alternately with the road lights. Audible warnings may continue to sound depending on design (check diagrams).	Up	Up X	Dn	Dn X
	Operate the exit function and remove the train simulation. Observe the following:				
13.9	The booms begin to rise.	Up	Up X	Dn	Dn X
13.10	The red road lights and crossing headlights extinguish and the audible warnings cease when the booms have reached approximately 45° from the horizontal.	Up	Up X	Dn	Dn X
13.11	The boom lights extinguish when the booms have reached approximately 81° from the horizontal.	Up	Up X	Dn	Dn X
13.12	The booms do not take more than 7 seconds to reach the fully raised position of between 81° and 85° from the horizontal.	Up	Up X	Dn	Dn X
13.13	Repeat steps 13.1 to 13.12 for the opposite direction on a single line and the other direction on double lines.	Up	Up X	Dn	Dn X

14. Double Lines Second Train Approaching Sequence

Is This Section Applicable to the Crossing Under Test?	Yes	No

14.1	Simulate a train striking in on line one as per 13.1.	Up	Dn
	Simulate a second train striking in on line two. Observe the following:		
14.2	The booms remain lowered.	Up	Dn
14.3	The road lights and any pedestrian lights continue to flash.	Up	Dn
14.4	The audible warning rate where designed to sound when booms are lowered continues at the normal rate (check diagrams).	Up	Dn
	Operate the exit function and remove the simulation on line one. Observe the following:		
14.5	The booms remain lowered.	Up	Dn
14.6	The road lights and any pedestrian lights continue to flash.	Up	Dn
14.7	The audible warning rate where designed to sound when booms are lowered changes to the increased rate (check diagrams)	Up	Dn
14.8	Operate the exit function and remove the simulation on line two. Observe that the sequence is the same as described in 13.8 to 13.11.	Up	Dn
14.9	Repeat steps 14.1 to 14.8 for a train striking in on line two first and a second train striking in on line one.		

14.10	Turn Mains Power on	

15. Special Control Function Sequence

Is This Section Applicable to the Crossing Under Test?	Yes	No

15.1	Perform any special control functions according to the control tables (Stopping/Non-Stopping, Signal, TRTS etc). Record the function performed and its results.

Function	Result

16. Strike in Track Circuit Resetting

Is This Section Applicable to the Crossing Under Test?	Yes	No

Direction	TC Name	Time (seconds)
Up		
Up X		
Dn		
Dn X		

16.1	Make up the track circuit and start timing with a stopwatch from the time the track circuit is re-connected. Check that the booms remain lowered				
16.2	Simulate an approaching train by shunting a controlling track circuit. Observe that the barrier lowering sequence is correct.	Up	Up X	Dn	Dn X
16.3	Observe that after 120 seconds the booms rise. If any adjustments have to be made to achieve this time, allow a period of time for the bi-metal strip in the timer to cool down.				

17. Leaving Track Circuit Resetting

Is This Section Applicable to the Crossing Under Test?	Yes	No

NOTE: *Check the diagrams to find if these controls are fitted to the crossing.*

The booms shall be operated by train simulation.

Record the actual times in the grid below.

Direction	Entrance TC	Exit TC	Time (seconds)
Up			
Up X			
Dn			
Dn X			

17.1	Simulate a train striking in by dropping a controlling track circuit, observe that the boom lowering sequence is correct	Up	Up X	Dn	Dn X
17.2	Drop the leaving track circuit, operate the exit function and make up the controlling track circuit. Check that the leaving track circuit remains dropped.	Up	Up X	Dn	Dn X
17.3	Observe that a boom raising sequence takes place when the controlling track circuit is made up, start timing with a stopwatch as soon as the booms start to rise.	Up	Up X	Dn	Dn X
17.4	Observe that after 130 seconds on double lines or 120 seconds on single lines a boom lowering sequence takes place	Up	Up X	Dn	Dn X
17.5	Re-connect the leaving track circuit and observe that after 120 seconds a boom raising sequence takes place. If any adjustments have to be made to achieve this time, allow a period of time for the bi-metal strip in the timer to cool down	Up	Up X	Dn	Dn X

18. Speed Discriminator

Is This Section Applicable to the Crossing Under Test?	Yes	No

18.1	Check (if fitted) that the speed discriminator synchronous motor timer times correctly.	Up	Dn
18.2	Record the time up and down (in seconds).		

Direction	Time
Up	
Dn	

19. Line Dimensions

Is This Section Applicable to the Crossing Under Test?	Yes	No

Where track works have taken place since the pervious test.

19.1	Check and identify the distance of track circuits and treadles as specified on the signalling plan. Record the design and actual dimensions.

Line	Design Measurement	Actual Measurement

20. Indications (Needle Type) and Audible Devices

Is This Section Applicable to the Crossing Under Test?	Yes	No

It may be convenient to combine this with Section 9 - Telephone systems

A competent person (not the Signaller) is required at the monitoring point(s) to observe the indications

20.1	Check that the indicator is in the barriers raised / power on position.	
20.2	Simulate a train striking in and observe that the indicator moves to the no legend (barriers working) position.	
20.3	Remove the train simulation and operate the exit function, observe that the indication returns to the barriers raised / power on position.	
20.4	Open the local control operator’s door, if door proving is fitted observe that the indicator moves to the no legend (barriers working) position.	
20.5	Otherwise operate the local control buttons to raise, lower and hand in turn and observe that the indicator moves to and remains in the no legend (barriers working) position.	
20.6	Return the local control unit to the auto position and close and lock the operator’s door, observe that the indicator returns to the barriers raised / power on position.	
20.7	Simulate a train striking in and observe that the indicator moves to the no legend (barriers working) position.	
20.8	Check that after 240 seconds on double lines or 180 seconds on single lines the audible alarm sounds and it can be silenced.	
20.9	Remove the train simulation and operate the exit function. Observe that the indication returns to the barriers raised / power on position and the audible alarm sounds and it can be silenced.	

20.10	Withdraw in turn each power supply fuse that is in the (PO) PR circuit (check diagrams). Observe that for each fuse the indicator moves to the barriers raised / power off position.	
20.11	Check that the audible alarm sounds and can be silenced.	
20.12	When each fuse is replaced observe that the indicator returns to the barriers raised / power on position.	
20.13	Check that the audible alarm sounds and can be silenced.	
20.14	Check (where provided) that the monitoring point test switches operate.	
20.15	If an Absent switch is provided, switch to the absent position and check that the indicator moves to the no legend (barriers working) position, the audible alarms devices do not sound and the level crossing protecting functions (block/signal) are effective.	
20.16	If a block switch is provided, switch to the alternative monitoring point and Check that at the normal monitoring point the indicator moves to the no legend (barriers working) position and the audible alarms devices do not sound. At the alternative monitoring point repeat 20.1 to 20.14.	

21. Indications (Lamp Type) and Audible Devices

Is This Section Applicable to the Crossing Under Test?	Yes	No

It may be convenient to combine this with Section 9 - Telephone systems.

A competent person (not the Signaller) is required at the monitoring point(s) to observe the indications.

The barrier indications are normally White for barriers raised, barriers working and power on. For barriers failed and standby in use they are normally Red.

21.1	Check that the indications show barriers raised and power on.	
21.2	Simulate a train striking in and observe the barriers raised indication extinguishes, the barriers working indication illuminates and the power on indication remains illuminated.	
21.3	Operate the exit function and remove the train simulation, observe that the barriers working indication extinguishes, the barriers raised indication illuminates and the power on indication remains illuminated.	
21.4	Open the LCU unit door and observe that the barriers raised indication extinguishes, the barriers working indication illuminates and the power on indication remains illuminated.	
21.5	Check that with each position of the switch (Raise, Lower/Hand and Auto) the barriers raised indication remains extinguished and the barriers working indication remains illuminated.	

21.6	Return the switch to the auto position, and close and lock the door. Observe that the barriers raised indication illuminates, the barriers working indication extinguishes and the power on indication remains illuminated.	

21.7	Unlock in turn each of the BR standard 843 barrier pedestal unit operator's doors (rear) and observe that the barriers raised indication extinguishes and the barriers working indication illuminates when unlocked and illuminates again when locked. The power on indication will remain illuminated.	
21.8	Operate in turn each exit treadle (or freddy) and observe that the barriers raised indication extinguishes and the barriers working indication illuminates when the treadle is not proving normal (or freddy activated) and returns to barriers raised illuminated, barriers working extinguished again when normal proving is regained (or freddy de-activated). The power on indication will remain illuminated.	
21.9	Simulate a train striking in and observe that the barrier raised indicator extinguishes and the barriers working indicator illuminates.	
21.10	Check that after 240 seconds on double lines or 180 seconds on single lines the barriers working indicator extinguishes, the barriers failed indication illuminates and the audible alarm sounds and it can be silenced. The power on indication will remain illuminated.	
21.11	Remove the train simulation and operate the exit function, observe that the barriers failed indication extinguishes, the barriers raised indication illuminates, and the audible alarm sounds and it can be silenced. The power on indication will remain illuminated.	
21.12	Withdraw in turn each power supply fuse that is in the (PO) PR circuit (check diagrams). Observe that for each fuse the power on indication extinguishes and the standby in use indication illuminates.	
21.13	Check that the audible alarm sounds and can be silenced. When each fuse is replaced observe that the standby in use indication extinguishes and the power on indication illuminates.	
21.14	Check that the audible alarm sounds and can be silenced. The barriers raised indication will remain illuminated.	
21.15	Check (where provided) that the monitoring point test switches operate.	
21.16	If an Absent switch is provided, switch to the absent position and check that all the indications extinguish, the audible alarms devices do not sound and the level crossing protecting functions (block/signal) are effective.	
21.17	If a block switch is provided, switch to the alternative monitoring point and check that at the normal monitoring point all the indications are extinguished and the audible alarms devices do not sound. At the alternative monitoring point repeat 21.1 to 21.16.	

22. Power Supplies and Batteries

22.1	Carry out NR/SMS/PartB/Test/051 (Busbar Earth Test) or NR/SMS/PartB/Test/053 (ELD Function Test).	
22.2	Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests) – Level Crosing Barriers.	

Power Supply Identification

APPENDIX A - Circuit Controller Band Settings

Band	Made Between
DN KR	0° and 4°
HJPR	42° and 90°#
MR	0° and 83°
UP KR	81° and 90°

#: The HJPR band on early installations may be set to make sooner than 42°. Check the diagrams for the required setting for the installation you are testing.

NOTE: *It is important to obtain the over-lap between the UP KR band making and the MR band breaking. This is to ensure that if a boom drops slightly it will drive up again before the red road signals operate.*

END

LEVEL CROSSING TESTING

AUTOMATIC HALF BARRIER CROSSING (RCM)

NR/SMS/LX70-1

Published & Issued by: Network Rail Kings Place 90 York Way, London N1 9AG

GENERAL

This test plan is in addition to NR/SMS/PartC/LC20 Services A & B'. It is for use of the person conducting the annual test of the level crossing and has relevant 'tick boxes' by each task so that particular item of the test can be correctly recorded as per the index in 'crossing defects'.

It does not cover AHBC installations controlled by HXP-3 crossing processors and those not maintained using NR/ROSE/LC maintenance standard.

a) The crossing ground plan.

b) The level crossing order.

c) The crossing control tables.

d) The signalling plan.

Missing documentation shall be listed as a defect.

TEST SUMMARY

Test Summary
Name of Level Crossing:
Level Crossing Type:
Name of Monitoring Signal Box(es):
Date of Full Test:
Time Full Test Commenced:
Time Full Test Completed:
Tested By:
Signature:
Date of Signature:
Grade and Title:

CROSSING DEFECTS

On the test plan each item shall be recorded with the following letters in the box provided:

X: Found Incorrect, Action Required.
R: Found Incorrect, Rectified on Day of Test.
C: Correct.
N: Not Applicable to this Installation.

Any items found incorrect (X or R) are to be listed on the summary pages. On items requiring action, list the party(s) responsible for rectifying them.

SUMMARY OF ITEMS FOUND INCORRECT (1)

List in the table below all sites found incorrect and rectified on the day of the test (code letter R).

Description of Items Found Incorrect and Rectified

SUMMARY OF ITEMS FOUND INCORRECT (2)

List in the table below items found incorrect and requiring action (code letter X).

Description of Items Found Incorrect and Requiring Action	Responsible Party (s)

1. Barrier and Machine BR Spec. 843

	Check the following on the barrier pedestal unit:		
1.1	Lower the barriers on the local control and leave the LCU switch in the Lower/Hand position.	Y	Z
1.2	Check that the boom can be lifted by hand to the fully raised position.	Y	Z
1.3	Measure by use of an inclinometer and digital voltmeter (on resistance) the setting of the bands whilst raising the boom on ‘hand’ operation. Adjust if necessary (Appendix A).	Y	Z

2. Local and Manual Control BR Spec. 843

2.1	Open the local control unit door. Check when unlocked that the key is retained in the lock and cannot be withdrawn unless the door is locked again.		
2.2	Operate the control switch to the lower position and Observe the following items:		
2.3	Open the operator’s door (rear) of Y pedestal. Check that if the audible warnings are designed to continue to operate when the booms are fully lowered they are silenced.		
	Extend the pump handle and hand pump the boom to the raised position. Observe the following items:		
2.4	The boom does not lower between pumping strokes.	Y	Z
2.5	The red flashing road signals are illuminated.	Y	Z
2.6	The audible warnings remain silent.	Y	Z
2.7	Open the operator’s door (rear) of Z pedestal. Extend the pump handle and hand pump the boom to the raised position. Observe the following items:		
2.8	The boom does not lower between pumping strokes.	Y	Z
2.9	The red flashing road signals stay illuminated until the Z boom is above 80° from the horizontal.	Y	Z
2.10	The audible warnings remain silent.	Y	Z
2.11	On Y pedestal lift the pump handle and allow the boom to fall sufficiently to illuminate the red flashing road signals.	Y	Z
2.12	Release the pump handle and check that the boom movement is arrested.	Y	Z
2.13	Check that the audible warnings are silent. Pump the boom to the raised position.	Y	Z
2.14	Observe that the red flashing road signals are extinguished when the boom is above 45° from the horizontal.	Y	Z
2.15	Repeat 2.11 to 2.14 for Z pedestal.		

2.16	On Y pedestal lift the pump handle and allow the boom to fully lower	Y	Z
2.17	Check that the operator's door cannot be closed and locked unless the pump handle is in the stowed position.	Y	Z
2.18	Check that the guide pin is seated in the bottom of the guide slot when the pump handle is fully stowed.	Y	Z
2.19	Check that the spiral pin is not bent and the spiral pin guide is not worn or does not have a 'step'.	Y	Z
2.20	Close and fully lock the operator's door ensuring that the audible warnings remain silent. When locking the operators' door check that the key is turned a further 90° clockwise then back again to the removal position to correctly operate the door proving micro switch.	Y	Z
2.21	Repeat 2.16 to 2.20 for Z pedestal ensuring that when the operator's door is fully locked the audible warnings (if designed to operate when the booms are lowered) begin to sound.		
	Operate the switch in the local control unit to the raise position and Observe the following:		
2.22	Both booms rise together.	Y	Z
2.23	The red road lights extinguish and the audible warnings cease before the booms have reached 45° from the horizontal.		
2.24	Operate the switch to the lower position and wait for the boom to be in the fully lowered		
2.25	Operate the switch to the auto position and Observe the sequence of events occur as listed in 2.22 to 2.24. On modern installations the switch can be put straight to the auto position, which will cause the booms to perform a lowering sequence then rise. Check the diagrams for the correct mode of operation applicable to the crossing.		
2.26	Close and lock the local control unit door.		

3. Telephone System

Different types of telephones systems are fitted to AHBC's. Older installations at BR standard Mk1crossings usually have two pedestal phones, two emergency phones, and two 'lay-by' phones.

If the crossing has had 'section 66' modifications the two 'lay-by' telephones are replaced with signs instructing the public to use the phones at the crossing.

Newer installations (BR Spec. 843) usually have two emergency phones and a LCU phone. There are also 'hybrid' installations, which can be a mixture of the two types.

The crossing section order will state the telephone system that is required at the crossing.

Identify telephones at the installation under test in the grid:

No.	Telephone Identity
1	
2	
3	
4	

		Telephone Identity (see Grid)			
3.1	Check the telephone and cord is undamaged.	1	2	3	4
3.2	Check the correct labels and symbols are fitted inside and outside the case and they are legible.	1	2	3	4
3.3	Check that any associated signs are stable, undamaged and legible. Emergency telephones require having the yellow telephone symbol visible on three sides of the telephone case or on a separate plate above the telephone.	1	2	3	4
3.4	Check that the correct crossing name is stated on any telephone labels and signs.	1	2	3	4
3.5	Check that telephone numbers given on any sign are correct. The site plan will give information on the correct names/numbers that shall be displayed.	1	2	3	4
3.6	If betalights are fitted, check they are lit. Betalights are usually fitted to older style telephones units that the public have access to.	1	2	3	4

3.7	On emergency telephones, check that an ETD number is given for the public to call in case they cannot contact the monitoring point. Ring this number and check that the recipient uses the correct procedures for the call.	1	2	3	4
Public Telephone Numbers					
3.8	Ring the monitoring point and check that the call is received correctly. Ask the monitoring point to ring back.	1	2	3	4
3.9	Check the telephone rings correctly. Check that the quality of speech and hearing is clear and not distorted. On Whitely PETS telephone systems there is a short time when answering a call at either end of the line where the system 'handshakes' During this period transmission and reception of speech is not possible.	1	2	3	4
3.10	If lay-by and/or pedestal telephones are fitted check that there is a ring differential at the monitoring point between them and the emergency telephones.	1	2	3	4
3.11	Check that if a lay-by or pedestal telephone is in use a call from the emergency telephone is still received correctly at the monitoring point	1	2	3	4
3.12	Check that with one of the emergency telephones left 'off the hook' calls on the other telephones can be made and received correctly. Whitely PETS systems will indicate a fault at the monitoring point.	1	2	3	4
3.13	If a block switch is fitted check that when operated 3.8 to 3.12 operate correct at the alternative monitoring point.				
3.14	Check that at the normal monitoring point any audible devices do not sound.				
3.15	Repeat 3.13 to 3.14 for any other alternative monitoring points.				
3.16	If an absent switch is fitted to the telephone system operate it and check that if an emergency call made this is indicated by a low level of illumination of the telephone unit and any audible devices do not sound. Operate the absent switch is back to normal operation and check that a normal emergence call is received.				
3.17	Switch off the mains power to the telephone system. After a period of time equal to the crossing sequence testing repeat tasks 3.8 to 3.16. Switch the mains power to the telephone system back on.				

4. Barrier Proving

Check that a cut-out is provided in the motor contactors before proceeding with 4.2 to 4.4.

The booms can be lowered and raised by local control or train simulation.

4.1	Turn the mains power off.		
4.2	Allow the booms to lower.		
4.3	Disconnect the Up KR link in the equipment room/location from one of the booms.	Y	Z
4.4	Turn the LCU Switch to raise, allow the booms to rise.		
4.5	Check that the red flashing road lights signals have extinguished when the booms reach 45° from the horizontal.	Y	Z
4.6	Check that the road signals re-illuminate 6 seconds after the booms have started to rise.	Y	Z
4.7	Reconnect the Up KR link and check that the road signals extinguish.	Y	Z
4.8	Repeat 4.2 to 4.7 for the other boom.		

5. Red Flashing Road Traffic Light Signal Proving

The booms shall be lowered and raised by train simulation.

Some early installations only require one red road light to be working on each side to allow the booms to rise. (RECR modifications have not been carried out)

Check the diagrams for circuit design. Report any of these crossings to the S&T Maintenance Engineer.

If auxiliary road traffic light signals are fitted (in addition to YO, YN, ZO and ZN), list the addional signal identification below:

	Signal number	Signal Identitication
	Aux 1	
	Aux 2	

5.1	Simulate a train striking in and allow the booms to lower. Check that all the red road signals are illuminated (flashing).	YO	YN	ZO	ZN	Aux 1	Aux 2
5.2	Measure the rate of flashing (Between 70 and 90 flashes per minute).			**FPM**			

5.3	Disconnect the left and right lamps on one of the light units by slipping the links in the equipment room/loc	YO	YN	ZO	ZN	Aux 1	Aux 2
5.4	Operate the exit function and remove the train simulation. Check that the booms remain lowered.	YO	YN	ZO	ZN	Aux 1	Aux 2
5.5	Re-connect the right hand lamp and check that the booms raise.	YO	YN	ZO	ZN	Aux 1	Aux 2
5.6	Disconnect again the right hand lamp and simulate a train striking in. Check that approximately 2 seconds after the amber lights extinguish the booms begin to lower.	YO	YN	ZO	ZN	Aux 1	Aux 2
5.7	Operate the exit function and remove the train simulation. Check that the booms remain lowered.	YO	YN	ZO	ZN	Aux 1	Aux 2
5.8	Re-connect the left hand lamp and check that the booms raise. Re- connect the right hand lamp	YO	YN	ZO	ZN	Aux 1	Aux 2
5.9	Repeat 5.1 to 5.8 for the other red road signal units. The flashes per minute rate only requires to be measured on one light unit.						
5.10	Reconnect the Mains Power.						

6. Special Control Function Sequence

Is This Section Applicable to the Crossing Under Test?	Yes	No

6.1	Turn the Mains power On
6.2	Perform any special control functions according to the control tables (Stopping/Non-Stopping, Signal, TRTS etc). Record the function performed and its results.

Function	**Result**

7. Strike in Track Circuit Resetting

Is This Section Applicable to the Crossing Under Test?	Yes	No

Direction	TC Name	Time (seconds)
Up		
Up X		
Dn		
Dn X		

		Up	Up X	Dn	Dn X
7.1	Simulate an approaching train by shunting a controlling track circuit. Observe that the barrier lowering sequence is correct.				
7.2	Make up the track circuit and start timing with a stopwatch from the time the track circuit is re-connected. Check that the booms remain lowered				
7.3	Observe that after 120 seconds the booms rise. If any adjustments have to be made to achieve this time, allow a period of time for the bi-metal strip in the timer to cool down.				

8. Leaving Track Circuit Resetting

Is This Section Applicable to the Crossing Under Test?	Yes	No

Check the diagrams to find if these controls are fitted to the crossing.

The booms shall be operated by train simulation.

Record the actual times in the grid below.

Direction	Entrance TC	Exit TC	Time (seconds)
Up			
Up X			
Dn			
Dn X			

8.1	Simulate a train striking in by dropping a controlling track circuit, Observe that the boom lowering sequence is correct	Up	Up X	Dn	Dn X
8.2	Drop the leaving track circuit, operate the exit function and make up the controlling track circuit. Check that the leaving track circuit remains dropped.	Up	Up X	Dn	Dn X
8.3	Observe that a boom raising sequence takes place when the controlling track circuit is made up, start timing with a stopwatch as soon as the booms start to rise.	Up	Up X	Dn	Dn X
8.4	Observe that after 130 seconds on double lines or 120 seconds on single lines a boom lowering sequence takes place	Up	Up X	Dn	Dn X
8.5	Re-connect the leaving track circuit and Observe that after 120 seconds a boom raising sequence takes place. If any adjustments have to be made to achieve this time, allow a period of time for the bi-metal strip in the timer to cool down	Up	Up X	Dn	Dn X

9. Speed Discriminator

Is This Section Applicable to the Crossing Under Test?	Yes	No

9.1	Check (if fitted) that the speed discriminator synchronous motor timer times correctly.	Up	Dn
9.2	Record the time up and down (in seconds).		

Direction	Time
Up	
Dn	

10. Line Dimensions

Is This Section Applicable to the Crossing Under Test?	Yes	No

Where track works have taken place since the pervious test

10.1	Check and identify the distance of track circuits and treadles as specified on the signalling plan. Record the design and actual dimensions.

Line	Design Measurement	Actual Measurement

11. Indications (Needle Type) and Audible Devices

Is This Section Applicable to the Crossing Under Test?	Yes	No

It may be convenient to combine this with Section 3 - Telephone systems.

A competent person (not the signaller) is required at the monitoring point(s) to observe the indications.

11.1	Check that the indicator is in the barriers raised / power on position.	
11.2	Simulate a train striking in and Observe that the indicator moves to the no legend (barriers working) position.	
11.3	Remove the train simulation and operate the exit function, Observe that the indication returns to the barriers raised / power on position.	
11.4	Open the local control operator’s door, if door proving is fitted Observe that the indicator moves to the no legend (barriers working) position.	
11.5	Otherwise operate the local control buttons to raise, lower and hand in turn and Observe that the indicator moves to and remains in the no legend (barriers working) position.	
11.6	Return the local control unit to the auto position and close and lock the operator’s door, Observe that the indicator returns to the barriers raised / power on position.	
11.7	Simulate a train striking in and Observe that the indicator moves to the no legend (barriers working) position.	

11.8	Check that after 240 seconds on double lines or 180 seconds on single lines the audible alarm sounds and it can be silenced.	
11.9	Remove the train simulation and operate the exit function. Observe that the indication returns to the barriers raised / power on position and the audible alarm sounds and it can be silenced.	
11.10	Withdraw in turn each power supply fuse that is in the (PO) PR circuit (check diagrams). Observe that for each fuse the indicator moves to the barriers raised / power off position.	
11.11	Check that the audible alarm sounds and can be silenced.	
11.12	When each fuse is replaced Observe that the indicator returns to the barriers raised / power on position	
11.13	Check that the audible alarm sounds and can be silenced.	
11.14	Check (where provided) that the monitoring point test switches operate.	
11.15	If an Absent switch is provided, switch to the absent position and check that the indicator moves to the no legend (barriers working) position, the audible alarms devices do not sound and the level crossing protecting functions (block/signal) are effective.	
11.16	If a block switch is provided, switch to the alternative monitoring point and check that at the normal monitoring point the indicator moves to the no legend (barriers working) position and the audible alarms devices do not sound. At the alternative monitoring point repeat 11.1 to 11.14.	

12. Indications (Lamp Type) and Audible Devices

Is This Section Applicable to the Crossing Under Test?	Yes	No

It may be convenient to combine this with Section 3 - Telephone systems

A competent person (not the signaller) is required at the monitoring point(s) to observe the indications

The barrier indications are normally White for barriers raised, barriers working and power on. For barriers failed and standby in use they are normally Red.

12.1	Check that the indications show barriers raised and power on.	
12.2	Simulate a train striking in and Observe the barriers raised indication extinguishes, the barriers working indication illuminates and the power on indication remains illuminated.	
12.3	Operate the exit function and remove the train simulation, Observe that the barriers working indication extinguishes, the barriers raised indication illuminates and the power on indication remains illuminated.	

12.4	Open the LCU unit door and Observe that the barriers raised indication extinguishes, the barriers working indication illuminates and the power on indication remains illuminated.	
12.5	Check that with each position of the switch (Raise, Lower/Hand and Auto) the barriers raised indication remains extinguished and the barriers working indication remains illuminated.	
12.6	Return the switch to the auto position, and close and lock the door. Observe that the barriers raised indication illuminates, the barriers working indication extinguishes and the power on indication remains illuminated.	
12.7	Unlock in turn each of the BR standard 843 barrier pedestal unit operator's doors (rear) and Observe that the barriers raised indication extinguishes and the barriers working indication illuminates when unlocked and illuminates again when locked. The power on indication will remain illuminated.	
12.8	Operate in turn each exit treadle (or freddy) and Observe that the barriers raised indication extinguishes and the barriers working indication illuminates when the treadle is not proving normal (or freddy activated) and returns to barriers raised illuminated, barriers working extinguished again when normal proving is regained (or freddy de-activated). The power on indication will remain illuminated.	
12.9	Simulate a train striking in and Observe that the barrier raised indicator extinguishes and the barriers working indicator illuminates.	
12.10	Check that after 240 seconds on double lines or 180 seconds on single lines the barriers working indicator extinguishes, the barriers failed indication illuminates and the audible alarm sounds and it can be silenced. The power on indication will remain illuminated.	
12.11	Remove the train simulation and operate the exit function, Observe that the barriers failed indication extinguishes, the barriers raised indication illuminates, and the audible alarm sounds and it can be silenced. The power on indication will remain illuminated.	
12.12	Withdraw in turn each power supply fuse that is in the (PO) PR circuit (check diagrams). Observe that for each fuse the power on indication extinguishes and the standby in use indication illuminates.	
12.13	Check that the audible alarm sounds and can be silenced. When each fuse is replaced Observe that the standby in use indication extinguishes and the power on indication illuminates.	
12.14	Check that the audible alarm sounds and can be silenced. The barriers raised indication will remain illuminated.	
12.15	Check (where provided) that the monitoring point test switches operate.	
12.16	If an Absent switch is provided, switch to the absent position and check that all the indications extinguish, the audible alarms devices do not sound and the level crossing protecting functions (block/signal) are effective.	

12.17	If a block switch is provided, switch to the alternative monitoring point and check that at the normal monitoring point all the indications are extinguished and the audible alarms devices do not sound. At the alternative monitoring point repeat 12.1 to 12.16.	☐

APPENDIX A - Circuit Controller Band Settings

Band	**Made Between**
DN KR	0° and 4°
HJPR	42° and 90°#
MR	0° and 83°
UP KR	81° and 90°

#: The HJPR band on early installations may be set to make sooner than 42°. Check the diagrams for the required setting for the installation you are testing.

NOTE: *It is important to obtain the over-lap between the UP KR band making and the MR band breaking. This is to ensure that if a boom drops slightly it will drive up again before the red road signals operate.*

END

LEVEL CROSSING TESTING

AUTOMATIC BARRIER CROSSING LOCALLY MONITORED (ABCL)

AND

AUTOMATIC FULL BARRIER CROSSING LOCALLY MONITORED (AFBCL)

NR/SMS/LX71

Published & Issued by: Network Rail Kings Place 90 York Way, London N1 9AG

GENERAL

This test plan covers the requirements of NR/SMS/PartC/LC10, NR/SMS/PartB/Test/071 and NR/SMS/PartB/Test/160 . It is for use of the person conducting the annual test of the level crossing and has relevant 'tick boxes' by each task so that particular item of the test can be correctly recorded as per the index in "crossing defects".

a) The crossing ground plan.

b) The level crossing order.

c) The crossing control tables.

d) The signalling plan.

Missing documentation shall be listed as a defect.

TEST SUMMARY

Test Summary
Name of Level Crossing:
Level Crossing Type:
Name of Monitoring Signal Box(es):
Date of Full Test:
Time Full Test Commenced:
Time Full Test Completed:
Tested By:
Signature:
Date of Signature:
Grade and Title:

CROSSING DEFECTS

On the test plan each item shall be recorded with the following letters in the box provided:

X: Found Incorrect, Action Required.
R: Found Incorrect, Rectified on Day of Test.
C: Correct.
N: Not Applicable to this Installation.

Any items found incorrect (X or R) are to be listed on the summary pages. On items requiring action, list the party(s) responsible for rectifying them.

SUMMARY OF ITEMS FOUND INCORRECT (1)

List in the table below all sites found incorrect and rectified on the day of the test (code letter R).

Description of Items Found Incorrect and Rectified

SUMMARY OF ITEMS FOUND INCORRECT (2)

List in the table below items found incorrect and requiring action (code letter X).

Description of Items Found Incorrect and Requiring Action	Responsible Party (s)

1. Road Arrangements

1.1	Check that the road markings are in accordance with the section order and plans.	
1.2	Check that the road markings on the approaches to the crossing (up to the stop line) are complete and visible.	
1.3	Check the condition and the sighting of the road signs on the crossing approaches. See NR/SMS/SG00 for details on reflective boards and signs.	
1.4	Check (if provided) the condition and security of any pedestrian guardrails.	
	Any defects found in 1.2 to 1.4 shall be reported to the appropriate council via the SM(S)	
1.5	Check the condition of the road surface over the crossing.	
1.6	Check that the road markings between and including the stop lines are complete and visible.	
1.7	Check (if provided) that the cattle/anti-trespass guards are complete and securely fastened down.	
1.8	Check (if provided) the condition and security of any wicket gates.	
1.9	Check the condition and the security of any fencing on the approach to equipment room or locations.	

2. Barrier and Machine (BR Spec. 843)

2.1	Check the following on the barrier pedestal unit:	YN	YO	ZN	ZO
2.2	The pedestal is correctly aligned and stable.	YN	YO	ZN	ZO
2.3	The locks and hinges are undamaged.	YN	YO	ZN	ZO
2.4	With the boom in the raised position there is adequate clearance between the side arm/counter balance weights and the ground/base.	YN	YO	ZN	ZO
2.5	The main shaft to side arm fastenings. Check that there is not any excessive play in the keyway.	YN	YO	ZN	ZO
2.6	Lower the barriers on local control and leave the LCU switch in the Lower position. Open the front and rear doors of the pedestal units and fully extend the manual pump handle. Pump the booms to the fully raised position and Observe they remain raised.	YN	YO	ZN	ZO
2.7	On each barrier in turn raise the pump handle until the boom begins to lower. Check that the pump handle roll pin has not reached an alignment where its top is above the bottom edge of the handle guide slot. Allow the boom to fully lower and Check the following:	YN	YO	ZN	ZO
2.8	The boom takes 6 to 8 seconds to lower.	YN	YO	ZN	ZO

2.9	The boom is damped during the last 10° to 15° of movement.	YN	YO	ZN	ZO
2.10	The boom is horizontal when fully lowered.	YN	YO	ZN	ZO
2.11	The boom is the correct length.	YN	YO	ZN	ZO
	Design	YN	YO	ZN	ZO
	Actual	YN	YO	ZN	ZO
2.12	Condition of the boom.	YN	YO	ZN	ZO
2.13	The security of the boom.	YN	YO	ZN	ZO
2.14	The boom fixing bolt 'E' clips are undamaged and the whole shear bolt assembly has had grease applied.	YN	YO	ZN	ZO
2.15	The reflective strips are undamaged, clean and are in the correct position.	YN	YO	ZN	ZO
2.16	The boom lamps, hoods, brackets, and fastenings are undamaged, free from corrosion and correctly aligned.	YN	YO	ZN	ZO
2.17	The boom wiring, plugs, clamps, and terminations are undamaged.	YN	YO	ZN	ZO
2.18	(If Fitted) the strainer wire, support bracket and fastenings are effective.	YN	YO	ZN	ZO
	Check the height of the boom from the road surface.				
2.19	Top of barrier at the centre of the road (0.9m Minimum).	YN	YO	ZN	ZO
2.20	Underside of barrier at any point (1m Maximum).	YN	YO	ZN	ZO
2.21	Check the counter balance weights are secure and are the correct weight by Measuring with a weight measuring device the tip weight by using the following method:				
	• At the tip end slowly lift the boom until it is approximately 4° to 5° from the horizontal.				
	• Connect the weight measuring device to the tip end of the boom.				
	• Release the boom onto the measuring device ensuring that the boom has not fully lowered then take a reading.				

Boom Length	Tip Weight
3.6m to 4.1m	7.6Kg
4.6m to 9.1m	6.1Kg

2.22	Check that the boom can be lifted by hand to the fully raised position.	YN	YO	ZN	ZO
2.23	Check the interior of the pedestal for water ingress and contamination. Clean as necessary.	YN	YO	ZN	ZO

	Check the following on the hydraulic pack assembly:				
2.24	The pack fastenings.	YN	YO	ZN	ZO
2.25	The top and bottom pack trunnion block mountings and lock washers.	YN	YO	ZN	ZO
2.26	Bolts through the trunnion to the operating lever are the correct length and spiral pins are fitted correctly.	YN	YO	ZN	ZO
2.27	The ram adjusting screw and lock washer. Do not adjust the screw.	YN	YO	ZN	ZO
2.28	The auto/manual valve is set in the auto position and the split pin and seal are intact.	YN	YO	ZN	ZO
2.29	The wiring and terminations to the pack. The movement of the pack can cause the B24 feed wire to break internal strands, disconnect the wires to check for this type of damage.	YN	YO	ZN	ZO
2.30	The fluid level is correct. Just visible in the filter strainer or to the max mark on the indicator.	YN	YO	ZN	ZO
2.31	The motor brushes. They shall be of sufficient length, slide freely in their holder and seat fully on the commutator.	YN	YO	ZN	ZO
2.32	The motor commutator (where accessible). It shall be undamaged and a light coffee colour.	YN	YO	ZN	ZO
2.33	Record the pack details (Mk and serial number). Check that the pack is of the correct type for an ABCL (coloured blue).				

Unit	Mk	Serial Number

2.34	Check that the shock absorber plunger cannot be depressed more than 3mm by finger pressure.	YN	YO	ZN	ZO
2.35	Check the up and down stop block striker pads. Replace if worn.	YN	YO	ZN	ZO
	Unfasten the lid of the circuit controller and Check the following items:				
2.36	The spindle and control arm are lubricated and free from wear. Do not lubricate the spindle if fitted with Oilite bearings. This can be identified by a P or an R stamped on the controller lid.	YN	YO	ZN	ZO

	Terminations and wiring.				
2.37	Contact fingers. Replace any fingers that are worn or have lost their spring tension.	YN	YO	ZN	ZO
2.38	Bands. Check they are clean and not worn (copper dust in the bottom of the casting) If worn the complete controller shall be renewed.	YN	YO	ZN	ZO
2.39	Measure by use of an inclinometer and digital voltmeter (on resistance) the setting of the bands whilst raising the boom on ‘hand’ operation. Adjust if necessary (Appendix A).	YN	YO	ZN	ZO
2.40	Close and fasten the circuit controller. Check if any adjustments have been carried out that all the terminations have been correctly tightened.	YN	YO	ZN	ZO
2.41	Check the circuit controller cam, cam slot and roller assembly.	YN	YO	ZN	ZO
2.42	Check the earth-bonding strip is secure and undamaged.	YN	YO	ZN	ZO
2.43	Check the main shaft bearings and fastenings. Check that sufficient grease has been applied to the bearings	YN	YO	ZN	ZO
2.44	Check the bearing end cap seals are effective. Water ingress into the end caps can freeze and prevent the booms from lowering.	YN	YO	ZN	ZO
2.45	Check that the pedestal fixing bolts are all fitted and correctly tightened.	YN	YO	ZN	ZO
2.46	Check the operator’s door (rear) micro switch assembly, fastenings and wires. Check that they are secure and undamaged.	YN	YO	ZN	ZO
2.47	Raise the boom by hand pumping, Check that the boom does not lower between pumping strokes.	YN	YO	ZN	ZO
2.48	Lower both the booms; stow the pump handles and close and lock the operator’s doors (rear). Raise the boom under ‘power’ operation by switching the LCU to raise and Check the following:	YN	YO	ZN	ZO
2.49	The booms are between 80° and 85° when fully raised.	YN	YO	ZN	ZO
2.50	The booms do not excessively oscillate when they come to rest in the raised position.	YN	YO	ZN	ZO
2.51	The booms do not ‘hunt’ when fully raised. This is a sign of an internal fluid leak inside the hydraulic pack.	YN	YO	ZN	ZO
2.52	Close and lock the front pedestal door.	YN	YO	ZN	ZO

3. Local and Manual Control

3.1	Open the local control unit door. Check when unlocked that the key is retained in the lock and cannot be withdrawn unless the door is locked again.	YN	YO	ZN	ZO
3.2	Operate the control switch to the lower position and Observe the following items:				
3.3	All the amber road signals illuminate, and the audible warnings commence concurrently (Yodalarms at normal warbling rate).	YN	YO	ZN	ZO
3.4	After 3 seconds all the amber signals extinguish, and all the red flashing road signals start to flash.	YN	YO	ZN	ZO
3.5	The crossing headlights illuminate the crossing at the same time the red road lights commence to flash.	YN	YO	ZN	ZO
3.6	The DWL signals do not illuminate for any direction.	YN	YO	ZN	ZO
3.7	After approximately a further 4 seconds the booms commence to lower.	YN	YO	ZN	ZO
3.8	The booms take 6 to 8 seconds to reach the fully lowered position.	YN	YO	ZN	ZO
3.9	Red flashing road lights continue to be illuminated. Audible warnings continue to sound.	YN	YO	ZN	ZO

As this Test covers both Two and Four barrier crossings steps 3.10 to 3.35 are repeated and should be carried out for both sides of the crossing. If carrying out a Four barrier crossing both columns should be completed

3.10	Open the operator's door (rear) of Y pedestal. Check the audible warnings are silenced. Extend the pump handle and hand pump the boom to the raised position. Observe the following items:		
3.11	The boom does not lower between pumping strokes.	2	4
3.12	The red flashing road signals are illuminated.	2	4
3.13	The audible warnings remain silent.	2	4
3.14	Open the operator's door (rear) of Z pedestal. Extend the pump handle and hand pump the boom to the raised position. Observe the following items:		
3.15	The boom does not lower between pumping strokes.	2	4
3.16	The red flashing road signals stay illuminated until the Z boom is above 80° from the horizontal.	2	4
3.17	The audible warnings remain silent.	2	4
3.18	Operate the LCU control switch to the raise position and check that the red flashing road signals are extinguished.	2	4

3.19	On Y pedestal lift the pump handle and allow the boom to fall sufficiently to illuminate the red flashing road signals. Release the pump handle and Check that the boom movement is arrested.	2	4
3.20	Check that the audible warnings are silent. Pump the boom to the raised position.	2	4
3.21	Observe that the red flashing road signals are extinguished when the boom is above 80° from the horizontal.	2	4
3.22	On Z pedestal lift the pump handle and allow the boom to fall sufficiently to illuminate the red flashing road signals. Release the pump handle and Check that the boom movement is arrested.	2	4
3.23	Check that the audible warnings are silent. Pump the boom to the raised position.	2	4
3.24	Observe that the red flashing road signals are extinguished when the boom is above 80° from the horizontal.	2	4
3.25	Operate the LCU switch to the lower position.	2	4
3.26	On Y pedestal lift the pump handle and allow the boom to fully lower	2	4
3.27	Check that the operator's door cannot be closed and locked unless the pump handle is in the stowed position.	2	4
3.28	Check that the guide pin is seated in the bottom of the guide slot when the pump handle is fully stowed.	2	4
3.29	Check that the spiral pin is not bent, and the spiral pin guide is not worn or does not have a 'step'.	2	4
3.30	Close and fully lock the operator's door ensuring that the audible warnings remain silent.	2	4
	When locking the operators' door check that the key is turned a further 90° clockwise then back again to the removal position to correctly operate the door proving micro switch.		
3.31	On Z pedestal lift the pump handle and allow the boom to fully lower	2	4
3.32	Check that the operator's door cannot be closed and locked unless the pump handle is in the stowed position.	2	4
3.33	Check that the guide pin is seated in the bottom of the guide slot when the pump handle is fully stowed.	2	4
3.34	Check that the spiral pin is not bent, and the spiral pin guide is not worn or does not have a 'step'.	2	4
3.35	Close and fully lock the operator's door ensuring that the audible warnings remain silent.	2	4
	Operate the switch in the local control unit to the raise position and Observe the following:		
3.36	All booms rise together.		
3.37	The red road lights extinguish, and the audible warnings cease before the booms have reached 45° from the horizontal.		

3.38	Check that the guide on the inside of the local control unit door prevents the door being closed and locked unless the switch is in the auto position.	
3.39	Operate the switch to the auto position and Observe that a lowering sequence takes place and then the booms rise as listed in section 13.	
3.40	Close and lock the local control unit door.	

4. Road Traffic Light Signals

If auxiliary road traffic light signals are fitted (in addition to YO, YN, ZO and ZN), list the additional signal identification below:

Signal Number	Signal Identification
Aux 1	
Aux 2	

On each of the road traffic light signals Check the following items:

4.1	The signal structure is stable.	YO	YN	ZO	ZN	Aux 1	Aux 2
4.2	The signal light units are undamaged, and the hoods are securely fitted.	YO	YN	ZO	ZN	Aux 1	Aux 2
4.3	The signal lenses are undamaged, clean and correctly orientated.	YO	YN	ZO	ZN	Aux 1	Aux 2
4.4	Signs and notices attached to the signal post are undamaged, clean, and legible See NR/SMS/PartC/SG00 (Signals : General) for details on reflective boards and signs.	YO	YN	ZO	ZN	Aux 1	Aux 2
4.5	Cables and conduit are undamaged and secure.	YO	YN	ZO	ZN	Aux 1	Aux 2
4.6	Check that if the signals are fitted with 50-watt Quartz Halogen lamps the road traffic light signal backboard is fitted with a red/white border. White only and red/white border backboards shall not be mixed together at the same crossing.	YO	YN	ZO	ZN	Aux 1	Aux 2

5. Audible Warnings

5.1	Check that the audible warning device and any exposed cables and conduit are undamaged and secure. Check that the device is correctly aligned.	YO	YN	ZO	ZN
5.2	Check that there has been no water ingress into audible warning device. Rectify or replace as necessary.	YO	YN	ZO	ZN
5.3	Check that the sound output of the audible warning is sufficient for the crossing circumstances and (if applicable) is reduced for the night time. Some crossings have had the sound output of audible warning device reduced because of local conditions, check the diagrams.	YO	YN	ZO	ZN
5.4	Check (if applicable) that the audible warning time clock is set to the correct time and the day/night settings are correct. Some time clocks have a control to 'skip' the set controls on certain days, check this is not activated.				

6. Pedestrian Signals

Is This Section Applicable to the Crossing Under Test?	Yes	No

If auxiliary pedestrian signals are fitted (in addition to YO, YN, ZO and ZN), list the additional signal identification below:

Signal Number	Signal Identification
Aux 1	
Aux 2	

6.1	Check that the sign is securely fixed to the post, the post is stable; the sign is undamaged and correctly aligned	YO	YN	ZO	ZN	Aux 1	Aux 2
6.2	Check that the hood is securely fitted, and the signal face is clean and undamaged	YO	YN	ZO	ZN	Aux 1	Aux 2
6.3	If a sun screen is fitted Check this is undamaged and securely fitted.	YO	YN	ZO	ZN	Aux 1	Aux 2

7. Crossing Headlight Unit

7.1	Check that the structure is stable and securely fixed in the ground.	Y	Z
7.2	Check that the light unit is undamaged and correctly aligned.	Y	Z
7.3	Check that the lens is clean, and the hood is securely fixed.	Y	Z

8. Drivers Crossing Indicators (DRL/DWL) Signals

8.1	Check (with no trains approaching) that the flashing red signal (DRL) is clearly visible from the speed restriction board	UP	UP X	DN	DN X
8.2	Check that the structure is stable and securely fixed in the ground.	UP	UP X	DN	DN X
8.3	Check that the unit is undamaged, correctly aligned and sighted	UP	UP X	DN	DN X
8.4	Check that the lens(es) are clean and the hood(s) is/are securely fitted.	UP	UP X	DN	DN X
8.5	Check that all the LED's on the DRL unit are flashing	UP	UP X	DN	DN X

9. Lineside Notice Boards and Signs

9.1	Check that the sign is securely fixed to the post, the post is stable and securely fixed in the ground	UP	UP X	DN	DN X
9.2	Check that the sign is correctly aligned and sighted	UP	UP X	DN	DN X
9.3	Check that the sign is of the correct retro-reflective material (see 1.3)	UP	UP X	DN	DN X
9.4	Check that the sign is clean, and the legend is correct and legible. The site plan will give details on the correct information that shall be displayed.	UP	UP X	DN	DN X

10. Telephone System

The majority of installations usually have two emergency phones and an LCU phone. There are also some installations that have 'lay-by' phones because of the road conditions. The crossing section order will state the telephone system that is required at the crossing.

Identify telephones at the installation under test in the grid below:

No.	Telephone Identity
1	
2	
3	
4	
5	
6	
7	

		Telephone Identity (see Grid)						
10.1	Check the telephone and cord is undamaged.	1	2	3	4	5	6	7
10.2	Check the correct labels and symbols are fitted inside and outside the case and they are legible.	1	2	3	4	5	6	7
10.3	Check that any associated signs are stable, undamaged and legible. Emergency telephones require having the yellow telephone symbol visible on three sides of the telephone case or on a separate plate above the telephone	1	2	3	4	5	6	7
10.4	Check that the correct crossing name is stated on any telephone labels and signs	1	2	3	4	5	6	7
10.5	Check that telephone numbers given on any sign are correct. The site plan will give information on the correct names/numbers that shall be displayed.	1	2	3	4	5	6	7
10.6	If betalights are fitted, check they are lit. Betalights are usually fitted to older style telephones units that the public have access to.	1	2	3	4	5	6	7
10.7	On emergency telephones Check that an ETD number is given for the public to call in case they cannot contact the monitoring point. Ring this number and Check that the recipient uses the correct procedures for the call.	1	2	3	4	5	6	7

Public Telephone Numbers

10.8	Ring the monitoring point and Check that the call is received correctly. Ask the monitoring point to ring back.	1	2	3	4	5	6	7

10.9	Check the telephone rings correctly. Check that the quality of speech and hearing is clear and not distorted. On Whitely PETS telephone systems there is a short time when answering a call at either end of the line where the system 'handshakes' During this period transmission and reception of speech is not possible.	1	2	3	4	5	6	7
10.10	Check that with one of the emergency telephones left 'off the hook' calls on the other telephones can be made and received correctly. Whitely PETS systems will indicate a fault at the monitoring point.	1	2	3	4	5	6	7
10.11	Switch off the mains power to the telephone system. After a period of time equal to the crossing sequence testing repeat tasks 10.8 to 10.10. Switch the mains power to the telephone system back on.							

11. Barrier Proving

Check that a cut-out is provided in the motor contactors before proceeding with 11.1 to 11.5.

The booms can be lowered and raised by local control or train simulation.

11.1	Turn the mains power off.				
11.2	Allow the booms to lower. Restrain the tip of one of the booms then allow the barriers to rise.	YO	YN	ZO	ZN
11.3	Check that the motor cut-out for the restrained boom operates within 25 seconds. This time relates to a SPX Contactor only, if a different contactor is fitted refer to site diagrams and report to Section Manager.	YO	YN	ZO	ZN
11.4	Release the boom and check that the motor cuts in again within 3 minutes and the boom fully rises.	YO	YN	ZO	ZN
11.5	Repeat 11.1to 11.4 for each of the other booms.				

11.6	Allow the booms to lower. Disconnect the Up KR link in the equipment room/location from one of the booms. Allow the booms to rise.	YO	YN	ZO	ZN
11.7	Check that the red flashing road lights signals have extinguished when the booms reach 45° from the horizontal.	YO	YN	ZO	ZN
11.8	Check that the road signals re-illuminate 6 seconds after the booms have started to rise.	YO	YN	ZO	ZN
11.9	Reconnect the Up KR link and Check that the road signals extinguish.	YO	YN	ZO	ZN
11.10	Repeat 11.6 to 11.9 for each of the other booms.				
	Turn the mains power on.				

12. Driver's White Light (DWL) Signal Proving

The crossing shall be operated by train simulation. Check on the following tests that only the DWL for the direction in which the train simulation is applied operates

12.1	Simulate a train striking in and allow the crossing to operate. Check that all the red road signals are illuminated (flashing).	YO	YN	ZO	ZN	Aux 1	Au x 2
12.2	Measure the rate of flashing (Between 70 and 90 flashes per minute)			**FPM**			
12.3	Check that the DWL is illuminated (flashing).	YO	YN	ZO	ZN	Aux 1	Au x 2
12.4	Disconnect the left and right lamps on one of the light units by slipping the links in the equipment room/loc and Check that the DWL extinguishes and the DRL illuminates.	YO	YN	ZO	ZN	Aux 1	Au x 2
12.5	Re-connect the right-hand lamp and Check that the DRL extinguishes and the DWL illuminates.	YO	YN	ZO	ZN	Aux 1	Au x 2
12.6	Disconnect again the right-hand lamp and Check that the DWL extinguishes and the DRL illuminates.	YO	YN	ZO	ZN	Aux 1	Au x 2
12.7	Re-connect the left-hand lamp and Check that the DRL (if provided) extinguishes and the DWL illuminates.	YO	YN	ZO	ZN	Aux 1	Au x 2
12.8	Repeat 12.2 to 12.6 for all other light units.	YO	YN	ZO	ZN	Aux 1	Au x 2

12.9	Open the door of the LCU unit and Check that the DWL extinguishes and the DRL illuminates. Close and lock the door and Check that the DRL extinguishes and the DWL illuminates.	YO	YN	ZO	ZN
12.10	In turn open the operator's door (rear) of the Y and Z pedestals, Check that the DWL is extinguished and the DRL is illuminated as the door is opened	YO	YN	ZO	ZN
12.11	Check that the DRL is extinguished and the DWL is illuminated as each door is correctly closed and locked again.	YO	YN	ZO	ZN
12.12	Operate the exit function and remove the train simulation. If necessary, re-set the circuits to normalise the crossing controls.				

13. Local Control Sequence

13.1	Operate the LCU to the LOWER position and Check the following:	
13.2	All the amber road signals illuminate, and the audible warnings commence concurrently (Yodalarms at normal warbling rate).	
13.3	After 3 seconds all the amber signals extinguish, and all the red road signals and any pedestrian lights start to flash.	
13.4	The crossing headlights illuminate the crossing at the time the red road lights commence to flash.	
13.5	The DWL do not illuminate.	
13.6	The DRL continue to flash.	
13.7	After approximately a further 4 seconds at older the booms commence to lower and the boom lamps illuminate.	
13.8	The booms take 6 to 8 seconds to reach the fully lowered position.	
13.9	Red road lights and any pedestrian lights continue to be illuminated. Audible warnings continue to sound.	
13.10	Operate the LCU to the RAISE position and Check the following:	
13.11	The booms begin to rise.	
13.12	The red road lights extinguish, the lineside headlights extinguish, and the audible warnings cease before the booms have reached 45° from the horizontal.	
13.13	The boom lights extinguish when the booms have reached approximately 81° from the horizontal.	
13.14	The booms do not take more than 7 seconds to reach the fully raised position of between 81° and 85° from the horizontal.	

13.15	Operate the switch to the auto position and Observe that a lowering sequence as listed in 13.1 to 13.9 takes place and then the booms raise as listed in 13.12 to 13.14.	
13.16	Close and lock the LCU door.	

14. Automatic Control Sequence

- Check in the crossing control tables for any special controls that affect the automatic control sequence.
- Where the word EXIT occurs the strike out treadle shall be operated.
- On single lines or where bi-directional controls exist the leaving track circuit shall also be operated.
- Where directional proving controls exists the bi-directional strike out treadle shall also be operated in the correct sequence.

14.1	Observe, with no train approaching all DRL are illuminated (flashing) and are visible from the speed restriction board.	Up	Up X	Dn	Dn X
14.2	Simulate an approaching train by shunting a controlling track circuit. Observe the following:	Up	Up X	Dn	Dn X
14.3	On double lines 10 seconds elapse before the crossing sequence commences. On single lines the sequence starts immediately.	Up	Up X	Dn	Dn X
14.4	All the amber road signals illuminate, and the audible warnings commence concurrently (Yodalarms at normal warbling rate).	Up	Up X	Dn	Dn X
14.5	After 3 seconds all the amber signals extinguish, and all the red road signals and any pedestrian lights start to flash	Up	Up X	Dn	Dn X
14.6	The crossing headlights illuminate the crossing at the time the red road lights commence to flash.	Up	Up X	Dn	Dn X
14.7	After approximately a further 4 seconds the booms commence to lower.	Up	Up X	Dn	Dn X
14.8	As the booms commence to lower the DRL extinguishes and the DWL commences to flash for the direction where the train simulation was applied. The DRL continues for the opposing directions.	Up	Up X	Dn	Dn X
14.9	The booms take 6 to 8 seconds to reach the fully lowered position.	Up	Up X	Dn	Dn X
14.10	The crossing headlights, red road lights and any pedestrian lights continue to be illuminated and audible warnings continue to sound.	Up	Up X	Dn	Dn X

14.11	Operate the exit function and remove the train simulation. Observe the following:	Up	Up X	Dn	Dn X
14.12	The booms begin to rise.	Up	Up X	Dn	Dn X
14.13	The DWL for the direction where the simulation was applied extinguishes and the DRL commences to flash.	Up	Up X	Dn	Dn X
14.14	The red road lights and crossing headlights extinguish and the audible warnings cease when the booms have reached approximately 45° from the horizontal.	Up	Up X	Dn	Dn X
14.15	The boom lights extinguish when the booms have reached approximately 81° from the horizontal.	Up	Up X	Dn	Dn X
14.16	The booms do not take more than 7 seconds to reach the fully raised position of between 81° and 85° from the horizontal.	Up	Up X	Dn	Dn X
14.17	Repeat steps 14.2 to 14.16 for the opposite direction on a single line and the other direction on double lines.	Up	Up X	Dn	Dn X

15. Double Lines Second Train Approaching Sequence

Is This Section Applicable to the Crossing Under Test?	Yes	No

15.1	Simulate a train striking in on line one as per 14.2.	Up	Dn
15.2	Simulate a second train striking in on line two. Observe the following:	Up	Dn
15.3	The booms remain lowered.	Up	Dn
15.4	The road lights and any pedestrian lights continue to flash.	Up	Dn
15.5	The audible warning rate continues at the normal rate	Up	Dn
15.6	The crossing headlights continue to illuminate	Up	Dn
15.7	Operate the exit function and remove the simulation on line one. Observe the following:	Up	Dn
15.8	The booms remain lowered.	Up	Dn
15.9	The road lights and any pedestrian lights continue to flash.	Up	Dn
15.10	The audible warning rate changes to the increased rate.	Up	Dn
15.11	The crossing headlights continue to illuminate	Up	Dn
15.12	The DWL for the direction of the simulation on line one extinguishes and the DRL commences to flash.	Up	Dn
15.13	The DRL for the simulation on line two extinguishes and the DWL commences to flash.	Up	Dn

15.14	Operate the exit function and remove the simulation on line two. Observe that the sequence is the same as described in 14.3.	Up	Dn
15.15	Repeat steps 15.1 to 15.14 for a train striking in on line two first and a second train striking in on line one.	Up	Dn

16. Special Control Function Sequence

Is This Section Applicable to the Crossing Under Test?	Yes	No

16.1	Perform any special control functions according to the control tables (Stopping/Non-Stopping, Signal, TRTS etc). Record the function performed and its results.

Function	Result

17. Track Circuit Timing

Direction	TC Name	DWL Extinguishes (Seconds)	Booms Rise (Seconds)

17.1	Simulate an approaching train by shunting a controlling track circuit.	Up	Up X	Dn	Dn X
17.2	Start timing with a stopwatch as soon as the red flashing road signals and the DWL for the direction in which the simulation was applied illuminate.	Up	Up X	Dn	Dn X
17.3	Check that after 180 seconds the DWL extinguishes and the DRL commences to flash.	Up	Up X	Dn	Dn X
17.4	Check that 30 seconds after the DWL extinguishes the barriers perform a raising sequence as in 17.12 to 17.16. The only exception will be that the DWL will already be extinguished and the DRL will be flashing.	Up	Up X	Dn	Dn X
17.5	Remove the train simulation and operate the exit function. Check that the crossing controls return to their normal state. If necessary, re-set the circuits.	Up	Up X	Dn	Dn X
17.6	Repeat 17.1 to 17.5 for all other directions where controls are provided	Up	Up X	Dn	Dn X

18. Drivers Plunger Unit

NOTE: *On some designs the DWL will not illuminate when the driver's plunger is operated after the crossing has timed out. The DRL will remain flashing. Check the control tables and diagrams for the crossing you are testing.*

18.1	Simulate an approaching train by shunting a controlling track circuit and allow the crossing to time out.	Up	Up X	Dn	Dn X
18.2	Check that the DWL extinguishes and the DRL commences to flash.	Up	Up X	Dn	Dn X
18.3	Open the door of the unit and operate the plunger. Check that the crossing sequence starts.	Up	Up X	Dn	Dn X
18.4	Check that DWL for the direction of the plunger operation illuminates (if designed to do so, see note at start of section).	Up	Up X	Dn	Dn X

18.5	Operate the exit function and remove the train simulation. Check that raising sequence takes place as listed in 14.12 to 14.16.	Up	Up X	Dn	Dn X
18.6	Check that the DWL extinguishes (if operating, see note at start of section) and the DRL commences (or continues) to flash.	Up	Up X	Dn	Dn X
18.7	If necessary, reset the circuits to normalise the crossing controls. Close and lock the door of the plunger unit.	Up	Up X	Dn	Dn X
18.8	Repeat 18.1 to 18.7 for all other driver's plunger units.	Up	Up X	Dn	Dn X

19. Line Dimensions

Is This Section Applicable to the Crossing Under Test?	Yes	No

Where track works have taken place since the pervious test.

Line	**Design Measurement**	**Actual Measurement**

19.1	Check and identify the distance of track circuits and treadles as specified on the signalling plan. Record the design and actual dimensions	Up	Up X	Dn	Dn X

20. Power Supplies and Batteries

20.1	Carry out NR/SMS/PartB/Test/051 (Busbar Earth Test) or NR/SMS/PartB/Test/053 (ELD Function Test).	
20.2	Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests) - Level Crossing Barriers.	

Power Supply Identification

APPENDIX A - Circuit Controller Band Settings

Band	Made Between
DN KR	0° and 4°
HJPR	42° and 90°
MR	0° and 83°
UP KR	81° and 90°

NOTE: *It is important to obtain the over-lap between the UP KR band making and the MR band breaking. This is to ensure that if a boom drops slightly it will drive up again before the red road signals operate.*

END

LEVEL CROSSING TESTING

AUTOMATIC OPEN CROSSING LOCALLY MONITORED

NR/SMS/LX72

Published & Issued by: Network Rail Kings Place 90 York Way, London N1 9AG

GENERAL

This test plan covers the requirements of NR/SMS/PartC/LC10 Level Crossings Operational Sequences , NR/SMS/PartB/Test/070 - AHB Operational Sequence Test. It is for use of the person conducting the annual test of the level crossing and has relevant 'tick boxes' by each task so that the particular item of the test can be correctly recorded as per the index in "crossing defects".

a) The crossing ground plan.

b) The level crossing order.

c) The crossing control tables.

d) The signalling plan.

Missing documentation shall be listed as a defect.

TEST SUMMARY

Test Summary
Name of Level Crossing:
Level Crossing Type:
Name of Monitoring Signal Box(es):
Date of Full Test:
Time Full Test Commenced:
Time Full Test Completed:
Tested By:
Signature:
Date of Signature:
Grade and Title:

CROSSING DEFECTS

On the test plan each item shall be recorded with the following letters in the box provided:

X: Found Incorrect, Action Required.
R: Found Incorrect, Rectified on Day of Test.
C: Correct.
N: Not Applicable to this Installation.

Any items found incorrect (X or R) are to be listed on the summary pages. On items requiring action, list the party(s) responsible for rectifying them.

SUMMARY OF ITEMS FOUND INCORRECT (1)

List in the table below all sites found incorrect and rectified on the day of the test (code letter R).

Description of Items Found Incorrect and Rectified

SUMMARY OF ITEMS FOUND INCORRECT (2)

List in the table below items found incorrect and requiring action (code letter X).

Description of Items Found Incorrect and Requiring Action	Responsible Party (s)

1. Road Arrangements

1.1	Check that the road markings are in accordance with the section order and plans.	☐
1.2	Check that the road markings on the approaches to the crossing (up to the stop line) are complete and visible.	☐
1.3	Check the condition and the sighting of the road signs on the crossing approaches. See NR/SMS/PartC/SG00 (Signals : General) for details on reflective boards and signs.	☐
1.4	Check (if provided) the condition and security of any pedestrian guardrails.	☐
	Any defects found in 1.2 to 1.4 shall be reported to the appropriate council via the SM(S).	
1.5	Check the condition of the road surface over the crossing.	☐
1.6	Check that the road markings between and including the stop lines are complete and visible.	☐
1.7	Check (if provided) that the cattle/anti-trespass guards are complete and securely fastened down.	☐
1.8	Check (if provided) the condition and security of any wicket gates.	☐
1.9	Check the condition and the security of any fencing on the approach to equipment room or locations.	☐

2. Local Control Unit

Is This Section Applicable to the Crossing Under Test?	Yes	No

2.1	Open the local control unit door. When unlocked Check that the key is retained in the lock and cannot be withdrawn unless the door is locked again.	☐
2.2	Operate the LCU to the on position, Check the road lights and audible warnings operate	☐
2.3	Check that the DWL do not illuminate.	☐
2.4	Operate the LCU to the off position, Check the road lights extinguish and audible warnings cease.	☐
2.5	Operate the LCU to on position, allow the sequence to complete then switch to the auto position. Observe the road lights extinguish and audible warnings cease. On modern installations the switch can be put straight to the auto position and the door locked. Check the diagrams for the correct mode of operation applicable to the crossing.	☐
2.6	Close and lock the LCU door. Check the door cannot be locked unless the switch is in the Auto position.	☐

3. Road Traffic Light Signals

If auxiliary road traffic light signals are fitted (in addition to YO, YN, ZO and ZN), list the additional signal identification below:

Signal Number	Signal Identification
Aux 1	
Aux 2	

	On each of the road traffic light signals check the following items:						
3.1	The signal structure is stable.	YO	YN	ZO	ZN	Aux 1	Aux 2
3.2	The signal light units are undamaged and the hoods are securely fitted.	YO	YN	ZO	ZN	Aux 1	Aux 2
3.3	The signal lenses are undamaged, clean and correctly orientated.	YO	YN	ZO	ZN	Aux 1	Aux 2
3.4	Signs and notices attached to the signal post are undamaged, clean, and legible. See NR/SMS/PartC/SG00 (Signals : General) for details on reflective boards and signs.	YO	YN	ZO	ZN	Aux 1	Aux 2
3.5	Cables and conduit are undamaged and secure.	YO	YN	ZO	ZN	Aux 1	Aux 2
3.6	Check that if the signals are fitted with 50-watt Quartz Halogen lamps, the road traffic light signal backboard is fitted with a red/white border. White only and red/white border backboards shall not be mixed together at the same crossing.	YO	YN	ZO	ZN	Aux 1	Aux 2

4. Audible Warnings

4.1	Check that the audible warning device and any exposed cables and conduit are undamaged and secure. Check that the device is correctly aligned.	YO	YN	ZO	ZN
4.2	Check that there has been no water ingress into audible warning device. Rectify or replace as necessary.	YO	YN	ZO	ZN
4.3	Check that the sound output of the audible warning is sufficient for the crossing circumstances and (if applicable) is reduced for the night time. Some crossings have had the sound output of audible warning device reduced because of local conditions, check the diagrams.	YO	YN	ZO	ZN

4.4	Check (if applicable) that the audible warning time clock is set to the correct time and the day/night settings are correct. Some time clocks have a control to 'skip' the set controls on certain days, check this is not activated.	YO	YN	ZO	ZN

5. Another Train Coming Signs

Is This Section Applicable to the Crossing Under Test?	Yes	No

If auxiliary pedestrian signals are fitted (in addition to YO, YN, ZO and ZN), list the additional signal identification below:

Signal Number	Signal Identification
Aux 1	
Aux 2	

5.1	Check that the sign is securely fixed to the post, the post is stable; the sign is undamaged and correctly aligned	YO	YN	ZO	ZN	Aux 1	Aux 2
5.2	Check that the hood is securely fitted and the signal face is clean and undamaged	YO	YN	ZO	ZN	Aux 1	Aux 2
5.3	If a sun screen is fitted, check this is undamaged and securely fitted.	YO	YN	ZO	ZN	Aux 1	Aux 2

6. Pedestrian Signals

Is This Section Applicable to the Crossing Under Test?	Yes	No

If auxiliary pedestrian signals are fitted (in addition to YO, YN, ZO and ZN), list the additional signal identification below:

Signal Number	Signal Identification
Aux 1	
Aux 2	

6.1	Check that the sign is securely fixed to the post, the post is stable; the sign is undamaged and correctly aligned	YO	YN	ZO	ZN	Aux 1	Aux 2
6.2	Check that the hood is securely fitted and the signal face is clean and undamaged	YO	YN	ZO	ZN	Aux 1	Aux 2

6.3	If a sun screen is fitted, check this is undamaged and securely fitted.	YO	YN	ZO	ZN	Aux 1	Aux 2

7. Crossing Headlight Unit

7.1	Check that the structure is stable and securely fixed in the ground.	Y	Z
7.2	Check that the light unit is undamaged and correctly aligned.	Y	Z
7.3	Check that the lens is clean and the hood is securely fixed.	Y	Z

8. Drivers Crossing Indicators (DRL/DWL) Signals

8.1	Check (on DRL/DWL units) that the flashing red signal is clearly visible from the speed restriction board	YO	YN	ZO	ZN
8.2	Check that the structure is stable and securely fixed in the ground.	YO	YN	ZO	ZN
8.3	Check that the unit is undamaged, correctly aligned and sighted.	YO	YN	ZO	ZN
8.4	Check that the lens(es) are clean and the hood(s) is/are securely fitted.	YO	YN	ZO	ZN
8.5	Check (on DRL/DWL units) that all the LED's on the DRL unit are flashing.	YO	YN	ZO	ZN

9. Lineside Notice Boards and Signs

9.1	Check that the sign is securely fixed to the post, the post is stable and securely fixed in the ground.	YO	YN	ZO	ZN
9.2	Check that the sign is correctly aligned and sighted.	YO	YN	ZO	ZN
9.3	Check that the sign is of the correct retro-reflective material.	YO	YN	ZO	ZN
9.4	Check that the sign is clean and the legend is correct and legible. The site plan will give details on the correct information that shall be displayed.	YO	YN	ZO	ZN

10. Telephone System

Most AOCL installations do not have public access telephones provided. Usually there is only an information sign giving contact details.

Is This Section Applicable to the Crossing Under Test?	Yes	No

Identify telephones at the installation under test in the grid below:

No.	Telephone Identity
1	
2	
3	
4	

		Telephone Identity (see Grid)			
10.1	Check the telephone and cord is undamaged.	1	2	3	4
10.2	Check the correct labels and symbols are fitted inside and outside the case and they are legible.	1	2	3	4
10.3	Check that any associated signs are stable, undamaged and legible. Emergency telephones require having the yellow telephone symbol visible on three sides of the telephone case or on a separate plate above the telephone.	1	2	3	4
10.4	Check that the correct crossing name is stated on any telephone labels and signs. The site plan will give information on the correct names that shall be displayed	1	2	3	4
10.5	If betalights are fitted, check they are lit. Betalights are usually fitted to older style telephones units that the public have access to.	1	2	3	4
10.6	Ring the monitoring point and Check that the call is received correctly. Ask the monitoring point to ring back.	1	2	3	4
10.7	Check the telephone rings correctly. Check that the quality of speech and hearing is clear and not distorted. On Whiteley PETS telephone systems there is a short time when answering a call at either end of the line where the system 'handshakes' during this period transmission and reception of speech is not possible				
10.8	Switch off the mains power to the telephone system. After a period of time equal to the crossing sequence testing repeat tasks 10.6 to 10.7. Switch the mains power to the telephone system back on.				

11. Public Telephone Numbers

11.1	Check the information on all the public information signs is correct and legible.	
11.2	Ring the ETD number given for the public to call in an emergency, Check that the recipient gives correct procedures for the call. The site plan will give information on the correct names/numbers that shall be displayed.	

Public Telephone Numbers

12. Red Flashing Road Traffic Light Signal Proving

The crossing shall be operated by train simulation.

Check on the following tests that only the DWL for the direction in which the train simulation is applied operates.

If the (DWL)CR/CSR is a slow to pick relay the DWL will not illuminate with only one red road light connected. Check the diagrams.

If auxiliary road traffic light signals are fitted (in addition to YO, YN, ZO and ZN), list the addional signal identification below:

Signal number	**Signal Identitication**
Aux 1	
Aux 2	

12.1	Simulate a train striking in and allow the booms to lower. Check that all the red road signals are illuminated (flashing).	YO	YN	ZO	ZN	Aux 1	Aux 2
12.2	Measure the rate of flashing (Between 70 and 90 flashes per minute).			**FPM**			
12.3	Check that the DWL is flashing.	YO	YN	ZO	ZN	Aux 1	Aux 2

12.4	Disconnect the left and right lamps on one of the light units by slipping the links in the equipment room/loc Check that the DWL extinguishes and (if provided) the DRL illuminates.	YO	YN	ZO	ZN	Aux 1	Aux 2
12.5	Re-connect the right hand lamp Check that the DRL (if provided) extinguishes and the DWL illuminates	YO	YN	ZO	ZN	Aux 1	Aux 2
12.6	Disconnect again the right hand lamp and Check that the DWL extinguishes and the DRL (if provided) illuminates.	YO	YN	ZO	ZN	Aux 1	Aux 2
12.7	Re-connect the left hand lamp and Check that the DRL (if provided) extinguishes and the DWL illuminates	YO	YN	ZO	ZN	Aux 1	Aux 2
12.8	Re-connect the right hand lamp and repeat 12.3 to 12.7 for the other red road signal units. The flashes per minute rate only requires to be measured on one light unit.	YO	YN	ZO	ZN	Aux 1	Aux 2

13. Local Control Sequence

Is This Section Applicable to the Crossing Under Test?	Yes	No

13.1	Operate the switch on the local control unit to the On position and Check the following items:	
13.2	All the amber road signals illuminate and the audible warnings commence concurrently (Yodalarms at normal warbling rate).	
13.3	After 3 seconds (5 seconds at older installations) all the amber signals extinguish and all the red flashing road signals start to flash and any pedestrian lights start to flash.	
13.4	The crossing headlights illuminate the crossing at the time the red road lights commence to flash.	
13.5	Check that the DWL do NOT illuminate.	
13.6	Operate the switch to the Off position and Check the following:	
13.7	The red flashing road signals, yodalarms and any pedestrian lights are extinguished.	
13.8	The crossing headlights are extinguished.	
13.9	Check that the guide on the inside of the local control unit door prevents the door being closed and locked unless the switch is in the auto position.	
13.10	Operate the switch to the On position and Observe that the sequence occurs as in 13.2 to 13.5, operate the switch to the Auto position and close and lock the door. Observe that all the crossing functions are extinguished.	

	On modern installations the switch can be put straight to the auto position and the door locked. Check the diagrams for the correct mode of operation applicable to the crossing.	

14. Automatic Control Sequence

- Check in the crossing control tables for any special controls that affect the automatic control sequence.
- Where the word EXIT occurs, the strike out treadle shall be operated.
- On single lines or where bi-directional controls exist, the leaving track circuit shall also be operated.
- Where directional proving controls exists the bi-directional strike out treadle shall also be operated in the correct sequence.

	Observe, with no train approaching, all DRL (if provided) are illuminated (flashing) and are visible from the speed restriction board				
14.1	Simulate an approaching train by shunting a controlling track circuit. Observe the following:	Up	Up X	Dn	Dn X
14.2	On double lines 10 seconds elapse before the crossing sequence commences. On single lines the sequence starts immediately.				
14.3	All the amber road signals illuminate and the audible warnings commence concurrently (Yodalarms at normal warbling rate).	Up	Up X	Dn	Dn X
14.4	After 3 seconds all the amber signals extinguish and all the red road signals and any pedestrian lights start to flash	Up	Up X	Dn	Dn X
14.5	The crossing headlights illuminate the crossing at the time the red road lights commence to flash	Up	Up X	Dn	Dn X
14.6	The DRL (if applicable) extinguishes and the DWL commences to flash for the direction where the train simulation was applied. The DRL (if applicable) continues for the opposing directions.	Up	Up X	Dn	Dn X
14.7	Operate the exit function and remove the train simulation. Observe the following	Up	Up X	Dn	Dn X
14.8	The road lights, any pedestrian lights, and audible warnings cease immediately.				
14.9	The DWL for the direction where the simulation was applied extinguishes	Up	Up X	Dn	Dn X
14.10	The DRL (if provided) commences to flash	Up	Up X	Dn	Dn X
14.11	Repeat steps 14.2 to 14.11 for the opposite direction on a single line and the other direction on double lines	Up	Up X	Dn	Dn X

15. Double Lines Second Train Approaching Sequence

Is This Section Applicable to the Crossing Under Test?	Yes	No

15.1	Simulate a train striking in on line one as per 14.2				
15.2	Simulate a second train striking in on line two. Observe the following:				
15.3	The road lights and any pedestrian lights continue to flash.	Up	Up X	Dn	Dn X
15.4	The audible warning rate continues at the normal rate.	Up	Up X	Dn	Dn X
15.5	The crossing headlights continue to illuminate.	Up	Up X	Dn	Dn X
15.6	Operate the exit function and remove the simulation for the first train and Check the following:	Up	Up X	Dn	Dn X
15.7	The road lights and any pedestrian lights continue to flash.	Up	Up X	Dn	Dn X
15.8	The audible warning rate changes to the increased rate.	Up	Up X	Dn	Dn X
15.9	The ATC signs (if Illuminating) illuminate, flash and the words are correct.	Up	Up X	Dn	Dn X
15.10	The crossing headlights continue to illuminate.	Up	Up X	Dn	Dn X
15.11	The DWL for the direction of the simulation on line one extinguishes and the DRL (if applicable) commences to flash.	Up	Up X	Dn	Dn X
15.12	The DRL (if applicable) for the simulation on line two extinguishes and the DWL commences to flash.	Up	Up X	Dn	Dn X
15.13	Operate the exit function and remove the simulation on line two. Observe that the sequence is the same as described in 14.9 to 14.11.				
15.14	Repeat steps 15.1 to 15.13 for a train striking in on line two first and a second train striking in on line one.				

16. Track Circuit Timing

16.1	Simulate an approaching train by shunting a controlling track circuit.				
16.2	The DWL for the direction of the simulation on line one extinguishes and the DRL (if applicable) commences to flash.	Up	Up X	Dn	Dn X
16.3	Start timing with a stopwatch as soon as the red flashing road signals and the DWL for the direction in which the simulation was applied illuminate.	Up	Up X	Dn	Dn X
16.4	Check that after 180 seconds the DWL extinguishes and the DRL (if applicable) commences to flash.	Up	Up X	Dn	Dn X

16.5	Check that 30 seconds after the DWL extinguishes the red flashing road signals extinguish.	Up	Up X	Dn	Dn X
16.6	Remove the train simulation and operate the exit function. Check that the crossing controls return to there normal state. If necessary re-set the circuits.	Up	Up X	Dn	Dn X
16.7	Repeat 16.1 to 16.5 for all other directions where controls are provided. Record the results in the table below. If any adjustments have to be made to achieve these times, allow a period of time for the bi-metal strip in the timer to cool down.	Up	Up X	Dn	Dn X

Direction	TC Name	DWL Extinguishes (Seconds)	Red Road Signals Extinguishes (Seconds)
Up			
Up X			
Dn			
Dn X			

17. Drivers Plunger Unit

Is This Section Applicable to the Crossing Under Test?	Yes	No

These are normally fitted to modern installations.

NOTE: *On some designs the DWL will not illuminate when the drivers plunger is operated after the crossing has timed out. The DRL (if provided) will remain flashing. Check the control tables and diagrams for the crossing you are testing.*

17.1	Simulate an approaching train by shunting a controlling track circuit and allow the crossing to time out.	Up	Up X	Dn	Dn X
17.2	Open the door of the unit and operate the plunger. Check that the crossing sequence starts.	Up	Up X	Dn	Dn X
17.3	Check that DWL for the direction of the plunger operation illuminates (if designed to do so, see note at start of section).	Up	Up X	Dn	Dn X
17.4	Reset the circuits to normalise the crossing controls. Close and lock the door of the plunger unit.	Up	Up X	Dn	Dn X
17.5	Repeat 17.1 and 17.3 for all other driver's plunger units.	Up	Up X	Dn	Dn X

18. Special Control Function Sequence

Is This Section Applicable to the Crossing Under Test?	Yes	No

Check in the control tables for any special controls functions that are applicable to the crossing

18.1	Perform any special control functions according to the control tables (Stopping/Non-Stopping, Signal, TRTS etc). Record the function performed and its results.

Function	Result

19. Line Dimensions

Is This Section Applicable to the Crossing Under Test?	Yes	No

Where track works have taken place since the pervious test

19.1	Check and identify the distance of track circuits and treadles as specified on the signalling plan. Record the design and actual dimensions.

Line	Design Measurement	Actual Measurement

20. Power Supplies and Batteries

20.1	Simulate a train striking in and allow the crossing to operate.	
20.2	Check that the DWL for the direction in which the simulation was applied illuminates and (if applicable) the DRL extinguishes.	
20.3	Disconnect the mains power and Check that the DWL extinguishes and (if provided) the DRL illuminates.	
20.4	Reconnect the power and Check that the DWL illuminates and the DRL extinguishes.	
20.5	Remove the train simulation and operate the exit function.	
20.6	Check that the crossing controls return to there normal state.	
20.7	If necessary re-set the circuits	
20.8	Carry out NR/SMS/PartB/Test/051 (Busbar Earth Test) or NR/SMS/PartB/Test/053 (ELD Function Test).	
20.9	Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests) - Level Crossing Barriers.	

Power Supply Identification

END

LEVEL CROSSING TESTING

AUTOMATIC OPEN CROSSING REMOTELY MONITORED

NR/SMS/LX73

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GENERAL

This test plan covers the requirements of NR/SMS/PartC/LC10 and NR/SMS/PartB/Test/073 . It is for use of the person conducting the annual test of the level crossing and has relevant 'tick boxes' by each task so that particular item of the test can be correctly recorded as per the index in "crossing defects".

a) The crossing ground plan.

b) The level crossing order.

c) The crossing control tables.

d) The signalling plan.

Missing documentation shall be listed as a defect.

TEST SUMMARY

Test Summary
Name of Level Crossing:
Level Crossing Type:
Name of Monitoring Signal Box(es):
Date of Full Test:
Time Full Test Commenced:
Time Full Test Completed:
Tested By:
Signature:
Date of Signature:
Grade and Title:

CROSSING DEFECTS

On the test plan each item shall be recorded with the following letters in the box provided:

X: Found Incorrect, Action Required.
R: Found Incorrect, Rectified on Day of Test.
C: Correct.
N: Not Applicable to this Installation.

Any items found incorrect (X or R) are to be listed on the summary pages. On items requiring action, list the party(s) responsible for rectifying them.

SUMMARY OF ITEMS FOUND INCORRECT (1)

List in the table below all sites found incorrect and rectified on the day of the test (code letter R).

Description of Items Found Incorrect and Rectified

SUMMARY OF ITEMS FOUND INCORRECT (2)

List in the table below items found incorrect and requiring action (code letter X).

Description of Items Found Incorrect and Requiring Action	Responsible Party (s)

1. Road Arrangements

1.1	Check that the road markings are in accordance with the section order and plans.	
1.2	Check that the road markings on the approaches to the crossing (up to the stop line) are complete and visible.	
1.3	Check the condition and the sighting of the road signs on the crossing approaches. See NR/SMS/SG00 for details on reflective boards and signs.	
1.4	Check (if provided) the condition and security of any pedestrian guardrails.	
	Any defects found in 1.2 to 1.4 shall be reported to the appropriate council via the SM(S)	
1.5	Check the condition of the road surface over the crossing.	
1.6	Check that the road markings between and including the stop lines are complete and visible.	
1.7	Check (if provided) that the cattle/anti-trespass guards are complete and securely fastened down.	
1.8	Check (if provided) the condition and security of any wicket gates.	
1.9	Check the condition and the security of any fencing on the approach to equipment room or locations.	

2. Local Control Unit

2.1	Open the local control unit door. Check when unlocked that the key is retained in the lock and cannot be withdrawn unless the door is locked again.	
2.2	Operate the LCU to the on position, Check the road lights and audible warnings operate	
2.3	Operate the LCU to the off position, Check the road lights extinguish and audible warnings cease.	
2.4	Operate the LCU to on position, allow the sequence to complete then switch to the auto position. Observe the road lights extinguish and audible warnings cease.	
2.5	Close and lock the LCU door. Check the door cannot be locked unless the switch is in the Auto position.	

3. Road Traffic Light Signals

If auxiliary road traffic light signals are fitted (in addition to YO, YN, ZO and ZN), list the additional signal identification below:

Signal Number	Signal Identification
Aux 1	
Aux 2	

3.1	On each of the road traffic light signals check the following items:						
3.2	The signal structure is stable.	YO	YN	ZO	ZN	Aux 1	Aux 2
3.3	The signal light units are undamaged and the hoods are securely fitted.	YO	YN	ZO	ZN	Aux 1	Aux 2
3.4	The signal lenses are undamaged, clean and correctly orientated.	YO	YN	ZO	ZN	Aux 1	Aux 2
3.5	Signs and notices attached to the signal post are undamaged, clean, and legible See NR/SMS/SG00 for details on reflective boards and signs.	YO	YN	ZO	ZN	Aux 1	Aux 2
3.6	Cables and conduit are undamaged and secure.	YO	YN	ZO	ZN	Aux 1	Aux 2
3.7	Check that if the signals are fitted with 50-watt Quartz Halogen lamps the road traffic light signal backboard is fitted with a red/white border. White only and red/white border backboards shall not be mixed together at the same crossing.	YO	YN	ZO	ZN	Aux 1	Aux 2

4. Audible Warnings

4.1	Check that the audible warning device and any exposed cables and conduit are undamaged and secure. Check that the device is correctly aligned.	YO	YN	ZO	ZN
4.2	Check that there has been no water ingress into audible warning device. Rectify or replace as necessary.	YO	YN	ZO	ZN
4.3	Check that the sound output of the audible warning is sufficient for the crossing circumstances and (if applicable) is reduced for the night time. Some crossings have had the sound output of audible warning device reduced because of local conditions, check the diagrams.	YO	YN	ZO	ZN
4.4	Check (if applicable) that the audible warning time clock is set to the correct time and the day/night settings are correct. Some time clocks have a control to 'skip' the set controls on certain days, check this is not activated.				

5. Another Train Coming Signs

Is This Section Applicable to the Crossing Under Test?	Yes	No

If auxiliary pedestrian signals are fitted (in addition to YO, YN, ZO and ZN), list the additional signal identification below:

Signal Number	Signal Identification
Aux 1	
Aux 2	

5.1	Check that the sign is securely fixed to the post, the post is stable; the sign is undamaged and correctly aligned	YO	YN	ZO	ZN	Aux 1	Aux 2
5.2	Check that the hood is securely fitted and the signal face is clean and undamaged	YO	YN	ZO	ZN	Aux 1	Aux 2
5.3	If a sun screen is fitted, check this is undamaged and securely fitted.	YO	YN	ZO	ZN	Aux 1	Aux 2

6. Pedestrian Signals

Is This Section Applicable to the Crossing Under Test?	Yes	No

If auxiliary pedestrian signals are fitted (in addition to YO, YN, ZO and ZN), list the additional signal identification below:

Signal Number	Signal Identification
Aux 1	
Aux 2	

6.1	Check that the sign is securely fixed to the post, the post is stable; the sign is undamaged and correctly aligned	YO	YN	ZO	ZN	Aux 1	Aux 2
6.2	Check that the hood is securely fitted and the signal face is clean and undamaged	YO	YN	ZO	ZN	Aux 1	Aux 2
6.3	If a sun screen is fitted Check this is undamaged and securely fitted.	YO	YN	ZO	ZN	Aux 1	Aux 2

7. Telephone System

The majority of installations usually have two emergency phones and an LCU phone. There are also some installations that have ‘lay-by’ phones because of the road
conditions. The crossing section order will state the telephone system that is required at the crossing.

Identify telephones at the installation under test in the grid below:

No.	Telephone Identity
1	
2	
3	
4	

		Telephone Identity (see Grid)			
7.1	Check the telephone and cord is undamaged.	1	2	3	4
7.2	Check the correct labels and symbols are fitted inside and outside the case and they are legible.	1	2	3	4
7.3	Check that any associated signs are stable, undamaged and legible. Emergency telephones require having the yellow telephone symbol visible on three sides of the telephone case or on a separate plate above the telephone	1	2	3	4
7.4	Check that the correct crossing name is stated on any telephone labels and signs. The site plan will give information on the correct names/numbers that shall be displayed.	1	2	3	4
7.5	If betalights are fitted Check they are lit. Betalights are usually fitted to older style telephones units that the public have access to.	1	2	3	4
7.6	On emergency telephones Check that an ETD number is given for the public to call in case they cannot contact the monitoring point. Ring this number and Check that the recipient uses the correct procedures for the call.	1	2	3	4

Public Telephone Numbers	Checked

7.7	Ring the monitoring point and Check that the call is received correctly. Ask the monitoring point to ring back.	1	2	3	4
7.8	Check the telephone rings correctly. Check that the quality of speech and hearing is clear and not distorted. On Whitely PETS telephone systems there is a short time when answering a call at either end of the line where the system 'handshakes' During this period transmission and reception of speech is not possible.	1	2	3	4
7.9	Check that with one of the emergency telephones left 'off the hook' calls on the other telephones can be made and received correctly. Whitely PETS systems will indicate a fault at the monitoring point.	1	2	3	4
7.10	If a block switch is fitted Check that when operated 7.5 to 7.6 operate correct at the alternative monitoring point.	1	2	3	4
7.11	Check that at the normal monitoring point any audible devices do not sound	1	2	3	4
7.12	Repeat 7.7 for any other alternative monitoring points.	1	2	3	4
7.13	If an absent switch is fitted to the telephone system operate it and Check that if an emergency call made this is indicated by a low level of illumination of the telephone unit and any audible devices do not sound. Operate the absent switch back to normal operation and Check that a normal emergence call is received.	1	2	3	4
7.14	Switch off the mains power to the telephone system. After a period of time equal to the crossing sequence testing repeat tasks 7.7 to 7.13. Switch the mains power to the telephone system back on.				

8. Red Flashing Road Traffic Light Signal Proving

The crossing shall be operated by train simulation. A competent person (not the signaller) is required at the monitoring point(s) to observe the indications.

If auxiliary road traffic light signals are fitted (in addition to YO,YN, ZO and ZN), list the additional signal identification below:

Signal Number	Signal Identification
Aux 1	
Aux 2	

8.1	Turn the mains power off.							
8.2	Simulate a train striking in and allow the crossing to operate. Check that all the red road signals are illuminated (flashing).	YO	YN	ZO	ZN	Aux 1	Aux 2
8.3	Measure the rate of flashing (Between 70 and 90 flashes per minute)			**FPM**			
8.4	Disconnect the left and right lamps on one of the light units by slipping the links in the equipment room/loc and Check that the indication at the monitoring point shows failed/local control.	YO	YN	ZO	ZN	Aux 1	Aux 2
8.5	Re-connect the right-hand lamp and check that the indication at the monitoring point shows in order.	YO	YN	ZO	ZN	Aux 1	Aux 2
8.6	Disconnect again the right-hand lamp and Check that the indication at the monitoring point shows failed/local control.	YO	YN	ZO	ZN	Aux 1	Aux 2
8.7	Re-connect the left-hand lamp and check that the indication at the monitoring point shows in order.	YO	YN	ZO	ZN	Aux 1	Aux 2
8.8	Re-connect the right hand lamp and Repeat 8.2 to 8.7 for all other light units. The flashes per minute rate only requires to be measured on one light unit.	YO	YN	ZO	ZN	Aux 1	Aux 2

9. Another Train Coming Signal Proving

Is This Section Applicable to the Crossing Under Test?	Yes	No

	On double lines where this facility exists simulate a train striking in on line one, then simulate a train striking in on line two.	
9.1	Operate the exit function for the train on line one and Check that the red flashing road signals and any pedestrian signals and (if applicable) ATC signs are illuminated and flashing.	
9.2	On the flasher unit disconnect the strap ER1 to ER2 and Check that red flashing road signals and any pedestrian signals and (if applicable) ATC signs remain illuminated and are not flashing	
9.3	Check at the monitoring point that a failed/local control indication is received	
9.4	Reconnect the strap ER1 to ER2 on the flasher and Check that red flashing road signals and any pedestrian signals and (if applicable) ATC signs remain illuminated and flashing.	
9.5	Check at the monitoring point that an in-order indication is received.	

10. Local Control Sequence

	Operate the switch on the local control unit to the On position and check the following items:	
10.1	All the amber road signals illuminate and the audible warnings commence concurrently (Yodalarms at normal warbling rate).	
10.2	After 3 seconds all the amber signals extinguish and all the red road signals and any pedestrian lights start to flash.	
10.3	Operate the switch to the Off position and check the following:	
10.4	The red flashing road signals, yodalarms and any pedestrian lights are extinguished.	
10.5	Check that the guide on the inside of the local control unit door prevents the door being closed and locked unless the switch is in the auto position.	
10.6	Operate the switch to the Auto position and close and lock the door. Check that the correct indication is received at the monitoring point.	

11. Automatic Control Sequence

- Check in the crossing control tables for any special controls that affect the automatic control sequence.
- Where the word EXIT occurs the strike out treadle shall be operated.
- On single lines or where bi-directional controls exist the leaving track circuit shall also be operated.
- Where directional proving controls exists the bi-directional strike out treadle shall also be operated in the correct sequence.

	Simulate an approaching train by shunting a controlling track circuit. Observe the following:				
11.1	On double lines 10 seconds elapse before the crossing sequence commences. On single lines the sequence starts immediately.	Up	Up X	Dn	Dn X
11.2	All the amber road signals illuminate and the audible warnings commence concurrently (Yodalarms at normal warbling rate).	Up	Up X	Dn	Dn X
11.3	After 3 seconds all the amber signals extinguish and all the red road signals and any pedestrian lights start to flash	Up	Up X	Dn	Dn X
11.4	Operate the exit function and remove the train simulation and Observe the road lights, any pedestrian lights and audible warnings cease immediately.	Up	Up X	Dn	Dn X
11.5	Repeat steps 11.1 to 11.5 for the opposite direction on a single line and the other direction on double lines.	Up	Up X	Dn	Dn X

12. Double Lines Second Train Approaching Sequence

Is This Section Applicable to the Crossing Under Test?	Yes	No

	Simulate a train striking in on line one.		
	Simulate a second train striking in on line two. check the following:		
12.1	The road lights and any pedestrian lights continue to flash.	Up	Dn
12.2	The audible warning rate continues at the normal rate	Up	Dn
12.3	Operate the exit function and remove the simulation on line one. Observe the following:		
12.4	The road lights and any pedestrian lights continue to flash.	Up	Dn
12.5	The audible warning rate changes to the increased rate.	Up	Dn
12.6	The ATC signs (if Illuminating) illuminate, flash and the words are correct	Up	Dn
12.7	Operate the exit function and remove the simulation on line two. Observe the road lights, any pedestrian lights and audible warnings cease immediately.	Up	Dn
12.8	Repeat steps 12.1 to 12.7 for a train striking in on line two first and a second train striking in on line one.	Up	Dn

13. Strike In Track Circuit Resetting

	Simulate an approaching train by shunting a controlling track circuit.				
13.1	As soon as the red flashing road signals illuminate remove the train simulation and start timing with a stopwatch.	Up	Up X	Dn	Dn X
13.2	Check that after 120 seconds the red flashing road signals extinguish.				
13.3	Check that the crossing controls return to their normal state. If necessary, re-set the circuits				
13.4	Repeat 13.1 to 13.3 for all other directions where controls are provided. Record the results in the table below If any adjustments have to be made to achieve these times, allow a period of time for the bi-metal strip in the timer to cool down.				

Direction	TC Name	Red Road Light extinguishes (second)
Up		
UpX		
Dn		
DnX		

14. Exit Track Circuit Resetting

	Simulate an approaching train by shunting a controlling track circuit.				
14.1	When the red flashing road signals have illuminated, shunt the exit track circuit, operate the exit function and remove the shunt from the strike in track circuit. Leave the exit track circuit shunted	Up	Up X	Dn	Dn X
14.2	Observe that the red flashing road signals extinguish and start timing with a stopwatch as soon as this occurs				
14.3	Check that after 130 seconds on double lines or 120 seconds on single lines the crossing sequence commences as detailed in 14.1				
14.4	Remove the shunt from the exit track circuit and Check that the crossing controls return to their normal state after the strike in track circuit timing has completed				
14.5	Repeat 14.1 to 14.4 for all other directions where controls are provided. Record the results in the table below. If any adjustments have to be made to achieve these times, allow a period of time for the bi-metal strip in the timer to cool down.				

Direction	TC Name	Red Road Light extinguishes (second)
Up		
UpX		
Dn		
DnX		

15. Special Control Function Sequence

Is This Section Applicable to the Crossing Under Test?	Yes	No

15.1	Perform any special control functions according to the control tables (Stopping/Non-Stopping, Signal, TRTS etc). Record the function performed and its results.

Function	Result

16. Line Dimensions

Is This Section Applicable to the Crossing Under Test?	Yes	No

Where track works have taken place since the pervious test

16.1	Check and identify the distance of track circuits and treadles as specified on the signalling plan. Record the design and actual dimensions	Up	Up X	Dn	Dn X

Line	Design Measurement	Actual Measurement
Up		
Up X		
Dn		
Dn X		

17. Indications (Needle Type) and Audible Devices

Is This Section Applicable to the Crossing Under Test?	Yes	No

It may be convenient to combine this with Section 7 Telephone systems

A competent person (not the signaller) is required at the monitoring point(s) to observe the indications.

17.1	Check that the indicator is in the in order/power on position.	
17.2	Simulate a train striking in and observe that the indicator moves to the no legend position.	
17.3	Remove the train simulation and operate the exit function, observe that the indication returns to the in order/power on position.	
17.4	Open the local control operator’s door observe that the indicator moves to the no legend position.	
17.5	Close and lock the operator’s door, observe that the indicator returns to the in order/power on position.	
17.6	Simulate a train striking in and observe that the indicator moves to the no legend position.	
17.7	Check that after 240 seconds on double lines or 180 seconds on single lines the audible alarm sounds and it can be silenced.	
17.8	Remove the train simulation and operate the exit function. Observe that the indication returns to the in order/power on position and the audible alarm sounds and it can be silenced.	
17.9	Withdraw in turn each power supply fuse that is in the (PO) PR circuit (check diagrams). Observe that for each fuse the indicator moves to the in order/power off position and Check that the audible alarm sounds and can be silenced.	
17.10	When each fuse is replaced Observe that the indicator returns to the barriers raised / power on position and Check that the audible alarm sounds and can be silenced.	
17.11	Check (where provided) that the monitoring point test switches operate.	

17.12	If an Absent switch is provided, switch to the absent position and Check that the indicator moves to the no legend position, the audible alarms devices do not sound, and the level crossing protecting functions (block/signal) are effective.	
17.13	If a block switch is provided, switch to the alternative monitoring point and Check that at the normal monitoring point the indicator moves to the no legend position and the audible alarms devices do not sound. At the alternative monitoring point repeat 17.1 to 17.12	

18. Indications (Lamp Type) and Audible Devices

Is This Section Applicable to the Crossing Under Test?	Yes	No

It may be convenient to combine this with Section 7 Telephone systems

A competent person (not the signaller) is required at the monitoring point(s) to observe the indications.

18.1	Check that the indications show in order and power on.	
18.2	Simulate a train striking in and Observe the in order indication extinguishes and the power on indication remains illuminated.	
18.3	Operate the exit function and remove the train simulation, Observe that the in order indication illuminates and the power on indication remains illuminated.	
18.4	Open the LCU unit door and Observe that the in order indication extinguishes. Close and lock the door. Observe that the in order indication illuminates and the power on indication remains illuminated.	
18.5	Simulate a train striking in and Observe that the in order indicator extinguishes.	
18.6	Check that after 240 seconds on double lines or 180 seconds on single lines the failed/local control indication illuminates and the audible alarm sounds and it can be silenced. The power on indication will remain illuminated	
18.7	Remove the train simulation and operate the exit function, Observe that the failed/local control indication extinguishes, the in order indication illuminates and the audible alarm sounds and it can be silenced. The power on indication will remain illuminated.	
18.8	Withdraw in turn each power supply fuse that is in the (PO) PR circuit (check diagrams). Observe that for each fuse the power on indication extinguishes and the standby in use indication illuminates.	
18.9	Check that the audible alarm sounds and can be silenced.	
18.10	When each fuse is replaced Observe that the standby in use indication extinguishes and the power on indication illuminates.	
18.11	Check that the audible alarm sounds and can be silenced. The in-order indication will remain illuminated.	

18.12	Check (where provided) that the monitoring point test switches operate.	
18.13	If an Absent switch is provided, switch to the absent position and Check that all the indications extinguish, the audible alarms devices do not sound and the level crossing protecting functions (block/signal) are effective.	
18.14	If a block switch is provided, switch to the alternative monitoring point and Check that at the normal monitoring point all the indications are extinguished and the audible alarms devices do not sound. At the alternative monitoring point repeat 18.1 to 18.13	

19. Power Supplies and Batteries

19.1	Carry out NR/SMS/PartB/Test/051 - Busbar Earth Test or NR/SMS/PartB/Test/053 - ELD Function Test.	
19.2	Carry out NR/SMS/PartB/Test/052 - Dynamic Earth Tests (Level Crossing Barriers).	

Power Supply Identification

END

LEVEL CROSSING TESTING

MINIATURE STOP LIGHT CROSSING (MINIATURE WARNING LIGHTS)

NR/SMS/LX74

Published & Issued by: Network Rail Kings Place 90 York Way, London N1 9AG

GENERAL

This test plan covers the requirements of NR/SMS/PartC/LC10 and NR/SMS/PartB/Test/074 . It is for use of the person conducting the annual test of the level crossing and has relevant 'tick boxes' by each task so that particular item of the test can be correctly recorded as per the index in "crossing defects".

a) The crossing ground plan.

b) The level crossing order.

c) The crossing control tables.

d) The signalling plan.

Missing documentation shall be listed as a defect.

TEST SUMMARY

Test Summary
Name of Level Crossing:
Level Crossing Type:
Name of Monitoring Signal Box(es):
Date of Full Test:
Time Full Test Commenced:
Time Full Test Completed:
Tested By:
Signature:
Date of Signature:
Grade and Title:

CROSSING DEFECTS

On the test plan each item shall be recorded with the following letters in the box provided:

X: Found Incorrect, Action Required.
R: Found Incorrect, Rectified on Day of Test.
C: Correct.
N: Not Applicable to this Installation.

Any items found incorrect (X or R) are to be listed on the summary pages. On items requiring action, list the party(s) responsible for rectifying them.

SUMMARY OF ITEMS FOUND INCORRECT (1)

List in the table below all sites found incorrect and rectified on the day of the test (code letter R).

Description of Items Found Incorrect and Rectified

SUMMARY OF ITEMS FOUND INCORRECT (2)

List in the table below items found incorrect and requiring action (code letter X).

Description of Items Found Incorrect and Requiring Action	Responsible Party (s)

1. Road Arrangements

1.1	Check that the road markings are in accordance with the section order and plans.	
1.2	Check that the road markings on the approaches to the crossing (up to the stop line) are complete and visible.	
1.3	Check the condition and the sighting of the road signs on the crossing approaches. See NR/SMS/SG00 for details on reflective boards and signs.	
1.4	Check (if provided) the condition and security of any pedestrian guardrails.	
	Any defects found in 1.2 to 1.4 shall be reported to the appropriate council via the SM(S)	
1.5	Check the condition of the road surface over the crossing.	
1.6	Check that the road markings between and including the stop lines are complete and visible.	
1.7	Check (if provided) that the cattle/anti-trespass guards are complete and securely fastened down.	
1.8	Check (if provided) the condition and security of any wicket gates.	
1.9	Check the condition and the security of any fencing on the approach to equipment room or locations.	

2. Red/Green Light Units

2.1	On each of the red/green light units check the following items:		
2.2	The light unit structure is stable.	Y	Z
2.3	The light unit is correctly aligned and the lights are clearly visible from the crossing entry point.	Y	Z
2.4	The light units are undamaged and the hoods are securely fitted.	Y	Z
2.5	The red and green lenses are undamaged and clean.	Y	Z
2.6	Signs and notices attached to the light unit post are undamaged, clean and legible.	Y	Z
2.7	Cables and conduit are undamaged and secure.	Y	Z

3. Gates

Is This Section Applicable to the Crossing Under Test?	Yes	No

3.1 C	Check that the gate and fixtures and fittings are undamaged and in good condition.	Y	Z
3.2	Check that the gatepost is stable and securely fixed into the ground.	Y	Z

3.3	Check that the gate locks or hooks are effective in both the open and closed positions.	Y	Z
3.4	Check that any red roundels or signs attached to the gate are undamaged, clean and legible. Signs and roundels shall be of class 1 retro-reflective material.	Y	Z
3.5	If wicket gates are provided, check they are undamaged, stable and in good condition.	Y	Z
3.6	Check that the gatepost is stable and securely fixed into the ground.	Y	Z
3.7	Check (if fitted) that the gate closing mechanism is effective.	Y	Z

4. Audible Warnings

Is This Section Applicable to the Crossing Under Test?	Yes	No

4.1 V	Check that the audible warning device and any exposed cables and conduit are undamaged and secure. Check that the device is correctly aligned.	Y	Z
4.2	Check that there has been no water ingress into audible warning device. Rectify or replace as necessary	Y	Z
4.3	Check that the sound output of the audible warning is sufficient for the crossing circumstances and (if applicable) is reduced for the night time. Some crossings have had the sound output of audible warning device reduced because of local conditions, check the diagrams.	Y	Z
4.4	Check (if applicable) that the audible warning time clock is set to the correct time and the day/night settings are correct. Some time clocks have a control to ‘skip’ the set controls on certain days, check this is not activated.	Y	Z

5. Telephone System

Is This Section Applicable to the Crossing Under Test?	Yes	No

5.1	Check the telephone and cord is undamaged and the correct labels and symbols are fitted inside and outside the case and they are legible.	Y	Z
5.2	Check that any associated signs are stable, undamaged and legible. Emergence telephones require having the yellow telephone symbol visible on three sides of the telephone case or on a separate plate above the telephone.	Y	Z
5.3	Check that the correct crossing name is stated on any telephone labels and signs.	Y	Z

5.4	Check that telephone numbers given on any sign are correct. The site plan will give information on the correct names/numbers that shall be displayed.	Y	Z
5.5	If betalights are fitted Check they are lit. Betalights are usually fitted to older style telephones units that the public have access to.	Y	Z
5.6	On emergency telephones Check that an ETD number is given for the public to call in case they cannot contact the monitoring point. Ring this number and Check the recipient gives correct procedures for the call.	Y	Z
5.7	Ring the monitoring point and Check that the call is received correctly. Ask the monitoring point to ring back and Check the telephone rings correctly. Check that the quality of speech and hearing is clear and not distorted. On Whiteley PETS telephone systems there is a short time when answering a call at either end of the line where the system 'handshakes', during this period transmission and reception of speech is not possible	Y	Z
5.8	Check that with one of the public access telephones left 'off the hook' calls on the other telephone can be made and received correctly. Whiteley PETS systems will indicate a fault at the monitoring point.	Y	Z
5.9	If an absent switch is fitted to the telephone system operate it and Check that if an emergency call made this is indicated by a low level of illumination of the telephone unit and any audible devices do not sound. Operate the absent switch back to normal operation and Check that a normal emergence call is received.	Y	Z
5.10	Switch off the mains power to the telephone system. After a period of time equal to the crossing sequence testing repeat tasks 5.7 to 5.9. Switch the mains power to the telephone system back on	Y	Z

6. Red/Green Lamp Operation

6.1	With no trains approaching Check that the light units are showing a green light, operate either the replacement switch to 'red' or slip the test link and Observe that the light units are showing a red light. Operate the replacement switch to the 'auto' position or re-connect the test link and Observe that the light units are showing a green light.	

7. Local Control Sequence

- Check in the crossing control tables for any special controls that affect the automatic control sequence.
- Where the word EXIT occurs, the strike out treadle shall be operated.

	Simulate an approaching train by shunting a controlling track circuit. Observe the following:				
7.1	The green lamps on both light units extinguish and the red lamps illuminate.	Up	Up X	Dn	Dn X
7.2	The audible warnings (if provided) sound.	Up	Up X	Dn	Dn X
7.3	Operate the exit function and remove the train simulation. Observe the following:				
7.4	The red lamps on both light units extinguish and the green lamps illuminate.	Up	Up X	Dn	Dn X
7.5	The audible warnings (if provided) cease	Up	Up X	Dn	Dn X
7.6	Repeat steps 7.1 to 7.6 for all other directions where controls are provided.	Up	Up X	Dn	Dn X

8. Double Lines Second Train Approaching Sequence

Is This Section Applicable to the Crossing Under Test?	Yes	No

	Simulate a train striking in on line one.				
	Simulate a second train striking in on line two. Check the following:				
	Operate the exit function and remove the simulation on line one. Observe the following:				
8.1	The green lamps on both light units stay extinguished and the red lamps stay illuminated	Up	Up X	Dn	Dn X
8.2	The audible warnings (if provided) changes to the increased rate.	Up	Up X	Dn	Dn X
8.3	Operate the exit function for the train simulation on line two and Observe the following.				
8.4	The red lamps on both light units extinguish and the green lamps illuminate.	Up	Up X	Dn	Dn X
8.5	The audible warnings (if provided) cease	Up	Up X	Dn	Dn X
8.6	Repeat steps 8.1 to 8.5 for all other directions where controls are provided.	Up	Up X	Dn	Dn X

9. Strike In Track Circuit Resetting

Is This Section Applicable to the Crossing Under Test?	Yes	No

9.1 0	Simulate an approaching train by shunting a controlling track circuit. Observe that the light units show a red light.	Up	Up X	Dn	Dn X
9.2	Make up the track circuit and start timing with a stopwatch from the time the track circuit is re-connected. Check that the red lights remain illuminated.	Up	Up X	Dn	Dn X
9.3	Observe that after 120 seconds the red lights are extinguished and the green lights illuminate. If any adjustments have to be made to achieve this time, allow a period of time for the bi-metal strip in the timer to cool down.	Up	Up X	Dn	Dn X
9.4	Repeat 9.1 to 9.3 for all other directions where controls are provided. Record the results in the table below.	Up	Up X	Dn	Dn X

Direction	TC Name	Red Road Light extinguishes (second)
Up		
UpX		
Dn		
DnX		

10. Leaving Track Circuit Monitoring

Is This Section Applicable to the Crossing Under Test?	Yes	No

10.1	Simulate a train striking in by dropping a controlling track circuit, Observe that the red lights illuminate	Up	Up X	Dn	Dn X
10.2	Drop the leaving track circuit, operate the exit function and make up the controlling track circuit. Check that the leaving track circuit remains dropped.	Up	Up X	Dn	Dn X
10.3	Observe that the red lights are extinguished and the green lights illuminate. Start timing with a stopwatch as soon as the red lights are extinguished.	Up	Up X	Dn	Dn X
10.4	Observe that after 240 seconds the green lights extinguish and the red lights stay extinguished.	Up	Up X	Dn	Dn X
10.5	Re-connect the leaving track circuit and reset the control circuits. Check that the green lights illuminate. Record the time in the table.	Up	Up X	Dn	Dn X

Direction	TC Name	Red Road Light extinguishes (second)
Up		
UpX		
Dn		
DnX		

11. Special Control Function Sequence

Is This Section Applicable to the Crossing Under Test?	Yes	No

11.1	Perform any special control functions according to the control tables (Stopping/Non-Stopping, Signal, TRTS etc). Record the function performed and its results.

Function	Result

12. Power Supplies and Batteries

12.1	Carry out NR/SMS/PartB/Test/051 - Busbar Earth Test or NR/SMS/PartB/Test/053 - ELD Function Test.	
12.2	Carry out NR/SMS/PartB/Test/052 - Dynamic Earth Tests (Level Crossing Barriers).	

Power Supply Identification

END

LEVEL CROSSING TESTING

MANUALLY CONTROLLED BARRIERS (MCB)

NR/SMS/LX75

Published & Issued by: Network Rail Kings Place 90 York Way, London N1 9AG

GENERAL

This test plan covers the requirements of NR/SMS/PartC/LC10 and NR/SMS/PartB/Test/075. It is for use of the person conducting the annual test of the level crossing and has relevant 'tick boxes' by each task so that particular item of the test can be correctly recorded as per the index in "crossing defects".

a) The crossing ground plan.

b) The level crossing order.

c) The crossing control tables.

d) The signalling plan.

Missing documentation shall be listed as a defect.

TEST SUMMARY

Test Summary
Name of Level Crossing:
Level Crossing Type:
Name of Monitoring Signal Box(es):
Date of Full Test:
Time Full Test Commenced:
Time Full Test Completed:
Tested By:
Signature:
Date of Signature:
Grade and Title:

CROSSING DEFECTS

On the test plan each item shall be recorded with the following letters in the box provided:

X: Found Incorrect, Action Required.
R: Found Incorrect, Rectified on Day of Test.
C: Correct.
N: Not Applicable to this Installation.

Any items found incorrect (X or R) are to be listed on the summary pages. On items requiring action, list the party(s) responsible for rectifying them.

SUMMARY OF ITEMS FOUND INCORRECT (1)

List in the table below all sites found incorrect and rectified on the day of the test (code letter R).

Description of Items Found Incorrect and Rectified

SUMMARY OF ITEMS FOUND INCORRECT (2)

List in the table below items found incorrect and requiring action (code letter X).

Description of Items Found Incorrect and Requiring Action	Responsible Party (s)

1. Road Arrangements

1.1	Check that the road markings are in accordance with the section order and plans.	
1.2	Check that the road markings on the approaches to the crossing (up to the stop line) are complete and visible.	
1.3	Check the condition and the sighting of the road signs on the crossing approaches. See NR/SMS/PartC/SG00 for details on reflective boards and signs.	
	Any defects found in 1.2 to 1.4 shall be reported to the appropriate council via the SM(S).	
1.4	Check the condition of the road surface over the crossing.	
1.5	Check that the road markings between and including the stop lines are complete and visible.	
1.6	Check (if provided) that the cattle/anti-trespass guards are complete and securely fastened down.	
1.7	Check the condition and the security of any fencing around the barrier machines and (if provided) on the approach to equipment room or locations.	
1.8	Check (if provided) that any crossing illumination works correctly.	

2. Booms and Barrier Machines

2.1	Check when lowered under power operation the lock down feature on each barrier is effective. Resistance is felt when the barrier is lifted.	YN	YO	ZN	ZO
2.2	Check when on hand operation the booms can be lifted by hand to a fully raised position and can be retained in that position. Hand operation can be by using the machines pump handle or manually lifting the boom as appropriate to the machine type.	YN	YO	ZN	ZO
2.3	Check by use of an inclinometer and digital voltmeter (on resistance) the setting of the bands or limit switches whilst raising the boom on 'hand' operation. Adjust if necessary (Appendix A). The inclinometer can be a stand-alone unit or the one built into the barrier pedestal (as long as it is undamaged)	YN	YO	ZN	ZO
2.4	Check (if provided) that the boom proving circuit is intact and operational. Beware of the (Barr)PR circuit being shorted out on individual booms.	YN	YO	ZN	ZO
2.5	Check when the booms are lowered that the boom skirting is undamaged and effective	YN	YO	ZN	ZO
2.6	Check on hydraulic barriers that the boom is damped during the last 10° to 15° of movement.	YN	YO	ZN	ZO

2.7	Check when the booms are fully raised that the skirting folds correctly. Replace any missing rods and replace/repair any broken bottom pieces	YN	YO	ZN	ZO
2.8	Check the alignment of each boom when they are lowered, check on two barrier installations they align correctly with the appropriate end post and on four barrier installations the two barrier ends align correctly. It shall not be possible for a person to get around the end of a boom	YN	YO	ZN	ZO
2.9	Installations with BR843 barrier packs only Check the counter balance weights are secure and are the correct weight by Measuring with a weight measuring device the tip weight by using the following method:				
	• At the tip end slowly lift the boom until it is approximately 4° to 5° from the horizontal.				
	• Connect the weight measuring device to the tip end of the boom.				
	• Release the boom onto the measuring device ensuring that the boom has not fully lowered then take a reading.				

Boom Length	Tip Weight
3.6m to 4.1m	7.6Kg
4.6m to 9.1m	6.1Kg

YO	YN	ZO	ZN

3. Road Traffic Light Signals

If auxiliary road traffic light signals are fitted (in addition to YO, YN, ZO and ZN), list the additional signal identification below:

Signal Number	Signal Identification
Aux 1	
Aux 2	

On each of the road traffic light signals Check the following items:

3.1	The signal structure is stable.	YO	YN	ZO	ZN	Aux 1	Aux 2
3.2	The signal light units are undamaged and the hoods are securely fitted.	YO	YN	ZO	ZN	Aux 1	Aux 2
3.3	The signal lenses are undamaged, clean and correctly orientated.	YO	YN	ZO	ZN	Aux 1	Aux 2
3.4	Signs and notices attached to the signal post are undamaged, clean, and legible See	YO	YN	ZO	ZN	Aux 1	Aux 2

	NR/SMS/SG00 for details on reflective boards and signs.						
3.5	Cables and conduit are undamaged and secure.	YO	YN	ZO	ZN	Aux 1	Aux 2
3.6	Check that if the signals are fitted with 50-watt Quartz Halogen lamps the road traffic light signal backboard is fitted with a red/white border. White only and red/white border backboards shall not be mixed together at the same crossing.	YO	YN	ZO	ZN	Aux 1	Aux 2

4. Audible Warnings

Is This Section Applicable to the Crossing Under Test?	Yes	No

4.1	Check that the audible warning device and any exposed cables and conduit are undamaged and secure. Check that the device is correctly aligned.	YO	YN	ZO	ZN
4.2	Check that there has been no water ingress into audible warning device. Rectify or replace as necessary.	YO	YN	ZO	ZN
4.3	Check that the sound output of the audible warning is sufficient for the crossing circumstances and (if applicable) is reduced for the night time. Some crossings have had the sound output of audible warning device reduced because of local conditions, check the diagrams.	YO	YN	ZO	ZN
4.4	Check (if applicable) that the audible warning time clock is set to the correct time and the day/night settings are correct. Some time clocks have a control to ‘skip’ the set controls on certain days, check this is not activated.				

5. Barrier Proving

Is This Section Applicable to the Crossing Under Test?	Yes	No

These tests are to be carried out under power operation

5.1	Prevent one of the booms from lowering then lower the remaining boom(s). Check that after 20 seconds a failed indication is received on the signallers control panel.	
5.2	Lower the still raised boom and Check that when it is fully lowered the failed indication is extinguished.	
5.3	Prevent one of the booms from rising then raise the remaining boom(s). Check that after 20 seconds a failed indication is received on the Signallers control panel.	

5.4	Lower the booms and then allow all the booms to rise. Check that the failed indication extinguishes when all the booms are fully lowered or when the raise button is operated. If these times are not achieved adjustment shall be made to the (Failed)JR. This is a pneumatic slow release relay therefore no 'cooling' time is required between adjustments				
	(Failed)JR Timing (In Seconds)				
	Before Adjustment		After Adjustment		

6. Red Flashing Road Traffic Light Signal Proving

Some early installations only require one red road light to be working on the Y or Z side before an indication is given of lamp failure. Check the diagrams for circuit design.

At TMOB the indications will be via the DCI, check the diagrams for the circuit design.

If auxiliary road traffic light signals are fitted (in addition to YO, YN, ZO and ZN), list the additional signal identification below:

Signal Number	Signal Identification
Aux 1	
Aux 2	

6.1	Lower the booms and check that all the red road signals are illuminated (flashing) and the red road light indications on the signaller's panel are illuminated.	YO	YN	ZO	ZN	Aux 1	Aux 2
6.2	Measure the rate of flashing (Between 70 and 90 flashes per minute).			**FPM**			
6.3	Disconnect the left lamp on one of the Y side light units by slipping the link in the equipment room/loc. Check that the Y road light indication on the signaller's panel begins to flash.	YO	YN	ZO	ZN	Aux 1	Aux 2
6.4	Disconnect the right lamp on the same light unit and check that the Y road light indication on the signaller's panel extinguishes.	YO	YN	ZO	ZN	Aux 1	Aux 2

6.5	Reconnect the left lamp on the light unit and check that the Y road light indication on the signaller's panel begins to flash.	YO	YN	ZO	ZN	Aux 1	Aux 2
6.6	Reconnect the right-hand lamp and check that the Y road light indication is illuminated and not flashing.	YO	YN	ZO	ZN	Aux 1	Aux 2
6.7	Repeat 6.3 to 6.6 for the other units on the Y side of the crossing and for the light units on the Z side of the crossing. When testing the Z road light units observe the Z road light indication on the signaller's panel	YO	YN	ZO	ZN	Aux 1	Aux 2

7. Barrier Operation Sequence (Not TMOB)

Is This Section Applicable to the Crossing Under Test?	Yes	No

	Press the lower button and Observe the following:	
7.1	All the Amber lights illuminate and show a steady light.	
7.2	The audible warnings (if fitted) sound when the amber lights illuminate and continue until all the booms have fully lowered	
7.3	After approximately 3 to 5 seconds the amber lights extinguish and all the red lights begin to flash	
7.4	After approximately 4 to 6 seconds after the red lights have started to flash the booms begin to lower	
7.5	At installations with four booms, Check the nearside booms (YN & ZN) lower first and are completely lowered before the offside booms (YO & ZO) began to lower	
7.6	The boom lights on each boom illuminate when the boom is approximately 80° from the horizontal	
7.7	Each boom takes between 6 to 10 seconds to completely lower. Check that the boom damping (if fitted) is effective when the boom is approximately 10° to 15° from the fully lowered position	
7.8	The audible warnings (if fitted) cease to sound when all the booms have fully lowered	
	Press the raise button and Observe the following:	
7.9	All the booms began to rise simultaneously and take 4 to 10 seconds to reach the fully raised position at between 83° and 85° from the horizontal	
7.10	The flashing red lights continue to show until the booms have reached a maximum of 45° from the horizontal	
7.11	The boom lights extinguish when all the booms have passed 80° from the horizontal	
7.12	Press the LOWER button and allow the sequence to continue until the nearside booms (YN & ZN) have started to lower then stop the lowering sequence (press the STOP button or release the LOWER button).	
7.13	Observe the boom movement is arrested. The flashing red lights and audible warnings (if fitted) continue to sound	

7.14	Press the LOWER button and Observe that the boom lower sequence continues.	
7.15	Repeat steps 7.12 to 7.14 for installations with four booms when the offside booms (ZO &YO) have started to lower	
	Press the RAISE button and allow the raise sequence to continue until the booms have started to rise and the flashing red lights have extinguished then stop the raising sequence (press the STOP button or press the LOWER button). Observe the following:	
7.16	All the booms movement is arrested.	
7.17	The audible warnings (if fitted) and amber lights commence to operate followed by the flashing red lights.	
	Operate either the RAISE or LOWER button and Observe the following:	
7.18	The RAISE button allows the booms to rise, extinguishing the amber/flashing red lights, and silencing the audible warnings (if fitted.)	
7.19	The LOWER button allows the boom to lower providing the amber and flashing red light periods have elapsed. At four barrier installations the nearside booms (YN & ZN) will lower first	

8. Crossing Clear Functions

NOTE: *Not installations with auto lower facilities.*

Is This Section Applicable to the Crossing Under Test?	Yes	No

8.1	Check when the booms are fully lowered that the protecting signals cannot be cleared until the crossing clear function has been operated.	
8.2	Check at CCTV-MB installations if auto raise is selected the picture on the monitor is extinguished when the crossing clear function is operated. Check if manual raise is selected the picture remains.	

9. Auto Lower Functions

Is This Section Applicable to the Crossing Under Test?	Yes	No

9.1	Check when the barriers are called to lower an audible warning (if provided) is given and a picture is called on the monitor.	
9.2	Check when the booms are fully lowered an audible warning (if provided) is given and the crossing clear indication flashes.	
9.3	Check when the crossing clear function is operated the protecting signals clear. If auto raise is selected Check that the picture on the monitor is extinguished.	

10. Track Circuits (CCTV-MB Installations Only)

Is This Section Applicable to the Crossing Under Test?	Yes	No

10.1	Shunt the approaching track circuits to the crossing and Observe that the amber road lights followed by the flashing red road lights illuminate and the audible warnings sound.	Up	Dn
10.2	Check that the sequence can be cancelled by pressing the raise button. At some installations, a full lowering sequence will have to be performed to normalise the controls.	Up	Dn

11. Installations Fitted with a Local Control Unit

Is This Section Applicable to the Crossing Under Test?	Yes	No

11.1	Open the door of the LCU, Check (if door proving is fitted) that the signaller's indications show failed otherwise switch to local control and Check that the signaller's indications show failed.	
11.2	Repeat steps 7.1 to 7.19 and Observe the following additional items at this location	
11.3	The Barriers Raised light (if provided) is not illuminated until local control is taken.	
11.4	The Barriers Lowered light (if provided) does not illuminate until all booms are fully lowered.	
11.5	At CCTV-MB installations no picture can be obtained on the monitors whilst the crossing is on local control.	
11.6	Return the crossing control back to the signaller. Check that the correct indications are obtained at the monitoring point. At some newer installations when giving local control back to the signaller the booms shall be in the lowered position. The signaller will then operate the booms to the raised position.	

12. Trainman Operated Barriers (TMOB)

Is This Section Applicable to the Crossing Under Test?	Yes	No

12.1	Check that the lowering sequence can only be initiated when the controlling track circuit is occupied, and the plunger is operated	
	Observe the following:	
12.2	All the Amber lights illuminate and show a steady light.	
12.3	The audible warnings (if fitted) sound when the amber lights illuminate and continue until all the booms have fully lowered	
12.4	After approximately 3 to 5 seconds the amber lights extinguish and all the red lights begin to flash	
12.5	After approximately 4 to 6 seconds after the red lights have started to flash the booms begin to lower.	

	At installations with four booms check the nearside booms (YN & ZN) lower first and are completely lowered before the offside booms (YO & ZO) began to lower.	
12.6	The boom lights on each boom illuminate when the boom is approximately 80° from the horizontal.	
12.7	Each boom takes between 6 to 10 seconds to completely lower. Check that boom damping (if fitted) is effective when the boom is approximately 10° to 15° from the fully lowered position.	
12.8	The audible warnings (if fitted) cease to sound when all the booms have fully lowered.	
12.9	Check the DCI (white light) operates only when all booms are fully lowered for the direction of the applied simulation.	
	Operate the exit function and Observe the following:	
12.10	All the booms begin to rise simultaneously and take 4 to 10 seconds to reach the fully raised position at between 83° and 85° from the horizontal.	
12.11	The flashing red lights continue to show until the booms have reached a maximum of 45° from the horizontal.	
12.12	The boom lights extinguish when all the booms have passed 80° from the horizontal.	
12.13	Check the DCI (white light) has extinguished.	

13. Power Supplies and Batteries

13.1	Carry out NR/SMS/PartB/Test/051 - Busbar Earth Test or NR/SMS/PartB/Test/053 - ELD Function Test.	
13.2	Carry out NR/SMS/PartB/Test/052 - Dynamic Earth Tests (Level Crossing Barriers).	

Power Supply Identification

APPENDIX A - Circuit Controller Band Settings

Band	Made Between
DN KR	0° and 4°
HJPR	42° and 90°(#)
MR	0° and 83°
UP KR	81° and 90°

#: The HJPR band on early installations may be set to make sooner than 42°. Check the diagrams for the required setting for the installation you are testing.

NOTE: *It is important to obtain the over-lap between the UP KR band making and the MR band breaking. This is to ensure that if a boom drops slightly it will drive up again before the red road signals operate.*

On barrier units that use limit switches in place of circuit controllers, reference shall be made to the diagrams for the positions of the cams.

END

LEVEL CROSSING TESTING

ON CALL BARRIERS (OCB)

NR/SMS/LX76

Published & Issued by: Network Rail Kings Place 90 York Way, London N1 9AG

GENERAL

This test plan covers the requirements of NR/SMS/PartC/LC10 and NR/SMS/PartB/Test/076. It is for use of the person conducting the annual test of the level crossing and has relevant 'tick boxes' by each task so that particular item of the test can be correctly recorded as per the index in "crossing defects".

a) The crossing ground plan.

b) The level crossing order.

c) The crossing control tables.

d) The signalling plan.

Missing documentation shall be listed as a defect.

TEST SUMMARY

Test Summary
Name of Level Crossing:
Level Crossing Type:
Name of Monitoring Signal Box(es):
Date of Full Test:
Time Full Test Commenced:
Time Full Test Completed:
Tested By:
Signature:
Date of Signature:
Grade and Title:

CROSSING DEFECTS

On the test plan each item shall be recorded with the following letters in the box provided:

X: Found Incorrect, Action Required.
R: Found Incorrect, Rectified on Day of Test.
C: Correct.
N: Not Applicable to this Installation.

Any items found incorrect (X or R) are to be listed on the summary pages. On items requiring action, list the party(s) responsible for rectifying them.

SUMMARY OF ITEMS FOUND INCORRECT (1)

List in the table below all sites found incorrect and rectified on the day of the test (code letter R).

Description of Items Found Incorrect and Rectified

SUMMARY OF ITEMS FOUND INCORRECT (2)

List in the table below items found incorrect and requiring action (code letter X).

Description of Items Found Incorrect and Requiring Action	Responsible Party (s)

1. Booms and Barrier Machines

OCB installations can have various types of barrier machines fitted, refer to the appropriate NR/SMS for the full service for the barrier machine.

1.1	Check (if provided) that the boom proving circuit is intact and operational	Y	Z
1.2	Check when the booms are lowered that the boom skirting is undamaged and effective	Y	Z
1.3	Check when the booms are fully raised that the skirting folds correctly. Replace any missing rods and replace/repair any broken bottom pieces.	Y	Z
1.4	<u>Installations with BR843 barrier packs only</u> Check the counter balance weights are secure and are the correct weight by Measuring with a weight measuring device, the tip weight by using the following method:		
1.5	Check the counter balance weights are secure and are the correct weight by Measuring with a weight measuring device the tip weight by using the following method:		
	• At the tip end slowly lift the boom until it is approximately 4° to 5° from the horizontal.		
	• Connect the weight measuring device to the tip end of the boom.		
	• Release the boom onto the measuring device ensuring that the boom has not fully lowered then take a reading.		

Boom Length	Tip Weight		
3.6m to 4.1m	7.6Kg	Y	Z
4.6m to 9.1m	6.1Kg		

2. Audible Warnings

2.1	Check that the audible warning device and any exposed cables and conduit are undamaged and secure. Check that the device is correctly aligned.	YO	YN	ZO	ZN
2.2	Check that there has been no water ingress into audible warning device. Rectify or replace as necessary.	YO	YN	ZO	ZN
2.3	Check that the sound output of the audible warning is sufficient for the crossing circumstances and (if applicable) is reduced for the night time. Some crossings have had the sound output of audible warning device reduced because of local conditions, check the diagrams.	YO	YN	ZO	ZN

2.4	Check (if applicable) that the audible warning time clock is set to the correct time and the day/night settings are correct. Some time clocks have a control to 'skip' the set controls on certain days, check this is not activated.	

3. Barrier Proving and Sequence Test

The booms can be lowered and raised by local control or train simulation.

	Operate the lower switch/button and Observe the following:		
3.1	The audible warnings sound.	Y	Z
3.2	The Booms commence to fall 8 to10 seconds after the audible warnings commence.	Y	Z
3.3	They are fully lowered in a further 8 to15 seconds.	Y	Z
3.4	The booms lights illuminate when the booms are approximately 80° from the horizontal.	Y	Z
3.5	The audible warnings continue to sound until both booms are fully lowered.	Y	Z
	Operate the raise switch/button and Observe the following:		
3.6	The booms commence to rise.	Y	Z
3.7	The boom lights extinguish when the booms have passed 80° from the horizontal.	Y	Z
3.8	The barrier cut-off is effective when the booms reach the fully raised position of between 83° and 85° from the horizontal.	Y	Z
3.9	The booms take 8 to 15 seconds to reach the fully raised position.	Y	Z
3.10	Operate the lower switch/button and wait until the boom begins to lower then operate the stop switch/button and Observe that the boom lowering movement is arrested.	Y	Z
3.11	Operate the raise switch/button and wait until the boom begins to rise then operate the stop switch/button and Observe the following:		
3.12	The boom raising movement is arrested.	Y	Z
3.13	The audible warnings sound if the booms have risen more than 5° from the horizontal	Y	Z
3.14	Lower the booms and operate the emergency plunger at each barrier. Observe the following:		
3.15	The audible warning sounds and the appropriate boom rises.	Y	Z
3.16	After a fixed period, the booms lower and the audible warning ceases to sound.	Y	Z
3.17	Disconnect the power supply and Observe the booms lower in 8 to 15 seconds	Y	Z

3.18	Insert the special Allen key in the socket on the clutch and check that the micro-switch motor isolating contacts are broken.	Y	Z
3.19	Push the boom up by hand to the fully raised position and check that it remains in the raised position when the Allen key is turned to lock the boom.	Y	Z
3.20	Unlock the boom and return it to the fully lowered position. Remove the Allen key.	Y	Z
3.21	Reconnect the power supply and operate the raise switch/button. Check that the boom is fully raised.	Y	Z

4. Power Supplies and Batteries

4.1	Carry out NR/SMS/PartB/Test/051 - Busbar Earth Test or NR/SMS/PartB/Test/053 - ELD Function Test.	
4.2	Carry out NR/SMS/PartB/Test/052 - Dynamic Earth Tests (Level Crossing Barriers).	

Power Supply Identification

END

LEVEL CROSSING TESTING

EBI GATE 200
LEVEL CROSSING SYSTEM

NR/SMS/LX77

Published & Issued by: Network Rail Kings Place 90 York Way, London N1 9AG

GENERAL

This test plan covers the requirements of NR/SMS/PartC/LC10 and NR/SMS/PartB/Test/082 – Part 6 & Part 7 It is for use of the person conducting the annual test of the level crossing and has relevant 'tick boxes' by each task so that particular item of the test can be correctly recorded as per the index in "crossing defects".

a) The crossing ground plan.

b) The level crossing order.

c) The crossing control tables.

d) The signalling plan.

Missing documentation shall be listed as a defect.

TEST SUMMARY

Test Summary
Name of Level Crossing:
Level Crossing Type:
Name of Monitoring Signal Box(es):
Date of Full Test:
Time Full Test Commenced:
Time Full Test Completed:
Tested By:
Signature:
Date of Signature:
Grade and Title:

CROSSING DEFECTS

On the test plan each item shall be recorded with the following letters in the box provided:

X: Found Incorrect, Action Required.
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C: Correct.
N: Not Applicable to this Installation.

Any items found incorrect (X or R) are to be listed on the summary pages. On items requiring action, list the party(s) responsible for rectifying them.

SUMMARY OF ITEMS FOUND INCORRECT (1)

List in the table below all sites found incorrect and rectified on the day of the test (code letter R).

Description of Items Found Incorrect and Rectified

SUMMARY OF ITEMS FOUND INCORRECT (2)

List in the table below items found incorrect and requiring action (code letter X).

Description of Items Found Incorrect and Requiring Action	Responsible Party (s)

1. Road Arrangements

1.1	Check that the road markings are in accordance with the section order and plans.	
1.2	Check the condition and the sighting of any signs on the crossing approaches. See NR/SMS/SG00 for details on reflective boards and signs.	
1.3	Check the condition of the road surface over the crossing.	
1.4	Check that the road markings between and including the stop lines are complete and visible.	
1.5	Check (if provided) that the cattle/anti-trespass guards are complete and securely fastened down.	
1.6	Check the condition and the security of any fencing around the barrier machines and (if provided) on the approach to equipment room or locations.	
1.7	Check (if provided) the condition and security of any pedestrian guardrails.	
1.8	Check (if provided) the condition and security of any wicket gates	
1.9	Check (if provided) that any crossing illumination works correctly.	

Any defects found in 1.1 and 1.3 shall be reported to the appropriate council via the SM(S).

2. EBI Gate Posts

	On each of the EBI Gate Posts check the following items:		
2.1	The Post is stable and undamaged	M	S
2.2	Signs and notices attached to post are undamaged, clean and legible.	M	S
2.3	The red and green lenses are undamaged and clean.	M	S
2.4	Observe LED illumination (Red/Green) from road and or foot approaches.	M	S
2.5	Check the background for any relevant side lighting and /or any obstructions such as fencing or vegetation. (Consider viewing positions for all type of crossing users – i.e crossing user in a high farm style vehicle or pedestrian)	M	S
2.6	If the crossing is an On-Demand type, check the push buttons on each unit are not damaged	M	S
	Terminations and wiring.		
2.7	Check that there has been no water ingress into EBI Gate Posts	M	S
2.8	Cables and plug couplers are undamaged and secure.	M	S

3. Gates

Is This Section Applicable to the Crossing Under Test?	Yes	No

3.1	Check that the gate and fixtures and fittings are undamaged and in good condition.	M	S
3.2	Check that the gatepost is stable and securely fixed into the ground.	M	S
3.3	Check that the gate locks or hooks are effective in both the open and closed positions.	M	S
3.4	Check that any red roundels or signs attached to the gate are undamaged, clean and legible. Signs and roundels shall be of class 1 retro-reflective material.	M	S
3.5	If wicket gates are provided check, they are undamaged, stable and in good condition.	M	S
3.6	Check that the gatepost is stable and securely fixed into the ground.	M	S
3.7	Check (if fitted) that the gate closing mechanism is effective.	M	S

4. Telephone Systems

Different types of telephone systems are fitted to AHBCs. BR Spec. 843 installations usually have two emergency phones and an LCU phone. The crossing section order will state the telephone system that is required at the crossing.

Identify telephones at the installation under test in the grid below:

No.	Telephone Identity
1	
2	
3	
4	

		Telephone Identity (see Grid)			
4.1	Check the telephone and cord is undamaged.	1	2	3	4
4.2	Check the correct labels and symbols are fitted inside and outside the case and they are legible.	1	2	3	4
4.3	Check that any associated signs are stable, undamaged and legible. Emergency telephones shall have the yellow telephone symbol visible on three sides of the telephone case or on a separate plate above the telephone.	1	2	3	4

4.4	Check that the correct crossing name is stated on any telephone labels and signs	1	2	3	4
4.5	Check that telephone numbers given on any sign are correct. The site plan will give information on the correct names/numbers that shall be displayed.	1	2	3	4
4.6	If betalights are fitted, check they are lit. Betalights are usually fitted to older style telephone units that the public have access to.	1	2	3	4
4.7	Ring the monitoring point and check that the call is received correctly. Ask the monitoring point to ring back	1	2	3	4
4.8	Check the telephone rings correctly. Check the quality of speech and hearing is clear and not distorted. On Whiteley PETS telephone systems there is a short time when answering a call at either end of the line where the system 'handshakes'. During this period transmission and reception of speech is not possible.	1	2	3	4
4.9	If lay-by and/or pedestal telephones are fitted Check that there is a ring differential at the monitoring point between them and the emergency telephones.	1	2	3	4
4.10	Check that if a lay-by or pedestal telephone is in use a call from the emergency telephone is still received correctly at the monitoring point.	1	2	3	4
4.11	Check that with one of the emergency telephones left 'off the hook' calls on the other telephones can be made and received correctly Whitely PETS systems will indicate a fault at the monitoring point.	1	2	3	4
4.12	Ring the ETD number given for the public to call in an emergency, Check that the recipient gives correct procedures for the call. The site plan will give information on the correct names/numbers that shall be displayed.				

Public Telephone Numbers	**Checked**

5. System Test

5.1	Power down the system by removing the supply fuse and power back up and wait until the ACB boards are displaying alternating – -109 - 209 (System Initialising)	M

Toggle the Test/Reset switch to "Test" position and release and observe the following sequence on master and slave post.

On Demand System Check

5.2	RED LED's illuminate	M	S
5.3	After 5 seconds with the RED LED's still illuminated the Audible Warning sounds	M	S
5.4	After a further 5 seconds with the RED LED's still illuminated the Second Train Coming Audible warning sounds	M	S
5.5	Hold the test switch for 5 seconds with the RED LED's still illuminated the GREEN LED's also Illuminate. briefly	M	S
5.6	'If fitted push the On Demand button" and release the GREEN aspect will flash once (which signifies the button is operating correctly).	M	S
5.7	Then both the RED and GREEN LED will extinguish	M	S
5.8	The system is now in Dark Mode awaiting initialisation. This requires the Test/Reset switch to be operated.	M	S

Automatic Configuration Test Sequence

5.9	RED LED's illuminate	M	S
5.10	After 5 seconds with the RED LED's still illuminated the Audible Warning sounds	M	S
5.11	After a further 5 seconds with the RED LED's still illuminated the Second Train Coming Audible warning sounds	M	S
5.12	Hold the test switch for 5 seconds the RED LED's still illuminated the GREEN LED's also Illuminate.	M	S
5.13	Both the RED and GREEN will extinguish	M	S
5.14	The system is now in Dark Mode awaiting initialisation. This requires the Test/Reset switch to be operated.	M	S

6. Observe or simulate a train in normal direction

	Press one of the "on Demand" buttons (If Provided) At locations where an "On Demand" system is fitted, the button shall be pressed to illuminate the Red/Green LEDs. The system will revert to energy saving mode after a period of 5 minutes.		
6.1	Observe both Green LED's are illuminated.	M	S
6.2	When the train strikes in or the first axle counter section is occupied by using the toggle switches on the Axle counter Evaluator Board (IMC)	M	
6.3	Observe the Green LED's extinguish and are replaced by Red LED's	M	S
6.4	Check the audible warning sound from both Posts	M	S

6.5	Check the Axle Counter Board (ACB) for the first section shows an axle count.	M	
6.6	When the train has completely traversed the 2nd axle counter head or has been counted out, Check the ACB has returned to zero.	M	
6.7	Observe the Red LED's extinguished and are replaced by Green LED's and the audible warning has ceased to sound.	M	S
6.8	Observe the count shown on the ACB first section has transferred to the ACB for the second section.	M	
6.9	If you are observing the passage of a real train, check the ACB counts back to zero as the train passes over the last axle counter head.	M	
6.10	If you have simulated the passage of a train, you should complete this passage by using the toggle switches on the third IMC card to count out the axles shown on the ACB card.	M	

7. Double Lines Second Train Approaching Sequence

Is This Section Applicable to the Crossing Under Test?	Yes	No

Up Direction

7.1	Press the on-demand button (if provided). Simulate the passage of a train in the "Up" direction using the toggle switches on the Axle counter Evaluator Board (IMC). Occupying block sections 1 and 2.	M	
7.2	Simulate a second train striking in in the "Down" direction.	M	
7.3	Observe that the Slave Post Red LED stays illuminated.		S
7.4	Observe that the Master Post Red LED stays illuminated.	M	
7.5	Check the audible warning from the Slave Post changes to the Another Train Coming warning.		S
7.6	Check the audible warning from the Master Post changes to the Another Train Coming warning.	M	
7.7	Complete the "normal passage" sequence for the train simulated on the "Up"	M	
7.8	Complete the "normal passage" sequence for the train simulation on the "Down" line and that the LED's return to Green.	M	

Down Direction

7.9	Press the on-demand button (if provided). Simulate the passage of a train in the "Down" direction using the toggle switches on the Axle counter Evaluator Board (IMC). Occupying block sections 3 and 4.	M	
7.10	Simulate a second train striking in in the Up direction.	M	
7.11	Observe that the Slave Post Red LED stays illuminated.		S
7.12	Observe that the Master Post Red LED stays illuminated.	M	
7.13	Check the audible warning from the Slave Post changes to the Another Train Coming warning.		S
7.14	Check the audible warning from the Master Post changes to the Another Train Coming warning.	M	
7.15	Complete the "normal passage" sequence for the train simulation on the "Down" Line.	M	
7.16	Complete the "normal passage" sequence for the train simulation on the "Up" line and that the LED's return to Green.	M	

8. Normal Direction Strike In Monitoring

8.1	Press the "on Demand" button on the Master Post (If Provided)	M	
8.2	Observe Green LED's are illuminated on both Posts.	M	S
8.3	Simulate a train striking in in the normal direction by using the toggle switches on the Axle counter Evaluator Board (IMC).	M	
8.4	Check the Post LED's are now Red and the audible alarm is sounding.	M	S
8.5	Using a stopwatch measure the length of time the audible alarms sound and the Red LED are displayed. By default, this should be 300 seconds (5 minutes) +/- 15 seconds. This time is the default setting; however, site specific condition may vary this time. The timer continues for another 600 seconds before the ACB cards resets and displays -109 / -209. This will mean a total time recorded should be 900 seconds.	Seconds	
8.6	Observe that the Red LED's extinguish / audible warning silenced and the crossing reverts to Dark Mode. No Post LED's are displayed when the "On Demand" (If provided) is pressed	M	S
8.7	The system can be reset by either the passage of a train or the simulated of the passage of a train.	M	

9. Wrong Direction Strike In Monitoring

9.1	Press the "on Demand" button on the Master Post (If Provided).	M	
9.2	Observe Green LED's are illuminated on both Posts.	M	S
9.3	Simulate a train striking in in the wrong direction by using the toggle switches on the Axle counter Evaluator Board (IMC).	M	
9.4	Check the Post LED's are now Red and the audible alarm is sounding.	M	S
9.5	Using a stopwatch measure the length of time the audible alarms sound and the Red LED are displayed. By default, this should be 300 seconds (5 minutes) +/- 15 seconds. This time is the default setting; however, site specific condition may vary this time. The timer continues for another 600 seconds before the ACB cards resets and displays -109 / -209. This will mean a total time recorded should be 900 seconds.	Seconds	
9.6	Observe that the Red LED's extinguish / audible warning silenced and the crossing reverts to Dark Mode. No Post LED's are displayed when the "On Demand" (If provided) is pressed.	M	S
9.7	The system can be reset by either the passage of a train or the simulated of the passage of a train.	M	

10. Power Supplies and Batteries

The EBI Gate 200 Level crossing Systems power requirements are provided from an external location case therefore; any power supply testing will be completed at that location and not within the EBI Gate 200 Post.

However, there is a UPS Controller and Battery within the Master Post's upper section, this should be isolated from the external power supply before any power supply testing is carried out.

Power Supply Identification

END

LEVEL CROSSING TESTING

VAMOS
LEVEL CROSSING SYSTEM

NR/SMS/LX78

Published & Issued by: Network Rail, 2nd Floor, One Eversholt Street, London, NW1 2DN

GENERAL

This test plan covers the requirements of NR/SMS/PartC/LC10 and NR/SMS/PartB/Test/159. It is for use of the person conducting the annual test of the level crossing and has relevant 'tick boxes' by each task so that particular item of the test can be correctly recorded as per the index in "crossing defects".

a) The crossing ground plan.

b) The level crossing order.

c) The crossing control tables.

d) The signalling plan.

Missing documentation shall be listed as a defect.

TEST SUMMARY

Test Summary
Name of Level Crossing:
Level Crossing Type:
Name of Monitoring Signal Box(es):
Date of Full Test:
Time Full Test Commenced:
Time Full Test Completed:
Tested By:
Signature:
Date of Signature:
Grade and Title:

CROSSING DEFECTS

On the test plan each item shall be recorded with the following letters in the box provided:

X: Found Incorrect, Action Required.
R: Found Incorrect, Rectified on Day of Test.
C: Correct.
N: Not Applicable to this Installation.

Any items found incorrect (X or R) are to be listed on the summary pages. On items requiring action, list the party(s) responsible for rectifying them.

SUMMARY OF ITEMS FOUND INCORRECT (1)

List in the table below all sites found incorrect and rectified on the day of the test (code letter R).

Description of Items Found Incorrect and Rectified

SUMMARY OF ITEMS FOUND INCORRECT (2)

List in the table below items found incorrect and requiring action (code letter X).

Description of Items Found Incorrect and Requiring Action	Responsible Party (s)

1. Road Arrangements (If Provide)

1.1	Check that the road markings are in accordance with the section order and plans.	
1.2	Check the condition and the sighting of any signs on the crossing approaches. See NR/SMS/SG00 - Section 28 for details on reflective boards and signs.	
1.3	Check the condition of the road surface over the crossing.	
1.4	Check that the road markings between and including the stop lines are complete and visible.	
1.5	Check (if provided) that the cattle/anti-trespass guards are complete and securely fastened down.	
1.6	Check the condition and the security of any fencing around the barrier machines and (if provided) on the approach to equipment room or locations.	
1.7	Check (if provided) the condition and security of any pedestrian guardrails.	
1.8	Check (if provided) the condition and security of any wicket gates	

Any defects found in 1.1 and 1.3 shall be reported to the appropriate council via the SM(S).

2. Indication Posts

NOTE: *For the purposes of identification the "Indication Post" closest to the system location is called Pole 1 and the stand alone Pole 2.*

	On each of the Indication Posts check the following items:		
2.1	The post is stable and undamaged and anti-rotation is working	1	2
2.2	The post is correctly aligned and the LED's Indications are clearly visible from the crossing decision point.	1	2
2.3	The red and green lenses are undamaged and clean.	1	2
2.4	If the crossing is an On-Demand type, check the touch buttons on each unit are not damaged.	1	2
2.5	Signs and notices attached to post are undamaged, clean and legible.	1	2
2.6	Cables and/or plug couplers are undamaged and secure and shows no damage to cables with door opening and closing	1	2

3. Gates

Is This Section Applicable to the Crossing Under Test?	Yes	No

3.1	Check that the gate and fixtures and fittings are undamaged and in good condition and pedestrian gates are self-closing	1	2

3.2	Check that the gatepost is stable and securely fixed into the ground	1	2
3.3	Check that the gate locks or hooks are effective in both the open and closed positions	1	2
3.4	Check that any red roundels or signs attached to the gate are undamaged, clean and legible. Signs and roundels shall be of class 1 retro-reflective material	1	2
3.5	If wicket gates are provided check, they are undamaged, stable and in good condition.	1	2
3.6	Check (if fitted) that the gate closing mechanism is effective	1	2

4. **Telephone Systems** (Use as Applicable)

4.1	Check the telephone and cord is undamaged.	1	2
4.2	Check the correct labels and symbols are fitted inside and outside the case and they are legible.	1	2
4.3	Check that any associated signs are stable, undamaged and legible. Emergency telephones shall have the yellow telephone symbol visible on three sides of the telephone case or on a separate plate above the telephone.	1	2
4.4	Check that the correct crossing name is stated on any telephone labels and signs.	1	2
4.5	Check that telephone numbers given on any sign are correct. The site plan will give information on the correct names/numbers that shall be displayed.	1	2
4.6	If betalights are fitted, check they are lit. Betalights are usually fitted to older style telephone units that the public have access to.	1	2
4.7	On emergency telephones, check that an ETD number is given for the public to call in case they cannot contact the monitoring point.	1	2
4.8	Ring this number and check that the recipient gives correct procedures for the call.	1	2
4.9	Ring the monitoring point and check that the call is received correctly. Ask the monitoring point to ring back.	1	2
4.10	Check the telephone rings correctly. Check the quality of speech and hearing is clear and not distorted. On Whiteley PETS telephone systems there is a short time when answering a call at either end of the line where the system ‘handshakes’. During this period transmission and reception of speech is not possible.	1	2
4.11	If lay-by and/or pedestal telephones are fitted check that there is a ring differential at the monitoring point between them and the emergency telephones.	1	2

4.12	Check that if a lay-by or pedestal telephone is in use a call from the emergency telephone is still received correctly at the monitoring point.	1	2
4.13	Check that with one of the emergency telephones left 'off the hook' calls on the other telephones can be made and received correctly Whitely PETS systems will indicate a fault at the monitoring point.	1	2

5. Cabinet

5.1	Check the cabinet securely mounted, undamaged and locked.	
5.2	Check for water ingress and other contaminates.	
5.3	Check cables and or plug couplers are undamaged and secure.	
5.4	Scroll through the Telemetry Module screens to check there is are no failure modes present, if one is note investigate and correct the issue.	
5.5	Check that the Green "DC ok" LED is illuminated on the 24v DC PULS supply unit and the green "Status" light on the Buffer Module are both lit.	
5.6	Check that both of the surge arrestors have green indications showing in the status windows.	

For each IMC board working from left to right carry out the following

ES1A

5.7	Check the "PWR" LED is lit.	
5.8	Record the system current for SYS1	
5.9	Record the system current for SYS2	

AS1B

5.10	Check the "PWR" LED is lit.	
5.11	Record the system current for SYS1	
5.12	Record the system current for SYS2	

ES1B (Use as Applicable)

5.13	Check the "PWR" LED is lit.	
5.14	Record the system current for SYS1	
5.15	Record the system current for SYS2	

ES2B (Use as Applicable)

5.16	Check the "PWR" LED is lit.	
5.17	Record the system current for SYS1	
5.18	Record the system current for SYS2	

AS2A (Use as Applicable)

5.19	Check the "PWR" LED is lit.	
5.20	Record the system current for SYS1	
5.21	Record the system current for SYS2	

ES2A (Use as Applicable)

5.22	Check the "PWR" LED is lit.	
5.23	Record the system current for SYS1	
5.24	Record the system current for SYS2	

6. User Instruction Signs

6.1	Check that user instruction signage is legible and secure.	1	2

7. Wheel Sensor Test (Detection Capability)

By observation of the passage of a train or simulation check that each sensor head is functioning correctly

Rail Sensor	Location / Unique identity	Checked	
		Passage of Train	Simulation
ES1A			
AS1B			
ES1B			
ES2B			
AS2A			
ES2A			

8. Operational Sequence Test - No Train

NOTE: *Check no train will enter the level crossing strike in area from any direction for the duration of test.*

8.1	With the system in "Standby Mode" (No red or green indicator LED lit) using a timing device Press/touch the "On-Demand" button on one of the indication posts and start timing.	1	2
8.2	Observe that the "On-Demand" blue LED is extinguished and goes to yellow whilst touching button, at the same time the green LEDs illuminate in both indication posts.	1	2
8.3	Check the green LED's are extinguished after 5 minutes.	1	2
8.4	Check the crossing returns to "Standby Mode" and the "On – Demand" red LED's are illuminated.	1	2

9. Operational Sequence Test - One Train

NOTE: *Check no train will enter the level crossing strike in area from any direction for the duration of test.*

9.1	With the system in "Standby Mode" (No red or green indicator LED lit) Press/touch the "On-Demand" button on one of the indication posts. Observe that the "On-Demand" blue LED is extinguished and goes to yellow whilst touching button, at the same time the green LEDs illuminate in both indication posts.	1	2
9.2	Simulate a train "striking in" on a strike in sensor head by operating the test switches on a Strike-in evaluator board (IMC).	1	2
9.3	Observe the green LEDs on both indicator posts are extinguished and that the red LED's illuminate.	1	2
9.4	Confirm both the audible warnings sounders are working correctly.	1	2
9.5	Simulate a train "striking out" on a strike out sensor head on the same line as the "Strike in" sensor by operating the test switches on a Strike-out evaluator board (IMC).	1	2
9.6	After a short delay (3-6 seconds) observe the indicator post LED's change from red to green.	1	2
9.7	Confirm the audible warning ceases.	1	2

10. Operational Sequence Test - Double Lines Second Train Approaching

NOTE: *Check no train will enter the level crossing strike in area from any direction for the duration of test.*

10.1	With the system in "Standby Mode" (No red or green indicator LED lit) Simulate a train "striking in" on a strike in sensor head by operating the test switches on a Strike-in evaluator board (IMC). Press/touch the "On-Demand" button on one of the indication posts. Observe that the "On-Demand" LED is extinguished, at the same time the red LEDs illuminate in both indication posts.	1	2
10.2	Simulate a train "striking in" on the first strike in sensor head mounted on 2nd line in the "opposite direction" to the first train by operating the test switches on a Strike-in evaluator board (IMC).	1	2
10.3	Confirm both audible warnings sounders DO NOT change to the second train approaching warning.	1	2
10.4	Check both indication posts continue to display a red LED.	1	2
10.5	Simulate a train "striking out" on first sensor by operating the test switches on a Strike-out evaluator board (IMC).	1	2
10.6	Check both audible warnings sounders NOW change to the second train approaching warning.	1	2
10.7	Check both indication posts continue to display a red LED and the warning continue to sound.	1	2
10.8	Simulate a train "striking out" on 2nd line by operating the test switches on a Strike-out evaluator board (IMC).	1	2
10.9	After a short delay (3-6 seconds) Observe the indicator post LED's change from red to green.	1	2
10.10	Confirm the audible warning ceases	1	2
10.11	The "On-Demand" LED's will remain extinguished until the crossing reverts to "Standby Mode".	1	2

11. Power Supplies and Batteries

The Vamos Level crossing Systems power requirements are provided from an external location case therefore, any power supply testing will be done at that location and not within the Vamos System.

Note state of power supply and Buffer unit below.

Power Supply Identification

END

LEVEL CROSSING TESTING

FLEX
LEVEL CROSSING SYSTEM

NR/SMS/LX79

Published & Issued by: Network Rail, 2nd Floor, One Eversholt Street, London, NW1 2DN

GENERAL

This test plan covers the requirements of NR/SMS/PartC/LC10 (Level Crossings Operational Sequences) and NR/SMS/PartB/Test/161 (Flex – Operational Sequence Tests). It is for use of the person conducting the annual test of the level crossing and has relevant ‘tick boxes’ by each task so that the particular item of the test can be correctly recorded as per the index in “crossing defects”.

a) The crossing ground plan.

b) The level crossing order.

c) The crossing control tables.

d) The signalling plan.

Missing documentation shall be listed as a defect.

TEST SUMMARY

Test Summary
Name of Level Crossing:
Level Crossing Type:
Name of Monitoring Signal Box(es):
Date of Full Test:
Time Full Test Commenced:
Time Full Test Completed:
Tested By:
Signature:
Date of Signature:
Grade and Title:

CROSSING DEFECTS

On the test plan each item shall be recorded with the following letters in the box provided:

X: Found Incorrect, Action Required.
R: Found Incorrect, Rectified on Day of Test.
C: Correct.WW
N: Not Applicable to this Installation.

Any items found incorrect (X or R) are to be listed on the summary pages. On items requiring action, list the party(s) responsible for rectifying them.

SUMMARY OF ITEMS FOUND INCORRECT (1)

List in the table below all sites found incorrect and rectified on the day of the test (code letter R).

Description of Items Found Incorrect and Rectified

SUMMARY OF ITEMS FOUND INCORRECT (2)

List in the table below items found incorrect and requiring action (code letter X).

Description of Items Found Incorrect and Requiring Action	Responsible Party (s)

1. **Road Arrangements** (If Provide)

1.1	Check that the road markings are in accordance with the section order and plans if provided.	
1.2	Check the condition and the sighting of any signs on the crossing approaches. See NR/SMS/PartC/SG00 (Signals: General) for details on reflective boards and signs.	
1.3	Check the condition of the road surface over the crossing.	
1.4	Check that the road markings between and including the stop lines are complete and visible.	
1.5	Check (if provided) that the cattle/anti-trespass guards are complete and securely fastened down.	
1.6	Check the condition and the security of any fencing around the barrier machines and (if provided) on the approach to equipment room or locations.	
1.7	Check (if provided) the condition and security of any pedestrian guardrails.	
1.8	Check (if provided) the condition and security of any wicket gates.	

Any defects found in 1.1 and 1.3 shall be reported to the via the SM(S).

2. **Indication Posts**

NOTE: *For the purposes of identification the "Indication Posts"are called Pole 1 (closest to the system location case) and Pole 2 (is the standalone post).*

	On each of the Indication Posts check the following items:		
2.1	The post is stable and undamaged and Anti-Rotation working.	A	B
2.2	The post is correctly aligned and the LED's Indications are clearly visible from the crossing decision point and NOT towards the railway in the direction of travel.	A	B
2.3	The red and green lenses are undamaged and clean.	A	B
2.4	Signs and notices attached to post are undamaged, clean and legible.	A	B
2.5	Cables and/or plug couplers are undamaged and secure and shows on damage to cables with door opening and closing.	A	B

3. **Gates**

Is This Section Applicable to the Crossing Under Test?	Yes	No

3.1	Check that the gate and fixtures and fittings are undamaged and in good condition and that the does not stay open.	A	B

3.2	Check that the gatepost is stable and securely fixed into the ground.	A	B
3.3	Check that the gate locks or hooks are effective in both the open and closed positions.	A	B
3.4	Check that any red roundels or signs attached to the gate are undamaged, clean and legible. Signs and roundels shall be of class 1 retro-reflective material.	A	B
3.5	If wicket gates are provided check they are undamaged, stable and in good condition.	A	B
3.6	Check (if fitted) that the gate closing mechanism is effective.	A	B

4. **Telephone Systems** (Use as Applicable)

4.1	Check the telephone and cord is undamaged.	A	B
4.2	Check the correct labels and symbols are fitted inside and outside the case and they are legible.	A	B
4.3	Check that any associated signs are stable, undamaged and legible. Emergency telephones shall have the yellow telephone symbol visible on three sides of the telephone case or on a separate plate above the telephone.	A	B
4.4	Check that the correct crossing name is stated on any telephone labels and signs.	A	B
4.5	Check that telephone numbers given on any sign are correct. The site plan will give information on the correct names/numbers that shall be displayed.	A	B
4.6	If betalights are fitted, check they are lit. Betalights are usually fitted to older style telephone units that the public have access to.	A	B
4.7	On emergency telephones, check that an ETD number is given for the public to call in case they cannot contact the monitoring point.	A	B
4.8	Ring this number and check that the recipient gives correct procedures for the call.	A	B
4.9	Ring the monitoring point and check that the call is received correctly. Ask the monitoring point to ring back.	A	B
4.10	Check the telephone rings correctly. Check the quality of speech and hearing is clear and not distorted. On Whiteley PETS telephone systems there is a short time when answering a call at either end of the line where the system ‘handshakes’. During this period, transmission and reception of speech is not possible.	A	B
4.11	If lay-by and/or pedestal telephones are fitted, check that there is a ring differential at the monitoring point between them and the emergency telephones.	A	B

4.12	Check that if a lay-by or pedestal telephone is in use a call from the emergency telephone is still received correctly at the monitoring point.	A	B
4.13	Check that with one of the emergency telephones left 'off the hook' calls on the other telephones can be made and received correctly. Whitely PETS systems will indicate a fault at the monitoring point.	A	B

5. Cabinet

5.1	Check the cabinet is securely mounted, undamaged and locked.	
5.2	Check for water ingress and other contaminates.	
5.3	Check cables and or plug couplers are undamaged and secure.	
5.4	Scroll through the Flex life Telemetry Module screens to check there are no failure modes present. If one is, note investigate and correct the issue.	
5.5	Check that the Green "Operation" LED is illuminated on the 230VAC Akkutec Battery Charger unit and the green "Battery Voltage within" LED is lit.	
5.6	Check that both of the surge arrestors have green indications showing in the status windows.	

For each IMC board working from left to right carry out the following

ES1A

5.7	Check the "PWR" LED is lit.	
5.8	Record the system current for SYS1.	
5.9	Record the system current for SYS2.	

SSN1A (Use as Applicable)

5.10	Check the "PWR" LED is lit.	
5.11	Record the system current for SYS1.	
5.12	Record the system current for SYS2.	

AS1B (Use as Applicable)

5.13	Check the “PWR” LED is lit.	☐
5.14	Record the system current for SYS1.	☐
5.15	Record the system current for SYS2.	☐

ES1B (Use as Applicable)

5.16	Check the “PWR” LED is lit.	☐
5.17	Record the system current for SYS1.	☐
5.18	Record the system current for SYS2.	☐

ES2B (Use as Applicable)

5.19	Check the “PWR” LED is lit.	☐
5.20	Record the system current for SYS1.	☐
5.21	Record the system current for SYS2.	☐

SSN2B (Use as Applicable)

5.22	Check the “PWR” LED is lit.	☐
5.23	Record the system current for SYS1.	☐
5.24	Record the system current for SYS2.	☐

AS2A (Use as Applicable)

5.25	Check the “PWR” LED is lit.	☐
5.26	Record the system current for SYS1.	☐
5.27	Record the system current for SYS2.	☐

ES2A (Use as Applicable)

5.28	Check the “PWR” LED is lit.	
5.29	Record the system current for SYS1.	
5.30	Record the system current for SYS2.	

6. User Instruction Signs

6.1	Check that user instruction signage is legible and secure.	A	B

7. Wheel Sensor Test (Detection Capability)

By observation of the passage of a train or simulation check that each sensor head is functioning correctly

Rail Sensor	Location / Unique identity	Checked	
		Passage of Train	Simulation
ES1A			
SSN1A			
AS1B			
ES1B			
ES2B			
SNN2B			
AS2A			
ES2A			

8. Operational Sequence Test - One Train (With Interface Signal OFF)

NOTE: *Check no train will enter the level crossing strike in area from any direction for the duration of test.*

		Track 1	Track 2
8.1	Confirm any interface signals are showing “proceed”.	A	B
8.2	Simulate a train “striking in” on a strike in sensor head by operating the test switches on a Strike-in evaluator board (IMC).	A	B
8.3	Observe that the green LEDs on both indicator posts are extinguished and that the red LED’s illuminate.	A	B
8.4	Check both audible warnings sounders are working correctly.	A	B
8.5	Simulate a train “striking out” on a strike out sensor head on the same line as the “Strike in” sensor by operating the test switches on a Strike-out evaluator board (IMC).	A	B
8.6	After a short delay (3-6 seconds).	A	B
8.7	Observe the indicator post LED’s change from red to green.	A	B
8.8	Check the audible warning ceases.	A	B

9. Operational Sequence Test - Double Lines Second Train Approaching (With Interface Signal OFF)

NOTE: *Check no train will enter the level crossing strike in area from any direction for the duration of test.*

		Track 1	Track 2
9.1	Confirm any interface signals are showing “proceed”	A	B
9.2	Simulate a train “striking in” on a strike in sensor head by operating the test switches on a Strike-in evaluator board (IMC).	A	B
9.3	Observe that the the red LEDs illuminate in both indication posts. Check both audible warnings sounders sound and Green’s LEDs go Out”.	A	B
9.4	Simulate a train “striking in” on a strike in sensor head mounted on 2nd line in the “opposite direction” to the first train by operating the test switches on a Strike-in evaluator board (IMC).	A	B
9.5	Check both audible warnings sounders remain and do not change to the second train approaching warning.	A	B
9.6	Check both indication posts continue to display a red LED.	A	B
9.7	Simulate a train “striking out” on first sensor by operating the test switches on a Strike out evaluator boatd (IMC).	A	B
9.8	Check both audible warnings sounders, now change to the second train approaching warning.	A	B
9.9	Check both indication posts continue to display a red LED and the warning continues to sound.	A	B

9.10	Simulate a train “striking out” on 2nd line by operating the test switches on a Strike out evaluator board (IMC).	A	B
9.11	After a short delay (3-6 seconds).	A	B
9.12	Observe the indicator post LED’s change from red to green.	A	B
9.13	Check the audible warning ceases straight away.	A	B

10. Operational Sequence Test – One Train (With Interface Signal ON)

NOTE: *Check no train will enter the level crossing strike in area from any direction for the duration of test.*

		Track 1	Track 2
10.1	Confirm the interface signal is at red, and has been for greater than 2 minutes.	A	B
10.2	Simulate a train “striking in” on a strike in sensor head by operating the test switches on a Strike-in evaluator board (IMC).	A	B
10.3	Observe the green LEDs on both indicator posts remain lit.	A	B
10.4	Clear the interface signal.	A	B
10.5	Observe the green LEDS on both indicator posts are extinguished, and the red LEDS are illuminated.	A	B
10.6	Check both the audible warning sounds are working correctly.	A	B
10.7	Observe interface signal clears to proceed aspect after signal regulation time (if applied, check for in control tables).	A	B
10.8	Simulate a train “striking out” on a strike out sensor head on the same line as the “Strike in” sensor by operating the test switches on a Strike-out evaluator board (IMC).	A	B
10.9	After a short delay (3-6 seconds).	A	B
10.10	Observe the indicator post LED’s change from red to green.	A	B
10.11	Check the audible warning ceases straight away.	A	B

11. Power Supplies and Batteries

The Flex Level crossing Systems power requirements are provided via an Akkutec 230 VAC Battery Charger and 2 “Power save” Lead-acid batteries providing 24VDC to the Flex case.

11.1 Switch the battery charger off via it’s MCB.

11.2 Allow a few minutes for the cell voltages to stabilize before taking the readings and measure each individual cell voltage.

11.3 Measure all cells and record the lowest reading on the record card. Arrange for any cells below the minimum voltage to be replaced.

11.4 Measure and record the full battery voltage.

11.5 Connect the voltmeter across one cell. Switch the battery charger on. The cell voltage rises slightly above the nominal voltage.

This indicates that the charger is working.

11.6 Carry out voltage checks and ELD reading in power supply location

Power Supply Identification

END

LEVEL CROSSING TESTING

AUTOMATIC HALF BARRIER CROSSING

WITH LEVEL CROSSING PREDICTOR

NR/SMS/LX80

Published & Issued by: Network Rail Kings Place 90 York Way, London N1 9AG

GENERAL

This document has been produced as an alternative test plan to that provided in NR/SMS/PartD/LX70 to incorporate a number of necessary maintenance tasks that are specific to crossings controlled using Level Crossing Predictors (LCP). The scope of this document includes Westinghouse GCP3000 and Harmon HXP-3R and HXP-3R2 predictors.

Differences between the Westinghouse and Harmon Predictors that influence application of this Specification are detailed below:

Terminology:

Whilst the technology employed in both the Westinghouse and Harmon Level Crossing Predictors is similar, some functions are referred to differently. To avoid confusion, the following common terms shall be used throughout this document:

Term Used in this Document	Westinghouse Equivalent	Harmon Equivalent
Loop Impedance	EZ	RX
Ballast Condition	EX	Phase Angle

Disconnecting the Output of the Predictor

<u>Westinghouse GCP3000</u>

Remove the disconnection link labeled "(LCP) R Test Link". To re-connect the output; put the link back in place.

<u>Harmon HXP-3R and HXP-3R2</u>

Place a high visibility wire strap across AAR terminals R1-1 and R2-1. To re-connect the output, remove the strap.

This test plan covers the requirements of NR/SMS/PartC/LC10 (Level Crossings Operational Sequences), NR/SMS/PartB/Test/080 (AHB Operational Sequence Test). It is for use of the person conducting the annual test of the level crossing and has relevant 'tick boxes' by each task so that the particular item of the test can be correctly recorded as per the index in "crossing defects".

a) The crossing ground plan.

b) The level crossing order.

c) The crossing control tables.

d) The signalling plan.

Missing documentation shall be listed as a defect.

TEST SUMMARY

Test Summary		
Name of Level Crossing:		
Level Crossing Type:		
Name of Monitoring Signal Box(es):		
Value of Loop Impedance on Arrival:	T1:	T2:
Value of Ballast Condition on Arrival:	T1:	T2:
Date of Full Test:		
Time Full Test Commenced:		
Time Full Test Completed:		
Tested By:		
Signature:		
Date of Signature:		
Grade and Title:		

CROSSING DEFECTS

On the test plan each item shall be recorded with the following letters in the box provided:

X: Found Incorrect, Action Required.
R: Found Incorrect, Rectified on Day of Test.
C: Correct.
N: Not Applicable to this Installation.

Any items found incorrect (X or R) are to be listed on the summary pages. On items requiring action, list the party(s) responsible for rectifying them.

SUMMARY OF ITEMS FOUND INCORRECT (1)

List in the table below all sites found incorrect and rectified on the day of the test (code letter R).

Description of Items Found Incorrect and Rectified

SUMMARY OF ITEMS FOUND INCORRECT (2)

List in the table below items found incorrect and requiring action (code letter X).

Description of Items Found Incorrect and Requiring Action	Responsible Party (s)

1. Road Arrangements

1.1	Check that the road markings are in accordance with the section order and plans.	
1.2	Check that the road markings on the approaches to the crossing (up to the stop line) are complete and visible.	
1.3	Check the condition and the sighting of the road signs on the crossing approaches. See NR/SMS/PartC/SG00 (Signals : General) for details on reflective boards and signs.	
1.4	Check (if provided) the condition and security of any pedestrian guardrails.	
	Any defects found in 1.2 to 1.4 shall be reported to the appropriate council via the SM(S).	
1.5	Check the condition of the road surface over the crossing.	
1.6	Check that the road markings between and including the stop lines are complete and visible.	
1.7	Check (if provided) that the cattle/anti-trespass guards are complete and securely fastened down.	
1.8	Check (if provided) the condition and security of any wicket gates.	
1.9	Check the condition and the security of any fencing on the approach to equipment room or locations.	

2. Barrier and Machine

	Check the following on the barrier pedestal unit:		
2.1	The pedestal is correctly aligned and stable.	Y	Z
2.2	The locks and hinges are undamaged.	Y	Z
2.3	With the boom in the raised position there is adequate clearance between the side arm/counter balance weights and the ground/base.	Y	Z
2.4	The main shaft to side arm fastenings. Check that there is not any excessive play in the keyway.	Y	Z
2.5	Observe they remain raised.	Y	Z
2.6	Lower the barriers on local control and leave the LCU switch in the lower/hand position. Open the front and rear doors of the pedestal units and fully extend the manual pump handle. Pump the booms to the fully raised position and observe they remain raised.	Y	Z
2.7	On each barrier in turn raise the pump handle until the boom begins to lower. Check that the pump handle roll pin has not reached an alignment where its top is above the bottom edge of the handle guide slot.	Y	Z

	Allow the boom to fully lower and check the following:		
2.8	The boom takes 6 to 8 seconds to lower.	Y	Z
2.9	The boom is damped during the last 10° to 15° of movement.	Y	Z
2.10	The boom is horizontal when fully lowered.	Y	Z
2.11	The boom is the correct length.	Y	Z
	Design: Y / Z		
	Actual: Y / Z		
2.12	Condition of the boom.	Y	Z
2.13	The security of the boom.	Y	Z
2.14	The boom fixing bolt 'E' clips are undamaged and the whole shear bolt assembly has had grease applied.	Y	Z
2.15	The reflective strips are undamaged, clean and are in the correct position.	Y	Z
2.16	The boom lamps, hoods, brackets, and fastenings are undamaged, free from corrosion and correctly aligned.	Y	Z
2.17	The boom wiring, plugs, clamps, and terminations are undamaged.	Y	Z
2.18	(If Fitted) the strainer wire, support bracket and fastenings are effective.	Y	Z
	Check the height of the boom from the road surface.		
2.19	Top of barrier at the centre of the road (0.9m Minimum).	Y	Z
2.20	Underside of barrier at any point (1m Maximum).	Y	Z
2.21	Check the counter balance weights are secure and are the correct weight by Measuring with a weight measuring device the tip weight by using the following method:	Y	Z

- At the tip end slowly lift the boom until it is approximately 4° to 5° from the horizontal.
- Connect the weight measuring device to the tip end of the boom.
- Release the boom onto the measuring device ensuring that the boom has not fully lowered then take a reading.

Boom Length	Tip Weight
3.6m to 4.1m	7.6Kg ±0.5Kg
4.6m to 9.1m	6.1Kg ±0.5Kg

2.22	Check that the boom can be lifted by hand to the fully raised position.	Y	Z
2.23	Check the interior of the pedestal for water ingress and contamination. Clean as necessary.	Y	Z
	Check the following on the hydraulic pack assembly:		
2.24	The pack fastenings.	Y	Z
2.25	The top and bottom pack trunnion block mountings and lock washers.	Y	Z
2.26	Bolts through the trunnion to the operating lever are the correct length and spiral pins are fitted correctly.	Y	Z
2.27	The ram adjusting screw and lock washer. Do not adjust the screw.	Y	Z
2.28	The auto/manual valve is set in the auto position and the split pin and seal are intact.	Y	Z
2.29	The split pin and seal are intact.	Y	Z
2.30	The wiring and terminations to the pack. The movement of the pack can cause the B24 feed wire to break internal strands, disconnect the wires to check for this type of damage.	Y	Z
2.31	The fluid level is correct. Just visible in the filter strainer or to the max mark on the indicator.	Y	Z
2.32	The motor brushes. They shall be of sufficient length, slide freely in their holder and seat fully on the commutator.	Y	Z
2.33	The motor commutator (where accessible). It shall be undamaged and a light coffee colour.	Y	Z
2.34	Record the pack details (Mk and serial number).		

Unit	Mk	Serial Number
Y		
Z		

2.35	Check that the shock absorber plunger cannot be depressed more than 3mm by finger pressure.	Y	Z
2.36	Check the up and down stop block striker pads. Replace if worn.	Y	Z
2.37	Unfasten the lid of the circuit controller and check the following items:		
2.38	The spindle and control arm are lubricated and free from wear. Do not lubricate the spindle if fitted with Oilite bearings. This can be identified by a P or an R stamped on the controller lid.	Y	Z
	Terminations and wiring.		

2.39	Contact fingers. Replace any fingers that are worn or have lost their spring tension.	Y	Z
2.40	Bands. Check they are clean and not worn (copper dust in the bottom of the casting). If worn the complete controller shall be renewed.	Y	Z
2.41	Measure by use of an inclinometer and digital voltmeter (on resistance) the setting of the bands whilst raising the boom on 'hand' operation. Adjust if necessary (Appendix A).	Y	Z
2.42	Close and fasten the circuit controller. Check if any adjustments have been carried out that all the terminations have been correctly tightened.	Y	Z
2.43	Check the circuit controller cam, cam slot and roller assembly.	Y	Z
2.44	Check the earth-bonding strip is secure and undamaged.	Y	Z
2.45	Check the main shaft bearings and fastenings. Check that sufficient grease has been applied to the bearings	Y	Z
2.46	Check the bearing end cap seals are effective. Water ingress into the end caps can freeze and prevent the booms from lowering.	Y	Z
2.47	Check that the pedestal fixing bolts are all fitted and correctly tightened.	Y	Z
2.48	Check the operator's door (rear) micro switch assembly, fastenings and wires. Check that they are secure and undamaged.	Y	Z
2.49	Raise the boom by hand pumping, Check that the boom does not lower between pumping strokes.	Y	Z
2.50	Lower both the booms; stow the pump handles and close and lock the operator's doors (rear). Raise the boom under 'power' operation by switching the LCU to raise and check the following:	Y	Z
2.51	The booms are between 80° and 85° when fully raised.	Y	Z
2.52	The booms do not excessively oscillate when they come to rest in the raised position.	Y	Z
2.53	The booms do not 'hunt' when fully raised. This is a sign of an internal fluid leak inside the hydraulic pack.	Y	Z
2.54	Close and lock the front pedestal door.	Y	Z

3. Local and Manual Control

	On the pedestal with the LCU unit, unlock the local control access door.		
3.1	Check when unlocked the key is retained in the lock and cannot be withdrawn unless the door is locked again.	Y	Z
3.2	Operate the control switch to the LOWER position and observe the following items:		
3.3	All the amber road signals illuminate and the audible warnings commence concurrently (Yodalarms at normal warbling rate).	Y	Z

3.4	After 3 seconds all the amber signals extinguish and all the red flashing road signals start to flash	Y	Z
3.5	After approximately a further 4 seconds the booms commence to lower.	Y	Z
3.6	The booms take 6 to 8 seconds to reach the fully lowered position.	Y	Z
3.7	Red flashing road lights continue to be illuminated. Audible warnings may continue to sound depending on design (check diagrams).	Y	Z
3.8	Disconnect the output of the Level Crossing Predictor and allow the booms to lower. Turn the local control switch to the HAND position.	Y	Z
3.9	Open the Z barrier machine operator's door, fully extend the hydraulic power unit manual pump handle and Check that the boom can be pumped to the raised position.	Y	Z
3.10	Check that the red flashing road traffic light signals are illuminated and the audible warnings are silent.	Y	Z
3.11	Open the Y barrier machine operator's door, fully extend the hydraulic power unit manual pump handle and check that the boom can be pumped to the raised position.	Y	Z
3.12	Lift the barrier hydraulic power unit pump handle slowly and allow the boom to fall sufficiently to illuminate the red flashing road traffic light signals and the release the pump handle. Check that the boom movement is arrested.	Y	Z
3.13	Check that the audible warnings are silent.	Y	Z
3.14	Check, by hand pumping, that the amber lights/red flashing road traffic light signals extinguish when the boom is at an angle of 81° above the horizontal.	Y	Z
3.15	Lift the pump handle and Check that the boom lowers in 6 to 8 seconds.	Y	Z
3.16	Check that the pump handle guide pin in seated at the bottom of the guide slot when the pump handle is in the stowed position.	Y	Z
3.17	Check that the barrier machine operator's door cannot be fully closed until the pump handle is in the stowed position.	Y	Z
3.18	Re-connect the output of the Level Crossing Predictor.	Y	Z
3.19	Lock the barrier machine operator's door and restore to AUTO WORKING.	Y	Z
3.20	Repeat tasks 3.8 to 3.19 for the other barrier machine.		
3.21	Operate the switch in the local control unit to the RAISE position and observe the following:		
3.22	Both booms rise together.	Y	Z
3.23	The red road lights extinguish and the audible warnings (depending on design) cease before the booms have reached 45 degrees from the horizontal.	Y	Z

3.24	Check that the guide on the inside of the local control unit door prevents the door being closed unless the switch is in the auto position.	Y	Z
3.25	Operate the switch to the LOWER position and observe that the sequence of events occurs as listed in 3.3 to 3.7.	Y	Z
3.26	Operate the switch to the AUTO position and observe the sequence of events occur as listed in 3.22 to 3.23. It may be possible for the LCU switch to be put straight to the AUTO position, which will cause the booms to perform a lowering sequence then rise. Check the diagrams for the correct mode of operation applicable to the crossing.	Y	Z
3.27	Close and lock the local control unit door.	Y	Z

4. Road Traffic Light Signals

If auxiliary road traffic light signals are fitted (in addition to YO, YN, ZO and ZN), list the additional signal identification below:

Signal Number	Signal Identification
Aux 1	
Aux 2	

	On each of the road traffic light signals check the following items:						
4.1	The signal structure is stable.	YO	YN	ZO	ZN	Aux 1	Aux 2
4.2	The signal light units are undamaged and the hoods are securely fitted.	YO	YN	ZO	ZN	Aux 1	Aux 2
4.3	The signal lenses are undamaged, clean and correctly orientated.	YO	YN	ZO	ZN	Aux 1	Aux 2
4.4	Signs and notices attached to the signal post are undamaged, clean, and legible. See NR/SMS/PartC/SG00 (Signals : General) for details on reflective boards and signs.	YO	YN	ZO	ZN	Aux 1	Aux 2
4.5	Cables and conduit are undamaged and secure.	YO	YN	ZO	ZN	Aux 1	Aux 2

4.6	Check that if the signals are fitted with 50-watt Quartz Halogen lamps, the road traffic light signal backboard is fitted with a red/white border. White only and red/white border backboards shall not be mixed together at the same crossing.	YO	YN	ZO	ZN	Aux 1	Aux 2

5. Audible Warnings

5.1	Check that the audible warning device and any exposed cables and conduit are undamaged and secure. Check that the device is correctly aligned.	YO	YN	ZO	ZN
5.2	Check that there has been no water ingress into audible warning device. Rectify or replace as necessary.	YO	YN	ZO	ZN
5.3	Check that the sound output of the audible warning is sufficient for the crossing circumstances and (if applicable) is reduced for the night time. Some crossings have had the sound output of audible warning device reduced because of local conditions, check the diagrams.	YO	YN	ZO	ZN
5.4	Check (if applicable) that the audible warning time clock is set to the correct time and the day/night settings are correct. Some time clocks have a control to 'skip' the set controls on certain days, check this is not activated.	YO	YN	ZO	ZN

6. Pedestrian Signals

Is This Section Applicable to the Crossing Under Test?	Yes	No

	If auxiliary pedestrian signals are fitted (in addition to YO, YN, ZO and ZN), list the additional signal identification below:	
	Signal Number	**Signal Identification**
	Aux 1	
	Aux 2	

6.1	Check that the sign is securely fixed to the post, the post is stable; the sign is undamaged and correctly aligned	YO	YN	ZO	ZN	Aux 1	Aux 2
6.2	Check that the hood is securely fitted and the signal face is clean and undamaged	YO	YN	ZO	ZN	Aux 1	Aux 2

6.3	If a sun screen is fitted, check this is undamaged and securely fitted.	YO	YN	ZO	ZN	Aux 1	Aux 2

7. Telephone System

Different types of telephone systems are fitted to AHBCs. BR Spec. 843 installations usually have two emergency phones and an LCU phone. The crossing section order will state the telephone system that is required at the crossing.

Identify telephones at the installation under test in the grid below:

No.	Telephone Identity
1	
2	
3	

		Telephone Identity (see Grid)		
7.1	Check the telephone and cord is undamaged.	1	2	3
7.2	Check the correct labels and symbols are fitted inside and outside the case and they are legible.	1	2	3
7.3	Check that any associated signs are stable, undamaged and legible. Emergency telephones require having the yellow telephone symbol visible on three sides of the telephone case or on a separate plate above the telephone.	1	2	3
7.4	Check that the correct crossing name is stated on any telephone labels and signs.	1	2	3
7.5	Check that telephone numbers given on any sign are correct. The site plan will give information on the correct names/numbers that shall be displayed.	1	2	3
7.6	If betalights are fitted, check they are lit. Betalights are usually fitted to older style telephones units that the public have access to.	1	2	3
7.7	On emergency telephones, check that an ETD number is given for the public to call in case they cannot contact the monitoring point. Ring this number and check that the recipient uses the correct procedures for the call.	1	2	3

Public Telephone Numbers	Checked

7.8	Ring the monitoring point and check that the call is received correctly. Ask the monitoring point to ring back.	1	2	3
7.9	Check the telephone rings correctly. Check that the quality of speech and hearing is clear and not distorted. On Whitely PETS telephone systems there is a short time when answering a call at either end of the line where the system 'handshakes' During this period transmission and reception of speech is not possible.	1	2	3
7.10	Check that with one of the emergency telephones left 'off the hook' calls on the other telephones can be made and received correctly. Whitely PETS systems will indicate a fault at the monitoring point.	1	2	3
7.11	If a block switch is fitted Check that when operated 7.8 to 7.10 operate correct at the alternative monitoring point.			
7.12	Check that at the normal monitoring point any audible devices do not sound.			
7.13	Repeat 7.11 and 7.12 for any other alternative monitoring points.			
7.14	If an absent switch is fitted to the telephone system operate it and Check that if an emergency call made this is indicated by a low level of illumination of the telephone unit and any audible devices do not sound. Operate the absent switch is back to normal operation and Check that a normal emergence call is received.			
7.15	Switch off the mains power to the telephone system. After a period of time equal to the crossing sequence testing repeat tasks 7.8 to 7.14. Switch the mains power to the telephone system back on.			

8. Barrier Proving

Check that a cut-out is provided in the motor contactors before proceeding with 8.2 to 8.4.

The booms can be lowered and raised by local control or train simulation.

8.1	Turn the mains power off.		
8.2	Allow the booms to lower. Restrain the tip of the Y boom then allow the barriers to rise.		
8.3	Check that the motor cut-out for the restrained boom operates within 25 seconds. This time relates to a SPX Contactor only, if a different contactor is fitted refer to site diagrams and report to Section Manager.	Y	Z

8.4	Release the boom and check that the motor cuts in again within 3 minutes and the boom fully rises.	Y	Z
8.5	Disconnect the output of the Level Crossing Predictor and allow the booms to lower.		
8.6	Restrain the tip of the Y boom from reaching the raised position (50° to 70°).		
8.7	Re-connect the output of the Level Crossing Predictor and wait for the crossing to re-set.		
8.8	Check that the red flashing road traffic light signals extinguish and that they re-illuminated 6 seconds the other begins to rise.		
8.9	Release the Y boom and allow it to reach the raised position.		
8.10	Repeat 8.1 to 8.9 for the Z boom.		

9. Red Flashing Road Traffic Light Signal Proving

The booms shall be lowered and raised by train simulation.

If auxiliary road traffic light signals are fitted (in addition to YO, YN, ZO and ZN), list the addional signal identification below:

	Signal number	Signal Identitication
	Aux 1	
	Aux 2	

9.1	Disconnect the output of the Level Crossing Predictor and allow the booms to lower .	YO	YN	ZO	ZN	Aux 1	Aux 2
9.2	Measure the rate of flashing (Between 70 and 90 flashes per minute).			FPM			
9.3	Disconnect the left and right-lamps on one of the light units by slipping the links in the equipment room/loc	YO	YN	ZO	ZN	Aux 1	Aux 2
9.4	Re-connect the output of the Level Crossing Predictor and check that the booms remain lowered.	YO	YN	ZO	ZN	Aux 1	Aux 2
9.5	Re-connect the right-hand lamp and Check that the booms raise.	YO	YN	ZO	ZN	Aux 1	Aux 2
9.6	Disconnect again the right-hand lamp and Disconnect the output of the Level Crossing Predictor. Check that approximately 2 seconds after the amber lights extinguish the booms begin to lower.						

9.7	Re-connect the output of the Level Crossing Predictor and Check that the booms remain lowered.						
9.8	Re-connect the left-hand lamp and check that the booms rise. Re-connect the right-hand lamp						
9.9	Repeat 9.1 to 9.8 for the other red road signal units. The flashes per minute rate only requires to be measured on one light unit.						

10. Local Control Sequence

10.1	Operate the LCU to the LOWER position and check the following:	
10.2	All the amber road signals illuminate, and the audible warnings commence concurrently (Yodalarms at normal warbling rate).	
10.3	After 3 seconds all the amber signals extinguish, and all the red road signals and any pedestrian lights start to flash.	
10.4	After approximately a further 4 seconds the booms commence to lower and the boom lamps illuminate.	
10.5	The booms take 6 to 8 seconds to reach the fully lowered position.	
10.6	Red road lights and any pedestrian lights continue to be illuminated. Audible warnings continue to sound depending on design (check diagrams).	
10.7	Operate the LCU to the RAISE position and check the following:	
10.8	The booms begin to rise.	
10.9	The red road lights extinguish, the lineside headlights extinguish and the audible warnings cease before the booms have reached 45° from the horizontal.	
10.10	The boom lights extinguish when the booms have reached approximately 81° from the horizontal.	
10.11	The booms do not take more than 7 seconds to reach the fully raised position of between 81° and 85° from the horizontal.	
10.12	Operate the LCU to the LOWER position, allow the lowering sequence to take place and then operate the LCU switch to the AUTO position. Check that the lowering sequence is as 10.2 to 10.6 and the raise sequence is as 10.8 to 10.11. On modern installations the switch can be put straight to the auto position, which will cause the booms to perform a lowering sequence then rise. Check the diagrams for the correct mode of operation applicable to the crossing.	

10.13	Close and lock the LCU door.	

11. Another Train Coming

The tasks in this section are concerned with observing the correct operation of the crossing in its "Constant Warning" mode and shall be carried out whilst observing the passage of a train through the crossing area.

If the frequency of timetabled train services during the test period is such that an extended delay exists between trains on both lines, arrangements shall be made for the completion of crossing sequence observations to be carried out on a subsequent visit.

11.1	Confirm with the Signal Box that the correct indications are being received whilst tasks 11.1 to 11.22 are being carried out.	Up	Up X	Dn	Dn X
11.2	Note the warning time and Check that this does not fall below the minimum as stated in the site set-up sheet, which forms part of the Circuit Diagrams.	**Minimum**		**Recorded**	
11.3	Observe if applicable on double lines that 10 seconds elapse before the amber lights illuminate and that the audible warnings sound immediately.				
11.4	Check the sighting of the amber lights.				
11.5	Observe that the sound of the audible warning devices can be heard within the crossing area and on the immediate approaches to the crossing.				
11.6	Observe that after approx. 3 seconds the amber lights extinguish and the red flashing road traffic light signals commence flashing.				
11.7	Observe that all red flashing road signals illuminate and that the audible warnings continue to sound.				
11.8	Observe the sighting of the red flashing road traffic light signals				
11.9	Observe that the barriers commence to lower 4 seconds after the red flashing road traffic light signals illuminate.				
11.10	Observe that when the barriers commence to lower, they each take between 6 and 8 seconds to reach the horizontal position.				
11.11	Observe that when the barriers are lowering, all the barrier boom lights illuminate at approx. 80° from the horizontal.				
11.12	Check the sighting of the barrier boom lights.				

11.13	Observe that the red flashing road traffic light signals are illuminated and that the audible warnings continue to sound.				

11.14	Observe that as the train proceeds towards the crossing, the Loop Impedance decreases. When the train reaches the crossing, the value of the Loop Impedance shall be 0				
11.15	Observe that the audible warning warble rate changes to the increased rate.				
11.16	Observe that after the last train has left the crossing, the barriers begin to rise.				
11.17	Observe that before the barriers have reached 45° above the horizontal, the red flashing road lights extinguish.				
11.18	Observe that that audible warning ceases to sound.				
11.19	Observe that after the barriers have reached approx. 80° above the horizontal, the barrier lights extinguish.				
11.20	Observe that after commencing to rise, the barriers reach their final position in not more that 6 seconds.				
11.21	Observe that when raised, the barriers are between 80° and 85° from the horizontal.				
11.22	Observe that as the train moves away from the crossing, the Loop Impedance returns to the value noted on page 2 of this addendum.				

12. 12. **Automatic Control Sequence** (Harmon HXP-3R and HXP-3R2 only)

Is This Section Applicable to the Crossing Under Test?		Yes	No
12.1	Place a hard wire strap across AAR terminal R1-1 and R2- 1 and observe that the AX1 LED has extinguished.	Up	Dn
12.2	Observe that Track 2 has gone into motion detect mode by confirming that the MD LED on the Track 2 TRM is flashing.	Up	Dn
12.3	Confirm that the letters “MD” are shown on the IDK display	Up	Dn
12.4	Remove the wire strap and observe that the AX1 becomes energised	Up	Dn
12.5	Place a hard wire strap across AAR terminal R1-1 and R2- 1 and observe that the AX2 LED has extinguished.	Up	Dn
12.6	Observe that Track 1 has gone into motion detect mode by confirming that the MD LED on the Track 1 TRM is flashing.	Up	Dn
12.7	Confirm that the letters “MD” are shown one the IDK display.	Up	Dn
12.8	Remove the wire strap and Observe that the AX2 becomes energised	Up	Dn

13. Special Control Function Sequence

Is This Section Applicable to the Crossing Under Test?	Yes	No

13.1	Perform any special control functions according to the control tables (Stopping/Non-Stopping, Signal, TRTS etc). Record the function performed and its results.

Function	Result

14. Line Dimensions

Is This Section Applicable to the Crossing Under Test?	Yes	No

Where track works have taken place since the pervious test.

14.1	Check and Record the approach length for both directions.specified on the signalling plan. Record the design and actual dimensions.

Line	Design Measurement	Actual Measurement
Up		
Dn		

14.2	Check and Record the island length. This shall be carried out on each line when more than one exists .
14.3	Note the exact position of the start and finish of areas where steel sleepers are present..

Line	Design Measurement	Actual Measurement
Up		
Dn		

Line	Start Mileage	Finish Mileage
Up		
Dn		

15. Indications and Audible Devices

Obtain confirmation of points/indications and alarms as detailed in this section from the Signal Box

15.1	Disconnect the output of the Level Crossing Predictor causing the booms to lower and Check that the indication extinguishes.	
15.2	Re-connect the output of the Level Crossing Predictor and Check that the BARRIERS RAISED POWER ON indication illuminates.	
15.3	Open the local control switch access door and operate the local control switch to the RAISE, LOWER and HAND positions, checking that the indications extinguish and remain extinguished	
	Access Door	
	Raise	
	Lower	
	Hand	

15.4	Restore the local control to the AUTO position, close and lock the access door and Check that the BARRIERS RAISED POWER ON indication illuminates	
15.5	Disconnect the output of the Level Crossing Predictor and Check that the FAILED/LOCAL CONTROL indication illuminates.	
15.6	Check that the audible alarm sounds after the prescribed period (no more than 240 seconds for double line or no more than180 seconds for single line) and that it can be silenced.	
15.7	Re-connect the output of the Level Crossing Predictor and Check that the audible alarm sounds when the booms are in the raised position and that the alarm can be silenced.	
15.8	Check that the BARRIERS RAISED POWER ON indication illuminates.	
15.9	Withdraw, in turn, the power supply fuses for the functions that are on the (PO) PR circuit. For each power supply disconnection Check that the BARRIERS RAISED POWER OFF indication is obtained the audible alarm sounds and that it can be silenced	
15.10	Check, after restoring the final power supply that the indicator returns to the BARRIERS RAISED POWER ON position, that the audible alarm sounds and that is can be silenced.	
15.11	Check where provided, that the Monitoring Signal Box test switches operate	

16. Power Supplies and Batteries

16.1	Carry out NR/SMS/PartB/Test/051 - Busbar Earth Test or NR/SMS/PartB/Test/053 - ELD Function Test.	
16.2	Carry out NR/SMS/PartB/Test/052 - Dynamic Earth Tests (Level Crossing Barriers).	

Power Supply Identification

17. **Motion Detect Test** (Harmon HXP-3R and HXP-3R2 only)

Is This Section Applicable to the Crossing Under Test?	Yes	No

17.1	Place the STANDBY/AUTO/NORMAL switch on the Transfer Logic Module (TLM) in the NORMAL position.	
17.2	Place the CW/MD switch on the Relay Driver Module (RYD) in the MD position.	
17.3	Place a hard wire shunt on the track at the marker positioned at 90% of the approach from the crossing.	
17.4	Observe that a full crossing sequence occurs.	
17.5	Remove the hard wire shunt.	
17.6	Place the STANDBY/AUTO/NORMAL switch on the TLM in the STANDBY position.	
17.7	Repeat tasks 17.3 to 17.5.	
17.8	Temporarily place the STANDBY/AUTO/NORMAL switch on the Transfer Logic Module (TLM) in the Normal position before returning the switch to the AUTO position.	

18. **Motion Detect Test** (Westinghouse GCP3000 only)

Is This Section Applicable to the Crossing Under Test?	Yes	No

18.1	Place a hard wire shunt on the track at the marker positioned at 70% of the approach from the crossing	
18.2	Observe that a full crossing sequence occurs.	
18.3	Remove the hard wire shunt.	
18.4	Observe that the crossing does not reset for at least 120 seconds.	
18.5	Repeat tasks 18.1 to 18.5 for each approach (both right and wrong direction).	

19. Returning the Level Crossing Predictor to Service

19.1	Once all tasks have been completed, note the values of Loop Impedance and Ballast Condition and check to see that these are comparable to the values noted on page two of this addendum, remembering to give due consideration to any environmental changes which may have occurred since the reading was first taken.	

	T1	T2
Loop Impedance		
Ballast Condition		

APPENDIX A - Circuit Controller Band Settings

Band	Made Between
DN KR	0° and 4°
HJPR	42° and 90°
MR	0° and 83°
UP KR	81° and 90°

NOTE: *It is important to obtain the over-lap between the UP KR band making and the MR band breaking. This is to ensure that if a boom drops slightly it will drive up again before the red road signals operate.*

END

LEVEL CROSSING TESTING

MINIATURE STOP LIGHT CROSSING

USING A LEVEL CROSSING PREDICTOR

NR/SMS/LX81

Published & Issued by: Network Rail Kings Place 90 York Way, London N1 9AG

GENERAL

This document has been produced as an alternative test plan to that provided in NR/SMS/LX74 to incorporate a number of necessary maintenance tasks that are specific to crossings controlled using Level Crossing Predictors (LCP). The scope of this document includes Westinghouse GCP3000 and Harmon HXP-3R and HXP-3R2 predictors.

Differences between the Westinghouse and Harmon Predictors that influence application of this Specification are detailed below:

Terminology:

Whilst the technology employed in both the Westinghouse and Harmon Level Crossing Predictors is similar, some functions are referred to differently. To avoid confusion, the following common terms shall be used throughout this document:

Term Used in this Document	Westinghouse Equivalent	Harmon Equivalent
Loop Impedance	EZ	RX
Ballast Condition	EX	Phase Angle

Disconnecting the Output of the Predictor

Westinghouse GCP3000

Remove the disconnection link labeled “(LCP) R Test Link”. To re-connect the output; put the link back in place.

Harmon HXP-3R and HXP-3R2

Place a high visibility wire strap across AAR terminals R1-1 and R2-1. To re-connect the output, remove the strap.

This test plan covers the requirements of NR/SMS/PartC/LC10 (Level Crossings Operational Sequences), NR/SMS/PartB/Test/081 (MSL with Predictor Operational Sequence Test). It is for use of the person conducting the annual test of the level crossing and has relevant ‘tick boxes’ by each task so that the particular item of the test can be correctly recorded as per the index in “crossing defects”.

a) The crossing ground plan.

b) The level crossing order.

c) The crossing control tables.

d) The signalling plan.

Missing documentation shall be listed as a defect.

Assumptions have been made in this document about the nature of level crossing installations with which the modern Level Crossing Predictor will be associated.

It is considered highly unlikely that Level Crossing Predictor systems will be used with older variants of level crossing installations, for example those utilising SL35 type Miniature Warning Lights.

TEST SUMMARY

Test Summary		
Name of Level Crossing:		
Level Crossing Type:		
Name of Monitoring Signal Box(es):		
Value of Loop Impedance on Arrival:	T1:	T2:
Value of Ballast Condition on Arrival:	T1:	T2:
Date of Full Test:		
Time Full Test Commenced:		
Time Full Test Completed:		
Tested By:		
Signature:		
Date of Signature:		
Grade and Title:		

CROSSING DEFECTS

On the test plan each item shall be recorded with the following letters in the box provided:

X: Found Incorrect, Action Required.
R: Found Incorrect, Rectified on Day of Test.
C: Correct.
N: Not Applicable to this Installation.

Any items found incorrect (X or R) are to be listed on the summary pages. On items requiring action, list the party(s) responsible for rectifying them.

SUMMARY OF ITEMS FOUND INCORRECT (1)

List in the table below all sites found incorrect and rectified on the day of the test (code letter R).

Description of Items Found Incorrect and Rectified

SUMMARY OF ITEMS FOUND INCORRECT (2)

List in the table below items found incorrect and requiring action (code letter X).

Description of Items Found Incorrect and Requiring Action	Responsible Party (s)

1. Road Arrangements

1.1	Check that the road markings are in accordance with the section order and plans.	
1.2	Check that the road markings on the approaches to the crossing (up to the stop line) are complete and visible.	
1.3	Check the condition and the sighting of the road signs on the crossing approaches. See NR/SMS/SG00 for details on reflective boards and signs.	
1.4	Check (if provided) the condition and security of any pedestrian guardrails.	
	Any defects found in 1.2 to 1.4 shall be reported to the appropriate council via the SM(S)	
1.5	Check the condition of the road surface over the crossing.	
1.6	Check that the road markings between and including the stop lines are complete and visible.	
1.7	Check (if provided) that the cattle/anti-trespass guards are complete and securely fastened down.	
1.8	Check (if provided) the condition and security of any wicket gates.	
1.9	Check the condition and the security of any fencing on the approach to equipment room or locations.	

2. Red/Green Light Units

2.1	On each of the red/green light units Check the following items:		
2.2	The light unit structure is stable.	Y	Z
2.3	The light unit is correctly aligned and the lights are clearly visible from the crossing entry point.	Y	Z
2.4	The light units are undamaged and the hoods are securely fitted.	Y	Z
2.5	The red and green lenses are undamaged and clean.	Y	Z
2.6	Signs and notices attached to the light unit post are undamaged, clean and legible.	Y	Z
2.7	Cables and conduit are undamaged and secure.	Y	Z

3. Gates

Is This Section Applicable to the Crossing Under Test?	Yes	No

3.1	Check that the gate and fixtures and fittings are undamaged and in good condition.	Y	Z
3.2	Check that the gatepost is stable and securely fixed into the ground.	Y	Z

3.3	Check that the gate locks or hooks are effective in both the open and closed positions.	Y	Z
3.4	Check that any red roundels or signs attached to the gate are undamaged, clean and legible. Signs and roundels shall be of class 1 retro-reflective material.	Y	Z
3.5	If wicket gates are provided, check they are undamaged, stable and in good condition.	Y	Z
3.6	Check that the gatepost is stable and securely fixed into the ground.	Y	Z
3.7	Check (if fitted) that the gate closing mechanism is effective.	Y	Z

4. Audible Warnings

Is This Section Applicable to the Crossing Under Test?	Yes	No

4.1	Check that the audible warning device and any exposed cables and conduit are undamaged and secure. Check that the device is correctly aligned.	Y	Z
4.2	Check that there has been no water ingress into audible warning device. Rectify or replace as necessary	Y	Z
4.3	Check that the sound output of the audible warning is sufficient for the crossing circumstances and (if applicable) is reduced for the night time. Some crossings have had the sound output of audible warning device reduced because of local conditions, check the diagrams.	Y	Z
4.4	Check (if applicable) that the audible warning time clock is set to the correct time and the day/night settings are correct. Some time clocks have a control to ‘skip’ the set controls on certain days, check this is not activated.	Y	Z

5. Telephone System

Is This Section Applicable to the Crossing Under Test?	Yes	No

5.1	Check the telephone and cord is undamaged and the correct labels and symbols are fitted inside and outside the case and they are legible.	Y	Z
5.2	Check that any associated signs are stable, undamaged and legible. Emergence telephones require having the yellow telephone symbol visible on three sides of the telephone case or on a separate plate above the telephone.	Y	Z
5.3	Check that the correct crossing name is stated on any telephone labels and signs.	Y	Z

5.4	Check that telephone numbers given on any sign are correct. The site plan will give information on the correct names/numbers that shall be displayed.	Y	Z
5.5	If betalights are fitted Check they are lit. Betalights are usually fitted to older style telephones units that the public have access to.	Y	Z
5.6	On emergency telephones Check that an ETD number is given for the public to call in case they cannot contact the monitoring point. Ring this number and Check the recipient gives correct procedures for the call.	Y	Z
5.7	Ring the monitoring point and Check that the call is received correctly. Ask the monitoring point to ring back and Check the telephone rings correctly. Check that the quality of speech and hearing is clear and not distorted. On Whiteley PETS telephone systems there is a short time when answering a call at either end of the line where the system ‘handshakes’, during this period transmission and reception of speech is not possible	Y	Z
5.8	Check that with one of the public access telephones left ‘off the hook’ calls on the other telephone can be made and received correctly. Whiteley PETS systems will indicate a fault at the monitoring point.	Y	Z
5.9	If an absent switch is fitted to the telephone system operate it and Check that if an emergency call made this is indicated by a low level of illumination of the telephone unit and any audible devices do not sound. Operate the absent switch back to normal operation and Check that a normal emergence call is received.	Y	Z
5.10	Switch off the mains power to the telephone system. After a period of time equal to the crossing sequence testing repeat tasks 5.7 to 5.9. Switch the mains power to the telephone system back on	Y	Z

6. Red/Green Lamp Operation

6.1	With no trains approaching Check that the light units are showing a green light, operate either the replacement switch to ‘red’ or slip the test link and Observe that the light units are showing a red light. Operate the replacement switch to the ‘auto’ position or re-connect the test link and Observe that the light units are showing a green light.	

7. Sequence Test

Check in the crossing control tables for any special controls that affect the automatic control sequence.

7.1	Place a short circuit on the track at the 50% marker. Observe the following:				
7.2	The green lamps on both light units extinguish and the red lamps illuminate.	Up	Up X	Dn	Dn X
7.3	The audible warnings (if provided) sound.	Up	Up X	Dn	Dn X
7.4	Remove the short circuit from the 50% marker and allow the crossing to reset. Observe the following:				
7.5	The red lamps on both light units extinguish and the green lamps illuminate.	Up	Up X	Dn	Dn X
7.6	The audible warnings (if provided) cease	Up	Up X	Dn	Dn X
7.7	Repeat steps 7.1 to 7.6 for all other directions where controls are provided.	Up	Up X	Dn	Dn X

8. Double Lines Second Train Approaching Sequence

Is This Section Applicable to the Crossing Under Test?	Yes	No

8.1	Simulate a train striking in on line one by placing a short circuit on the track at the 50% marker				
8.2	Simulate a second train striking in on line two by placing a short circuit on the track at the 50% marker.				
8.3	Remove the short circuit from line one. Observe the following:				
8.4	The green lamps on both light units stay extinguished and the red lamps stay illuminated	Up	Up X	Dn	Dn X
8.5	Operate the exit function for the train simulation on line two and Observe the following.				
8.6	The red lamps on both light units extinguish and the green lamps illuminate.	Up	Up X	Dn	Dn X
8.7	The audible warnings (if provided) cease	Up	Up X	Dn	Dn X
8.8	Repeat steps 8.1 to 8.7 for all other directions where controls are provided.	Up	Up X	Dn	Dn X

9. Special Control Function Sequence

Is This Section Applicable to the Crossing Under Test?	Yes	No

9.1	Perform any special control functions according to the control tables (Stopping/Non-Stopping, Signal, TRTS etc). Record the function performed and its results.

Function	Result

10. Line Dimensions

Is This Section Applicable to the Crossing Under Test?	Yes	No

Where track works have taken place since the pervious test.

10.1	Check and Record the approach length for both directions.specified on the signalling plan. Record the design and actual dimensions.

Line	Design Measurement	Actual Measurement
Up		
Dn		

10.2	Check and Record the island length. This shall be carried out on each line when more than one exists .
10.3	Note the exact position of the start and finish of areas where steel sleepers are present..

Line	Design Measurement	Actual Measurement
Up		
Dn		

Line	Start Mileage	Finish Mileage
Up		
Dn		

11. Warning Sequence Reset

Is This Section Applicable to the Crossing Under Test?	Yes	No

11.1	Simulate a train striking in by placing a short circuit across the rails at the 50% marker, observe that the light units show a red light.	Up	Up X	Dn	Dn X
11.2	Remove the short circuit and start timing with a stopwatch from the time the track circuit is re- connected. Check that the red lights remain illuminated.	Up	Up X	Dn	Dn X
11.3	Observe that after 120 seconds the red lights are extinguished and the green lights illuminate.	Up	Up X	Dn	Dn X
11.4	Repeat 10.1 to 10.3 for all other directions where controls are provided. Record the results in the table below	Up	Up X	Dn	Dn X

Direction	Red Lamp Extinguishes (Seconds)
Up	
Up X	
Dn	
Dn X	

12. Power Supplies and Batteries

12.1	Carry out NR/SMS/PartB/Test/051 - Busbar Earth Test or NR/SMS/PartB/Test/053 - ELD Function Test.	
12.2	Carry out NR/SMS/PartB/Test/052 - Dynamic Earth Tests (Level Crossing Barriers).	

Power Supply Identification

13. Motion Detect Test (Harmon HXP-3R and HXP-3R2 only)

Is This Section Applicable to the Crossing Under Test?	Yes	No

13.1	Place the STANDBY/AUTO/NORMAL switch on the Transfer Logic Module (TLM) in the NORMAL position.	
13.2	Place the CW/MD switch on the Relay Driver Module (RYD) in the MD position.	
13.3	Place a hard wire shunt on the track at the marker positioned at 90% of the approach from the crossing.	
13.4	Observe that a full crossing sequence occurs.	
13.5	Remove the hard wire shunt.	
13.6	Place the STANDBY/AUTO/NORMAL switch on the TLM in the STANDBY position.	
13.7	Repeat tasks 17.3 to 17.5.	
13.8	Temporarily place the STANDBY/AUTO/NORMAL switch on the Transfer Logic Module (TLM) in the Normal position before returning the switch to the AUTO position.	

14. Motion Detect Test (Westinghouse GCP3000 only)

Is This Section Applicable to the Crossing Under Test?	Yes	No

14.1	Place a hard wire shunt on the track at the marker positioned at 70% of the approach from the crossing	☐
14.2	Observe that a full crossing sequence occurs.	☐
14.3	Remove the hard wire shunt.	☐
14.4	Observe that the crossing does not reset for at least 120 seconds.	☐
14.5	Repeat tasks 18.1 to 18.5 for each approach (both right and wrong direction).	☐

15. Returning the Level Crossing Predictor to Service

15.1	Once all tasks have been completed, note the values of Loop Impedance and Ballast Condition and check to see that these are comparable to the values noted on page two of this addendum, remembering to give due consideration to any environmental changes which may have occurred since the reading was first taken.	☐

END

LEVEL CROSSING TESTING

AUTOMATIC OPEN CROSSING LOCALLY MONITORED + BARRIERS

NR/SMS/LX83

Published & Issued by: Network Rail Kings Place 90 York Way, London N1 9AG

GENERAL

This test plan covers the requirements of NR/SMS/PartC/LC10, NR/SMS/PartB/Test/083. It is for use of the person conducting the annual test of the level crossing and has relevant 'tick boxes' by each task so that particular item of the test can be correctly recorded as per the index in "crossing defects".

a) The crossing ground plan.

b) The level crossing order.

c) The crossing control tables.

d) The signalling plan.

Missing documentation shall be listed as a defect.

TEST SUMMARY

Test Summary
Name of Level Crossing:
Level Crossing Type:
Name of Monitoring Signal Box(es):
Date of Full Test:
Time Full Test Commenced:
Time Full Test Completed:
Tested By:
Signature:
Date of Signature:
Grade and Title:

CROSSING DEFECTS

On the test plan each item shall be recorded with the following letters in the box provided:

X: Found Incorrect, Action Required
R: Found Incorrect, Rectified on Day of Test
C: Correct
N: Not Applicable to this Installation

Any items found incorrect (X or R) are to be listed on the summary pages. On items requiring action, list the party(s) responsible for rectifying them.

SUMMARY OF ITEMS FOUND INCORRECT (1)

List in the table below all sites found incorrect and rectified on the day of the test (code letter R).

Description of Items Found Incorrect and Rectified

SUMMARY OF ITEMS FOUND INCORRECT (2)

List in the table below items found incorrect and requiring action (code letter X).

Description of Items Found Incorrect and Requiring Action	Responsible Party (s)

1. Road Arrangements

1.1	Check that the road markings are in accordance with the section order and plans.	
1.2	Check that the road markings on the approaches to the crossing (up to the stop line) are complete and visible.	
1.3	Check the condition and the sighting of the road signs on the crossing approaches. See NR/SMS/SG00 for details on reflective boards and signs.	
1.4	Check (if provided) the condition and security of any pedestrian guardrails.	
	Any defects found in 1.2 to 1.4 shall be reported to the appropriate council via the SM(S)	
1.5	Check the condition of the road surface over the crossing.	
1.6	Check that the road markings between and including the stop lines are complete and visible.	
1.7	Check (if provided) that the cattle/anti-trespass guards are complete and securely fastened down.	
1.8	Check (if provided) the condition and security of any wicket gates.	
1.9	Check the condition and the security of any fencing on the approach to equipment room or locations.	

2. Barrier and Machine (BR Spec. 843)

If no LCU is provided, the booms can be lowered and raised by train simulation, or disconnection/reconnection of the REPR (or equivalent) circuit in the barrier location.

	Check the following on the barrier pedestal unit:	Y	Z
2.1	The pedestal is correctly aligned and stable.	Y	Z
2.2	The locks and hinges are undamaged.	Y	Z
2.3	With the boom in the raised position there is adequate clearance between the side arm/counter balance weights and the ground/base.	Y	Z
2.4	The main shaft to side arm fastenings. Check that there is not any excessive play in the keyway.	Y	Z
2.5	Lower the barriers on local control and leave the LCU switch in the Lower position. Open the front and rear doors of the pedestal units and fully extend the manual pump handle. Pump the booms to the fully raised position and Observe they remain raised.	Y	Z
2.6	Y pedestal lift the pump handle and allow the boom to fall to approximately 45°. Release the pump handle and Check that the boom movement is arrested. The (UP)KR circuit will need to be disconnected to power the barrier release valve. Once the boom has started to lower, reconnect the (UP)KR circuit.	Y	Z

2.7	Operate the LCU switch to the off position. Check the road lights and audible warnings extinguish. Pump the boom to the raised position.		Y	Z
2.8	Observe that the boom lights are extinguished when the boom is above 80° from the horizontal. Operate the LCU switch to the On/Lower/Hand position.		Y	Z
2.9	Repeat 2.7 to 2.9 for Z pedestal		Y	Z
2.10	On each barrier in turn raise the pump handle until the boom begins to lower. Check that the pump handle roll pin has not reached an alignment where its top is above the bottom edge of the handle guide slot. Allow the boom to fully lower and Check the following: The (UP)KR circuit may need to be disconnected to power the barrier release valve		Y	Z
2.11	The boom takes 6 to 8 seconds to lower.		Y	Z
2.12	The boom is damped during the last 10° to 15° of movement.		Y	Z
2.13	The boom is horizontal when fully lowered.		Y	Z
2.14	The boom is the correct length.	Design	Y	Z
		Actual	Y	Z
2.15	Condition of the boom.		Y	Z
2.16	The security of the boom.		Y	Z
2.17	The boom fixing bolt 'E' clips are undamaged and the whole shear bolt assembly has had grease applied.		Y	Z
2.18	The reflective strips are undamaged, clean and are in the correct position.		Y	Z
2.19	The boom lamps, hoods, brackets, and fastenings are undamaged, free from corrosion and correctly aligned.		Y	Z
2.20	The boom wiring, plugs, clamps, and terminations are undamaged.		Y	Z
2.21	(If Fitted) the strainer wire, support bracket and fastenings are effective.		Y	Z
	Check the height of the boom from the road surface.			
2.22	Top of barrier at the centre of the road (0.9m Minimum).		Y	Z
2.23	Underside of barrier at any point (1m Maximum).		Y	Z
2.24	Check the counter balance weights are secure and are the correct weight by Measuring with a weight measuring device the tip weight by using the following method:			
	• At the tip end slowly lift the boom until it is approximately 4° to 5° from the horizontal.			
	• Connect the weight measuring device to the tip end of the boom.			

- Release the boom onto the measuring device ensuring that the boom has not fully lowered then take a reading.

Boom Length	Tip Weight
3.6m to 4.1m	7.6Kg
4.6m to 9.1m	6.1Kg

2.25	Check that the boom can be lifted by hand to the fully raised position.	Y	Z
2.26	Check the interior of the pedestal for water ingress and contamination. Clean as necessary.	Y	Z
	Check the following on the hydraulic pack assembly:	Y	Z
2.27	The pack fastenings.	Y	Z
2.28	The top and bottom pack trunnion block mountings and lock washers.	Y	Z
2.29	Bolts through the trunnion to the operating lever are the correct length and spiral pins are fitted correctly.	Y	Z
2.30	The ram adjusting screw and lock washer. Do not adjust the screw.	Y	Z
2.31	The auto/manual valve is set in the auto position and the split pin and seal are intact.	Y	Z
2.32	The wiring and terminations to the pack. The movement of the pack can cause the B24 feed wire to break internal strands, disconnect the wires to check for this type of damage.	Y	Z
2.33	The fluid level is correct. Just visible in the filter strainer or to the max mark on the indicator.	Y	Z
2.34	The motor brushes. They shall be of sufficient length, slide freely in their holder and seat fully on the commutator.	Y	Z
2.35	The motor commutator (where accessible). It shall be undamaged and a light coffee colour.	Y	Z
2.36	Record the pack details (Mk and serial number). Check that the pack is of the correct type for an ABCL (coloured blue).		

Unit	Mk	Serial Number

2.37	Check that the shock absorber plunger cannot be depressed more than 3mm by finger pressure.	Y	Z

2.38	Check the up and down stop block striker pads. Replace if worn.	Y	Z
2.39	Unfasten the lid of the circuit controller and Check the following items:	Y	Z
2.40	The spindle and control arm are lubricated and free from wear. Do not lubricate the spindle if fitted with Oilite bearings. This can be identified by a P or an R stamped on the controller lid.	Y	Z
2.41	Terminations and wiring.	Y	Z
2.42	Contact fingers. Replace any fingers that are worn or have lost their spring tension.	Y	Z
2.43	Bands. Check they are clean and not worn (copper dust in the bottom of the casting) If worn the complete controller shall be renewed.	Y	Z
2.44	Measure by use of an inclinometer and digital voltmeter (on resistance) the setting of the bands whilst raising the boom on ‘hand’ operation. Adjust if necessary (Appendix A).	Y	Z
2.45	Close and fasten the circuit controller. Check if any adjustments have been carried out that all the terminations have been correctly tightened.	Y	Z
2.46	Check the circuit controller cam, cam slot and roller assembly.	Y	Z
2.47	Check the earth-bonding strip is secure and undamaged.	Y	Z
2.48	Check the main shaft bearings and fastenings. Check that sufficient grease has been applied to the bearings	Y	Z
2.49	Check the bearing end cap seals are effective. Water ingress into the end caps can freeze and prevent the booms from lowering.	Y	Z
2.50	Check that the pedestal fixing bolts are all fitted and correctly tightened.	Y	Z
2.51	Check the operator’s door (rear) micro switch assembly, fastenings and wires. Check that they are secure and undamaged.	Y	Z
2.52	Raise the boom by hand pumping, Check that the boom does not lower between pumping strokes. If necessary, reconnect the (UP)KR circuit.	Y	Z
2.53	Lower both the booms; stow the pump handles and close and lock the operator’s doors (rear). Raise the boom under ‘power’ operation by switching the LCU to off and Check the following: Check the barrier (CYC)SR if necessary, reset the circuits to normalise the crossing	Y	Z
2.54	The booms are between 80° and 85° when fully raised.	Y	Z
2.55	The booms do not excessively oscillate when they come to rest in the raised position.	Y	Z
2.56	The booms do not ‘hunt’ when fully raised. This is a sign of an internal fluid leak inside the hydraulic pack.	Y	Z

2.57	The boom lights stay illuminated until both booms are above 80° from the horizontal.	Y	Z
2.58	Check that the operator's door cannot be closed and locked unless the pump handle is in the stowed position	Y	Z
2.59	Check that the guide pin is seated in the bottom of the guide slot when the pump handle is fully stowed. Check that the spiral pin is not bent and the spiral pin guide is not worn or does not have a 'step'. Close and fully lock the operator's door. When locking the operators' door check that the key is turned a further 90° clockwise then back again to the removal position to correctly operate the door proving micro switch. Check the barrier (CYC)SR if necessary, reset the circuits to normalise the crossing.	Y	Z
2.60	Close and lock the front pedestal door.	Y	Z

3. Local Control Unit

Is This Section Applicable to the Crossing Under Test?	Yes	No

3.1	Open the local control unit door. Check when unlocked that the key is retained in the lock and cannot be withdrawn unless the door is locked again.	Y	Z
3.2	Operate the control switch to the lower position and Observe the following items:		
3.3	<u>All</u> the amber road signals illuminate and the audible warnings commence concurrently (Yodalarms at normal warbling rate).	Y	Z
3.4	After 3 seconds <u>all</u> the amber signals extinguish and all the red flashing road signals start to flash.	Y	Z
3.5	The crossing headlights illuminate the crossing at the same time the red road lights commence to flash.	Y	Z
3.6	The DWL signals do <u>not</u> illuminate for any direction.	Y	Z
3.7	After approximately a further 4 seconds the booms commence to lower.	Y	Z
3.8	The booms take 6 to 8 seconds to reach the fully lowered position.	Y	Z
3.9	Red flashing road lights continue to be illuminated. Audible warnings continue to sound.	Y	Z
3.10	Open the operator's door (rear) of Y pedestal. Check the audible warnings are silenced. Extend the pump handle and hand pump the boom to the raised position. Observe the following items:		
3.11	The boom does not lower between pumping strokes.	Y	Z
3.12	The red flashing road signals and boom lights are illuminated	Y	Z

3.13	The audible warnings are sounding.	Y	Z
	Open the operator's door (rear) of Z pedestal. Extend the pump handle and hand pump the boom to the raised position. Observe the following items:		
3.14	The boom does not lower between pumping strokes.	Y	Z
3.15	The red flashing road signals stay illuminated until the Z boom is above 80° from the horizontal.	Y	Z
3.16	The audible warnings are continuing to sound.	Y	Z
3.17	Operate the LCU control switch to the off position and check that the red flashing road signals and audible warnings are extinguished	Y	Z
3.18	Operate the LCU switch to the on/lower/hand position.	Y	Z
3.19	On each pedestal lift the pump handle and allow the boom to fully lower. The (UP)KR circuit will need to be disconnected to power the barrier release valve. Once the boom has started to lower, reconnect the (UP)KR circuit.	Y	Z
3.20	Operate the switch in the local control unit to the off position and Observe the following: Check the barrier (CYC)SR if necessary, reset the circuits to normalise the crossing.	Y	Z
3.21	The audible warnings cease and both booms rise together.	Y	Z
3.22	The red road lights extinguish once the booms have started to rise.	Y	Z
3.23	Check that the guide on the inside of the local control unit door prevents the door being closed and locked unless the switch is in the auto position.	Y	Z
3.24	Operate the switch to the on/lower/hand position and Observe that a lowering sequence takes place, operate the switch to the Auto position, close and lock the local control unit door, and Observe that the booms rise as listed in section 15.	Y	Z

4. Road Traffic Light Signals

If auxiliary road traffic light signals are fitted (in addition to YO, YN, ZO and ZN), list the additional signal identification below:

Signal Number	Signal Identification
Aux 1	
Aux 2	

On each of the road traffic light signals Check the following items:

4.1	The signal structure is stable.	YO	YN	ZO	ZN	Aux 1	Aux 2

4.2	The signal light units are undamaged and the hoods are securely fitted.	YO	YN	ZO	ZN	Aux 1	Aux 2
4.3	The signal lenses are undamaged, clean and correctly orientated.	YO	YN	ZO	ZN	Aux 1	Aux 2
4.4	Signs and notices attached to the signal post are undamaged, clean, and legible See NR/SMS/SG00 for details on reflective boards and signs.	YO	YN	ZO	ZN	Aux 1	Aux 2
4.5	Cables and conduit are undamaged and secure.	YO	YN	ZO	ZN	Aux 1	Aux 2
4.6	Check that if the signals are fitted with 50-watt Quartz Halogen lamps the road traffic light signal backboard is fitted with a red/white border. White only and red/white border backboards shall not be mixed together at the same crossing.	YO	YN	ZO	ZN	Aux 1	Aux 2

5. Audible Warnings

5.1	Check that the audible warning device and any exposed cables and conduit are undamaged and secure. Check that the device is correctly aligned.	YO	YN	ZO	ZN
5.2	Check that there has been no water ingress into audible warning device. Rectify or replace as necessary.	YO	YN	ZO	ZN
5.3	Check that the sound output of the audible warning is sufficient for the crossing circumstances and (if applicable) is reduced for the night time. Some crossings have had the sound output of audible warning device reduced because of local conditions, check the diagrams.	YO	YN	ZO	ZN
5.4	Check (if applicable) that the audible warning time clock is set to the correct time and the day/night settings are correct. Some time clocks have a control to 'skip' the set controls on certain days, check this is not activated.				

6. Another Train Coming Signs

Is This Section Applicable to the Crossing Under Test?	Yes	No

If auxiliary pedestrian signals are fitted (in addition to YO, YN, ZO and ZN), list the additional signal identification below:

	Signal Number	Signal Identification
	Aux 1	
	Aux 2	

6.1	Check that the sign is securely fixed to the post, the post is stable; the sign is undamaged and correctly aligned.	YO	YN	ZO	ZN	Aux 1	Aux 2
6.2	Check that the hood is securely fitted and the signal face is clean and undamaged.	YO	YN	ZO	ZN	Aux 1	Aux 2
6.3	If a sun screen is fitted Check this is undamaged and securely fitted.	YO	YN	ZO	ZN	Aux 1	Aux 2

7. Pedestrian Signals

Is This Section Applicable to the Crossing Under Test?	Yes	No

If auxiliary pedestrian signals are fitted (in addition to YO, YN, ZO and ZN), list the additional signal identification below:

	Signal Number	Signal Identification
	Aux 1	
	Aux 2	

7.1	Check that the sign is securely fixed to the post, the post is stable; the sign is undamaged and correctly aligned	YO	YN	ZO	ZN	Aux 1	Aux 2
7.2	Check that the hood is securely fitted and the signal face is clean and undamaged	YO	YN	ZO	ZN	Aux 1	Aux 2
7.3	If a sun screen is fitted Check this is undamaged and securely fitted.	YO	YN	ZO	ZN	Aux 1	Aux 2

8. Crossing Headlight Unit

8.1	Check that the structure is stable and securely fixed in the ground.	Y	Z
8.2	Check that the light unit is undamaged and correctly aligned.	Y	Z
8.3	Check that the lens is clean and the hood is securely fixed.	Y	Z

9. Drivers Crossing Indicators (DRL/DWL) Signals

Earlier installations usually only have a driver's white light unit, more recent installations have a combined driver's red light and white light unit.

9.1	Check (on DRL/DWL units) that the flashing red signal is clearly visible from the speed restriction board.	UP	UP X	DN	DN X
9.2	Check that the structure is stable and securely fixed in the ground.	UP	UP X	DN	DN X
9.3	Check that the unit is undamaged, correctly aligned and sighted	UP	UP X	DN	DN X
9.4	Check that the lens(es) are clean and the hood(s) is/are securely fitted.	UP	UP X	DN	DN X
9.5	Check (on DRL/DWL units) that all the LED's on the DRL unit are flashing.	UP	UP X	DN	DN X

10. Lineside Notice Boards and Signs

10.1	Check that the sign is securely fixed to the post, the post is stable and securely fixed in the ground	UP	UP X	DN	DN X
10.2	Check that the sign is correctly aligned and sighted	UP	UP X	DN	DN X
10.3	Check that the sign is of the correct retro-reflective material (see 1.3)	UP	UP X	DN	DN X
10.4	Check that the sign is clean and the legend is correct and legible. The site plan will give details on the correct information that shall be displayed.	UP	UP X	DN	DN X

11. Telephone System

Most AOCL+B installations do not have public access telephones provided. Usually there is only an information sign giving contact details

Identify telephones at the installation under test in the grid below:

No.	Telephone Identity
1	
2	
3	
4	

		Telephone Identity (see Grid)			
11.1	Check the telephone and cord is undamaged.	1	2	3	4
11.2	Check the correct labels and symbols are fitted inside and outside the case and they are legible.	1	2	3	4
11.3	Check that any associated signs are stable, undamaged and legible. Emergency telephones require having the	1	2	3	4

	yellow telephone symbol visible on three sides of the telephone case or on a separate plate above the telephone				
11.4	Check that the correct crossing name is stated on any telephone labels and signs. The site plan will give information on the correct names/numbers that shall be displayed	1	2	3	4
11.5	If betalights are fitted Check they are lit. Betalights are usually fitted to older style telephones units that the public have access to.	1	2	3	4
11.6	Ring the monitoring point and Check that the call is received correctly. Ask the monitoring point to ring back.	1	2	3	4
11.7	Check the telephone rings correctly. Check that the quality of speech and hearing is clear and not distorted. On Whiteley PETS telephone systems there is a short time when answering a call at either end of the line where the system 'handshakes' during this period transmission and reception of speech is not possible	1	2	3	4
11.8	Switch off the mains power to the telephone system. After a period of time equal to the crossing sequence testing repeat tasks 11.6 to 11.7. Switch the mains power to the telephone system back on.	1	2	3	4

12. Public Telephone Numbers

12.1	Check the information on all the public information signs is correct and legible.	
12.2	Ring the ETD number given for the public to call in an emergency, Check that the recipient gives correct procedures for the call. The site plan will give information on the correct names/numbers that shall be displayed.	

Public Telephone Numbers	Checked

13. Barrier Proving

The booms can be lowered and raised by local control or train simulation.

13.1	Turn the mains power off.				
13.2	Allow the booms to lower. Restrain the tip of one of the booms then allow the barriers to rise.	YO	YN	ZO	ZN
13.3	Check that the motor cut-out for the restrained boom operates within 25 seconds. This time relates to a SPX Contactor only, if a different contactor is fitted refer to site diagrams and report to Section Manager.	YO	YN	ZO	ZN
13.4	Release the boom and check that the motor cuts in again within 3 minutes and the boom fully rises.	YO	YN	ZO	ZN
13.5	Repeat 13.1 to 13.4 for each of the other booms.				
	Turn the mains power on.				

14. Red Flashing Road Traffic Light and Drivers White Light (DWL) Signal Proving

The crossing shall be operated by train simulation. Check on the following tests that only the DWL for the direction in which the train simulation is applied operates.

If the (DWL)CR/CSR is a slow to pick relay the DWL will not illuminate with only one red road light connected. Check the diagrams

14.1	Simulate a train striking in and allow the crossing to operate. Check that all the red road signals are illuminated (flashing).	YO	YN	ZO	ZN	Aux 1	Aux 2
14.2	Measure the rate of flashing (Between 70 and 90 flashes per minute)			FPM			
14.3	Check that the DWL is illuminated (flashing).	YO	YN	ZO	ZN	Aux 1	Aux 2
14.4	Disconnect the left and right lamps on one of the light units by slipping the links in the equipment room/loc and Check that the DWL extinguishes and (if provided) the DRL illuminates.	YO	YN	ZO	ZN	Aux 1	Aux 2
14.5	Re-connect the right-hand lamp and Check that the DRL (if provided) extinguishes and the DWL illuminates.	YO	YN	ZO	ZN	Aux 1	Aux 2
14.6	Disconnect again the right hand lamp and Check that the DWL extinguishes and the DRL (if provided) illuminates .	YO	YN	ZO	ZN	Aux 1	Aux 2

14.7	Re-connect the left-hand lamp and Check that the DRL (if provided) extinguishes and the DWL illuminates.	YO	YN	ZO	ZN	Aux 1	Aux 2
14.8	Repeat 14.3 to 14.7 for all other light units.	YO	YN	ZO	ZN	Aux 1	Aux 2
14.9	Open the door of the LCU unit and Check that the DWL extinguishes and the DRL illuminates. Close and lock the door and Check that the DRL extinguishes and the DWL illuminates.						
14.10	In turn open the operator's door (rear) of the Y and Z pedestals, Check that the DWL is extinguished and the DRL is illuminated as the door is opened					Y	Z
14.11	Check that the DRL is extinguished and the DWL is illuminated as each door is correctly closed and locked again.					Y	Z
14.12	Operate the exit function and remove the train simulation. If necessary, re-set the circuits to normalise the crossing controls.						

15. Local Control Sequence

15.1	Operate the LCU to the LOWER position and Check the following:	
15.2	All the amber road signals illuminate and the audible warnings commence concurrently (Yodalarms at normal warbling rate).	
15.3	After 3 seconds all the amber signals extinguish and all the red road signals and any pedestrian lights start to flash.	
15.4	The crossing headlights illuminate the crossing at the time the red road lights commence to flash.	
15.5	The DWL do not illuminate.	
15.6	The DRL continue to flash.	
15.7	After approximately a further 4 seconds at older the booms commence to lower and the boom lamps illuminate.	
15.8	The booms take 6 to 8 seconds to reach the fully lowered position.	
15.9	Red road lights and any pedestrian lights continue to be illuminated. Audible warnings continue to sound.	
15.10	Operate the LCU to the RAISE position and Check the following:	
15.11	The booms begin to rise.	
15.12	The lineside headlights extinguish and the audible warnings cease. The red road lights extinguish once the booms have started to rise.	
15.13	The boom lights extinguish when the booms have reached approximately 81° from the horizontal.	
15.14	The booms do not take more than 7 seconds to reach the fully raised position of between 81° and 85° from the horizontal.	

	Check the barrier (CYC)SR. if necessary, reset the circuits to normalise the crossing.	
15.15	Operate the switch to the auto position and Observe that a lowering sequence as listed in 15.1 to 15.9 takes place and then the booms raise as listed in 15.12 to 15.14.	

16. Automatic Control Sequence

- Check in the crossing control tables for any special controls that affect the automatic control sequence.
- Where the word EXIT occurs the strike out treadle shall be operated.
- On single lines or where bi-directional controls exist the leaving track circuit shall also be operated.
- Where directional proving controls exists the bi-directional strike out treadle shall also be operated in the correct sequence.

16.1	Observe, with no train approaching, all DRL (if provided) are illuminated (flashing) and are visible from the speed restriction board.	Up	Up X	Dn	Dn X
16.2	Simulate an approaching train by shunting a controlling track circuit. Observe the following:	Up	Up X	Dn	Dn X
16.3	On double lines 10 seconds elapse before the crossing sequence commences. On single lines the sequence starts immediately.	Up	Up X	Dn	Dn X
16.4	All the amber road signals illuminate and the audible warnings commence concurrently (Yodalarms at normal warbling rate).	Up	Up X	Dn	Dn X
16.5	After 3 seconds all the amber signals extinguish and all the red road signals and any pedestrian lights start to flash	Up	Up X	Dn	Dn X
16.6	The crossing headlights illuminate the crossing at the time the red road lights commence to flash.	Up	Up X	Dn	Dn X
16.7	After approximately a further 4 seconds the booms commence to lower.	Up	Up X	Dn	Dn X
16.8	As the booms commence to lower the DRL extinguishes and the DWL commences to flash for the direction where the train simulation was applied. The DRL continues for the opposing directions.	Up	Up X	Dn	Dn X
16.9	The booms take 6 to 8 seconds to reach the fully lowered position.	Up	Up X	Dn	Dn X

16.10	The crossing headlights, red road lights and any pedestrian lights continue to be illuminated and audible warnings continue to sound.	Up	Up X	Dn	Dn X
16.11	Operate the exit function and remove the train simulation. Observe the following:	Up	Up X	Dn	Dn X
16.12	The booms begin to rise.	Up	Up X	Dn	Dn X
16.13	The DWL for the direction where the simulation was applied extinguishes and the DRL commences to flash.	Up	Up X	Dn	Dn X
16.14	The red road lights and crossing headlights extinguish and the audible warnings cease when the booms have reached approximately 45° from the horizontal.	Up	Up X	Dn	Dn X
16.15	The boom lights extinguish when the booms have reached approximately 81° from the horizontal.	Up	Up X	Dn	Dn X
16.16	The booms do not take more than 7 seconds to reach the fully raised position of between 81° and 85° from the horizontal.	Up	Up X	Dn	Dn X
16.17	Repeat steps 16.2 to 16.16 for the opposite direction on a single line and the other direction on double lines.	Up	Up X	Dn	Dn X

17. Double Lines Second Train Approaching Sequence

Is This Section Applicable to the Crossing Under Test?		Yes	No
17.1	Simulate a train striking in on line one.	Up	Dn
17.2	Simulate a second train striking in on line two. Observe the following:	Up	Dn
17.3	The booms remain lowered.	Up	Dn
17.4	The road lights and any pedestrian lights continue to flash.	Up	Dn
17.5	The audible warning rate continues at the normal rate	Up	Dn
17.6	The crossing headlights continue to illuminate	Up	Dn
17.7	Operate the exit function and remove the simulation on line one. Observe the following:	Up	Dn
17.8	The booms remain lowered.	Up	Dn
17.9	The road lights and any pedestrian lights continue to flash.	Up	Dn
17.10	The audible warning rate changes to the increased rate.	Up	Dn
17.11	The crossing headlights continue to illuminate	Up	Dn
17.12	The DWL for the direction of the simulation on line one extinguishes and the DRL commences to flash.	Up	Dn
17.13	The DRL for the simulation on line two extinguishes and the DWL commences to flash.	Up	Dn

17.14	Operate the exit function and remove the simulation on line two. Observe that the sequence.	Up	Dn
17.15	Repeat steps 17.1 to 17.14 for a train striking in on line two first and a second train striking in on line one.	Up	Dn

18. Track Circuit Timing

18.1	Simulate an approaching train by shunting a controlling track circuit.	Up	Up X	Dn	Dn X
18.2	Start timing with a stopwatch as soon as the red flashing road signals and the DWL for the direction in which the simulation was applied illuminate.	Up	Up X	Dn	Dn X
18.3	Check that after 180 seconds the DWL extinguishes and the DRL (if applicable) commences to flash.	Up	Up X	Dn	Dn X
18.4	Check that 30 seconds after the DWL extinguishes the barriers perform a raising sequence as in 16.12 to 16.16. The only exception will be that the DWL will already be extinguished and the DRL will be flashing.	Up	Up X	Dn	Dn X
18.5	Remove the train simulation and operate the exit function. Check that the crossing controls return to their normal state. If necessary, re-set the circuits.	Up	Up X	Dn	Dn X
18.6	Repeat 18.1 to 18.5 for all other directions where controls are provided Record the results in the table below. If any adjustments have to be made to achieve these times, allow a period of time for the bi-metal strip in the timer to cool down.	Up	Up X	Dn	Dn X

Direction	TC Name	DWL Extinguishes (Seconds)	Booms Rise (Seconds)

19. Drivers Plunger Unit

These are normally fitted to modern installations.

NOTE: *On some designs the DWL will not illuminate when the drivers plunger is operated after the crossing has timed out. The DRL (if provided) will remain flashing. Check the control tables and diagrams for the crossing you are testing.*

Is This Section Applicable to the Crossing Under Test?	Yes	No

19.1	Simulate an approaching train by shunting a controlling track circuit and allow the crossing to time out.	Up	Up X	Dn	Dn X
19.2	Check that the DWL extinguishes and the DRL commences to flash.	Up	Up X	Dn	Dn X
19.3	Open the door of the unit and operate the plunger. Check that the crossing sequence starts.	Up	Up X	Dn	Dn X
19.4	Check that DWL for the direction of the plunger operation illuminates (if designed to do so, see note at start of section)	Up	Up X	Dn	Dn X
19.5	Reset the circuits to normalise the crossing controls. Close and lock the door of the plunger unit	Up	Up X	Dn	Dn X
19.6	Repeat 19.1 and 19.5 for all other driver's plunger units.	Up	Up X	Dn	Dn X

20. Special Control Function Sequence

Is This Section Applicable to the Crossing Under Test?	Yes	No

Check in the control tables for any special controls functions that are applicable to the crossing.

20.1	Perform any special control functions according to the control tables (Stopping/Non-Stopping, Signal, TRTS etc). Record the function performed and its results.	Up	Up X	Dn	Dn X

Function	Result

21. Line Dimensions

Is This Section Applicable to the Crossing Under Test?	Yes	No

Where track works have taken place since the pervious test

21.1	Check and identify the distance of track circuits and treadles as specified on the signalling plan. Record the design and actual dimensions	Up	Up X	Dn	Dn X

Line	Design Measurement	Actual Measurement

22. Power Supplies and Batteries

22.1	Carry out NR/SMS/PartB/Test/051 - Busbar Earth Test or NR/SMS/PartB/Test/053 - ELD Function Test.	
22.2	Carry out NR/SMS/PartB/Test/052 - Dynamic Earth Tests (Level Crossing Barriers).	

Power Supply Identification

APPENDIX A - Circuit Controller Band Settings

Band	Made Between
DN KR	0° and 4°
HJPR	42° and 90°
MR	0° and 83°
UP KR	81° and 90°

NOTE: *It is important to obtain the over-lap between the UP KR band making and the MR band breaking. This is to ensure that if a boom drops slightly it will drive up again before the red road signals operate.*

END

LEVEL CROSSING TESTING

MINIATURE STOP LIGHT CROSSING (MSL)

(RELIABILITY CENTRED MAINTENANCE)

NR/SMS/LX94

Published & Issued by: Network Rail, 2nd Floor, One Eversholt Street, London, NW1 2DN

GENERAL

This test plan is the NR/SMS/PartC/LC15. It is for use of the person conducting the annual test of the level crossing and has relevant 'tick boxes' by each task so that particular item of the test can be correctly recorded as per the index in 'crossing defects'.

a) The crossing ground plan.

b) The level crossing order.

c) The crossing control tables.

d) The signalling plan.

Missing documentation shall be listed as a defect.

TEST SUMMARY

Test Summary
Name of Level Crossing:
Level Crossing Type:
Name of Monitoring Signal Box(es):
Date of Full Test:
Time Full Test Commenced:
Time Full Test Completed:
Tested By:
Signature:
Date of Signature:
Grade and Title:

CROSSING DEFECTS

On the test plan each item shall be recorded with the following letters in the box provided:

X: Found Incorrect, Action Required
R: Found Incorrect, Rectified on Day of Test
C: Correct
N: Not Applicable to this Installation

Any items found incorrect (X or R) are to be listed on the summary pages. On items requiring action, list the party(s) responsible for rectifying them.

SUMMARY OF ITEMS FOUND INCORRECT (1)

List in the table below all sites found incorrect and rectified on the day of the test (code letter R).

Description of Items Found Incorrect and Rectified

SUMMARY OF ITEMS FOUND INCORRECT (2)

List in the table below items found incorrect and requiring action (code letter X).

Description of Items Found Incorrect and Requiring Action	Responsible Party (s)

1. Red /Green Light Unit

	On each of the Red / Green Light units check the following items:		
1.1	The post is stable and undamaged	Y	Z
1.2	The light unit is correctly aligned and the lights are clearly visible from the crossing entry point.	Y	Z
1.3	The light units are undamaged and the hoods are securely fitted.	Y	Z
1.4	The red and green lenses are undamaged and clean.	Y	Z
1.5	If the crossing is an On-Demand type, check the touch buttons on each unit are not damaged.	Y	Z
1.6	Signs and notices attached to post are undamaged, clean and legible.	Y	Z

2. Gates

Is This Section Applicable to the Crossing Under Test?	Yes	No

2.1	Check that any red roundels or signs attached to the gate are undamaged, clean and legible. Signs and roundels shall be of class 1 retro-reflective material	A	B

3. Audible Warnings

Is This Section Applicable to the Crossing Under Test?	Yes	No

3.1	Check that the sound output of the audible warning is sufficient for the crossing circumstances and (if applicable) is reduced for the night time. Some crossings have had the sound output of audible alarms reduced because of local conditions, check the diagrams.	A	B
3.2	Check (if applicable) that the audible warning time clock is set to the correct time and the day/night settings are correct.	A	B

4. Telephone Systems

Is This Section Applicable to the Crossing Under Test?	Yes	No

4.1	Check the telephone and cord is undamaged.	A	B
4.2	Check that any associated signs are stable, undamaged and legible. Emergency telephones shall have the yellow telephone symbol visible on three sides of the telephone case or on a separate plate above the telephone.	A	B
4.3	Check that the correct crossing name is stated on any telephone labels and signs	A	B
4.4	Check that telephone numbers given on any sign are correct. The site plan will give information on the correct names/numbers that shall be displayed.	A	B
4.5	If betalights are fitted, check they are lit. Betalights are usually fitted to older style telephone units that the public have access to.	A	B
4.6	On emergency telephones, check that an ETD number is given for the public to call in case they cannot contact the monitoring point.	A	B
4.7	Ring this number and check that the recipient gives correct procedures for the call	A	B
4.8	Ring the monitoring point and check that the call is received correctly. Ask the monitoring point to ring back	A	B
4.9	Check the telephone rings correctly. Check the quality of speech and hearing is clear and not distorted. On Whiteley PETS telephone systems there is a short time when answering a call at either end of the line where the system 'handshakes'. During this period transmission and reception of speech is not possible.	A	B
4.10	If lay-by and/or pedestal telephones are fitted Check that there is a ring differential at the monitoring point between them and the emergency telephones	A	B
4.11	Check that with one of the emergency telephones left 'off the hook' calls on the other telephones can be made and received correctly Whitely PETS systems will indicate a fault at the monitoring point	A	B
4.12	If an absent switch is fitted to the telephone system operate it and check that if an emergency call made this is indicated by a low level of illumination of the telephone unit and any audible devices do not sound. Operate the absent switch back to normal operation and check that a normal emergence call is received.	A	B
4.13	Switch off the mains power to the telephone system. After a period of time equal to the crossing sequence testing, repeat tasks 4.9 to 4.12. Switch the mains power to the telephone system back on.	A	B

5. **Red / Green Lamp Operation**

5.1	With no trains approaching check that the light units are showing a green light, operate either the replacement switch to 'red' or slip the test link and observe that the light units are showing a red light. Operate the replacement switch to the 'auto' position or re-connect the test link and Observe that the light units are showing a green light.	

6. **Sequence Test**

Check in the crossing control tables for any special controls that affect the automatic control sequence.

Where the word EXIT occurs, the strike out treadle shall be operated.

6.1	Simulate an approaching train by shunting a controlling track circuit.	Up	Up X	Dn	Dn X
	Observe the following:				
6.2	The green lamps on both light units extinguish and the red lamps illuminate.	Up	Up X	Dn	Dn X
6.3	The audible warnings (if provided) sound.	Up	Up X	Dn	Dn X
6.4	Operate the exit function and remove the train simulation.	Up	Up X	Dn	Dn X
	Observe the following:				
6.5	The red lamps on both light units extinguish and the green lamps illuminate.	Up	Up X	Dn	Dn X
6.6	The audible warnings (if provided) cease.	Up	Up X	Dn	Dn X

Repeat steps 6.1 to 6.6 for all other directions where controls are provided.

7. **Double Lines Second Train Approaching Sequence**

Is This Section Applicable to the Crossing Under Test?	Yes	No

7.1	Simulate an approaching train as in 6.1 on line one.	Up	Up X	Dn	Dn X
7.2	Simulate a second train striking in on line two.	Up	Up X	Dn	Dn X
7.3	Operate the exit function for the train simulation on line one.	Up	Up X	Dn	Dn X

	Observe the following:				
7.4	The green lamps on both light units stay extinguished and the red lamps stay illuminated.	Up	Up X	Dn	Dn X
7.5	The audible warnings (if provided) changes to the increased rate.	Up	Up X	Dn	Dn X
7.6	Operate the exit function for the train simulation on line two and Observe that the sequence is as 6.5 to 6.6.	Up	Up X	Dn	Dn X

Repeat steps 7.1 to 7.6 for a train striking in on line two first and a second train striking in on line one.

8. Special Control Function Sequence

Is This Section Applicable to the Crossing Under Test?	Yes	No

8.1	Perform any special control functions according to the control tables (Stopping/Non-Stopping, Signal, TRTS etc). Record the function performed and its results.

Function	Result

9. Track Circuit Resetting Tests.

Is This Section Applicable to the Crossing Under Test?	Yes	No

9.1	Simulate a train striking in by dropping a controlling track circuit, observe that the light units show a red light.	Up	Up X	Dn	Dn X
9.2	Make up the track circuit and start timing with a stopwatch from the time the track circuit is re-connected. Check that the red lights remain illuminated.	Up	Up X	Dn	Dn X
9.3	Observe that after 120 seconds the red lights are extinguished and the green lights illuminate. If any adjustments have to be made to achieve this time, allow a period of time for the bi-metal strip in the timer to cool down.	Up	Up X	Dn	Dn X

9.4	Repeat 9.1 to 9.3 for all other directions where controls are provided	Up	Up X	Dn	Dn X

Direction	TC Name	Red Road Light extinguishes (second)
Up		
UpX		
Dn		
DnX		

10. Leaving Track Circuit Monitoring.

Is This Section Applicable to the Crossing Under Test?	Yes	No

10.1	Simulate a train striking in by dropping a controlling track circuit, Observe that the red lights illuminate.	Up	Up X	Dn	Dn X
10.2	Drop the leaving track circuit, operate the exit function and make up the controlling track circuit. Check that the leaving track circuit remains dropped.	Up	Up X	Dn	Dn X
10.3	Observe that the red lights are extinguished and the green lights illuminate. Start timing with a stopwatch as soon as the red lights are extinguished.	Up	Up X	Dn	Dn X
10.4	Observe that after 240 seconds the green lights extinguish and the red lights stay extinguished.	Up	Up X	Dn	Dn X
10.5	Re-connect the leaving track circuit and reset the control circuits. Check that the green lights illuminate. Record the time in the table below.	Up	Up X	Dn	Dn X

Time in Seconds

11. Power Supplies and Batteries

11.1	Carry out NR/SMS/PartB/Test/051 - Busbar Earth Test or NR/SMS/PartB/Test/053 - ELD Function Test.	
11.2	Carry out NR/SMS/PartB/Test/052 - Dynamic Earth Tests (Level Crossing Barriers).	

Power Supply Identification

END

[illegible]	[illegible]
[illegible]	1[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]

[illegible]

[illegible]

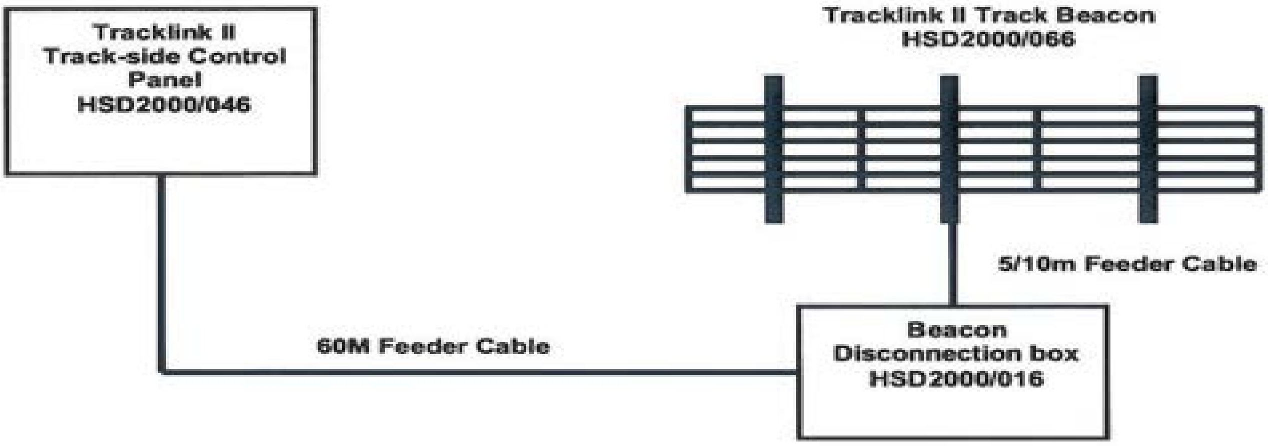
INDEX

END

Includes:	Beacon and support beams, disconnection box, feeder cables, PIBS enclosure, transmitter control unit, power supply unit, coding plugs, LED switch indicators, panel condensation heater and thermostat, termination
Excludes:	Any other type of Beacon or Balise, Train borne equipment

The function of PIBS is to identify which platform the train enters at a station with multiple length platforms, in order to maximize the number of doors that can be released, rather than defaulting to the shortest platform length at the station.

A typical PIBS installation consists of the following components:



As PIBS performs a great deal of self-checking on a continual basis and any malfunctions will be identified as each train passes the beacon, routine maintenance operations are minimal.

SERVICE B

1. Beacon Assembly

1.1 Check the beacon assembly and fixings for security and physical damage.

1.2 Remove metallic and other debris and combustible material from the proximity of the beacon.

1.3 Check all the connectors and glands are in place and they are securely attached.

1.4 Check all cables for damage or signs of fraying.

1.5 Check the external labels for security.

2. Disconnection Box

2.1 Check the disconnection box for security and physical damage.

2.2 Check that the lid (and padlock, if provided) are securely fitted.

2.3 Check for rodent damage and protect as necessary.

2.4 Check all the glands are in place and securely attached.

2.5 Check all cables for damage or signs of fraying.

2.6 Check the external labels for security.

3. Transmitter Control Panel Enclosure

3.1 Check the transmitter panel enclosure for security and physical damage.

3.2 Check that the padlock is in place.

3.3 Check all that all the connectors and glands are in place and securely attached.

3.4 Check all cables for damage or signs of fraying.

3.5 Check the external labels for security.

3.6 Open the panel door and visually Check for water and dust ingress.

3.7 Check that the panel LEDs illuminate.

3.8 Check the security of all connections to the terminal rail.

3.9 Check for the security of earth connections, internal and external.

3.10 Check for security of the coding plugs.

End

Development

An axle bearing on a train that has lost its lubrication will run hot, smoke badly and eventually seize up. This could lead to the derailment of the train.

Before the wide spread deployment of Power Signal Boxes covering large areas of route miles, smaller Mechanical Signal Boxes were numerous, this along with higher levels of track side staff due to more labour intensive procedures meant that the observation of passing trains was higher and therefore the detection of overheated axle boxes was intensive.

To overcome the reduction of human observation due to modernisation, Hot Axle Box (now usually referred to as Bearing) Detector (HABD) equipment was developed to check the axles bearings of passing trains and if found to be overheated, send an alarm to the monitoring Signal Box.

Generic Operation

Heat is radiated as infrared radiation, HABDs use various types of sensor (depending on make and age) to detect this radiation at a specific point; compare it to various parameters and the ambient temperature.

If pre-set conditions are not met, an alarm will be generated. Transducers or wheel sensors are used before and after the heat sensor to govern the operation of the HABD.

The latest generation of HABD equipment can also detect hot braking systems along with hot axle bearings.

NOTE This is generic basic detail of operation. Reference should be made to the appropriate equipment manuals for detailed and specific modes of operation.

Equipment Set-up

Due to numerous factors, the set up of the HABD equipment is critical to its correct and reliable operation, this is especially so in older units that do not benefit from the latest advances in electronic technology.

The testing and set-up procedures in the tasks/tests shall be followed. Your SM(S) shall be informed if any of the results of the tasks/tests do not meet the parameters specified.

Equipment Spares

Older versions of HABD equipment are no longer manufactured (e.g. Servo 7788, 7789, 8889 & 9909), avoid damaging any components.

All spare components for these units shall be regarded as strategic spares.

Maintenance

If any faults or problems are discovered during maintenance, they should be rectified immediately as corrective maintenance. If this is not possible, your SM(S) and the relevant Infrastructure Fault Control informed at once.

Certain tasks and tests may be carried out by other teams (e.g. Signalling Technical Support) or equipment specialists. Your SM(S) will inform you if any of these groups will undertake certain tasks/tests.

Equipment Types

Listed in the following table are outline details of the most common HABD equipment currently in use. Reference to the appropriate manufactures manuals should be made for more details.

The 'R' suffix after certain equipment types stands for 'Retrofit'. This is where a system has had the scanners replaced with a different scanner type or has had different scanner mounting brackets fitted.

System Details

System	Details
Servo 7788 & 7789	HABD systems fitted with ballast mounted scanners, inclined at an angle to the rail.
Servo 7788R & 7789R	HABD systems that have had the ballast mounted scanners replaced by a rail mounted type the same as those used in the Servotrim 9909 series).
Servo 8889	HABD system with rail mounted scanners (but further from and inclined at an angle to the rail compared to the Servotrim 9909 type).
Servo 8889R	HABD system with rail mounted scanner (8889 type) fitted with different mounting brackets so that the scanner is effectively identical to the Servotrim 9909 type.
Servotrim 9909	HABD system with rail mounted scanners, with scanners parallel and close to the rail.
Cyberscan 2000 (Trim II)	HABD system with rail mounted scanners that can have a vertical or inclined optical system.
GETS FÜS	HABD system where the heat measuring sensors are mounted in a hollow steel sleeper that can detect overheated bearings or brakes.

NOTE Due to local conditions there may be slight variations in system fittings, if you are in doubt to the system type, ask your SM(S). Both the Servo 7788 and 7788R use the same DPU System.

Imperial/Metric

Due to Servosafe and Servotrim equipment being designed to imperial measurements (inches and Fahrenheit), these are the only measurements used.

Later equipment types are designed to metric standards (millimetres and Celsius) therefore these are the only measurements used.

References

All reference to Servosafe and Servotrim scanners are in accordance with the manufacturer's terminology (i.e., in normal direction of travel):

- Rail 1 is the left hand or cess side unit
-
- Rail 2 is the right hand or six foot side unit
-

Older Systems

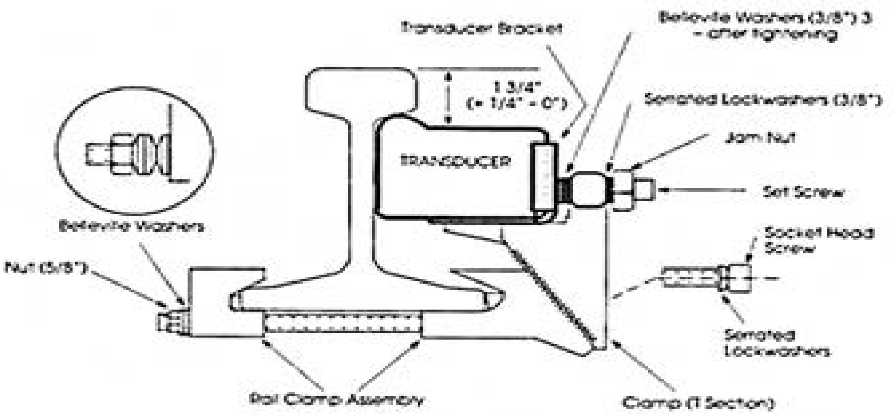
The NR/SMS tasks/tests for the Servosafe and Servotrim systems are based on the manufactures manuals that were written when the systems were new. As with the components page in older systems, tolerances and levels can vary.

They may be at different levels to that stated in the task/test but are working correctly for present system configuration. This condition may also lead to certain tests and measurements in the NR/SMS to be unobtainable.

Certain tasks and tests ask for the removal of cards, in some cases this may lead to damage of the card edge connector and with spares no longer being available the system may become inoperable.

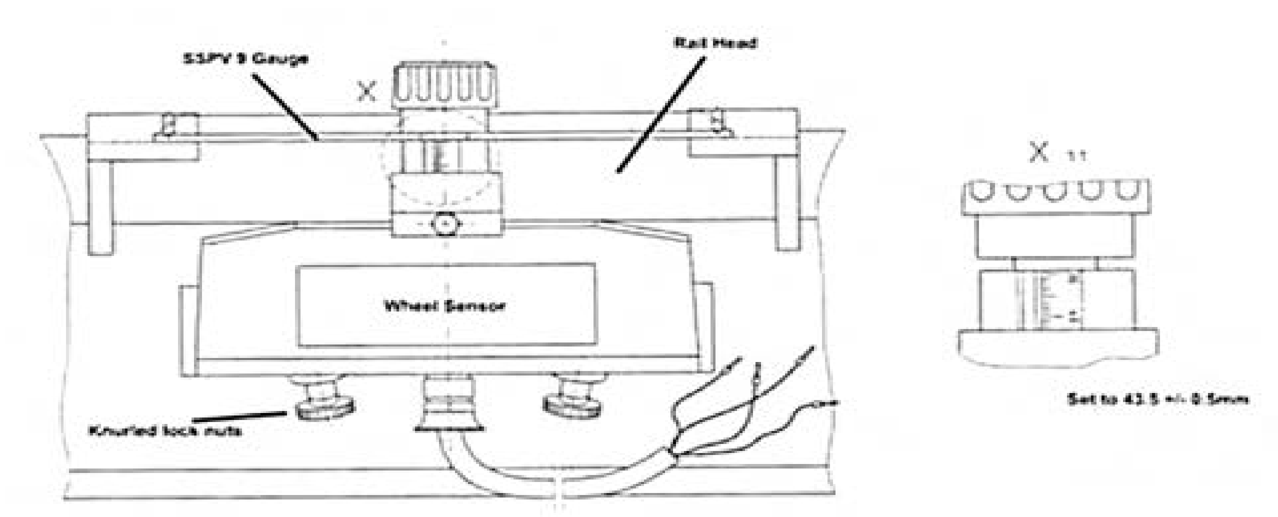
If you think a task/test action or requirement will severely disrupt the operation or reliability of the HABD system you are maintaining, ask your SM(S) before proceeding.

Servotrip Transducer



NOTE On some systems the older larger servo pole transducer still being used, usually on ballast mounted.

GETS FUS Wheel Sensor

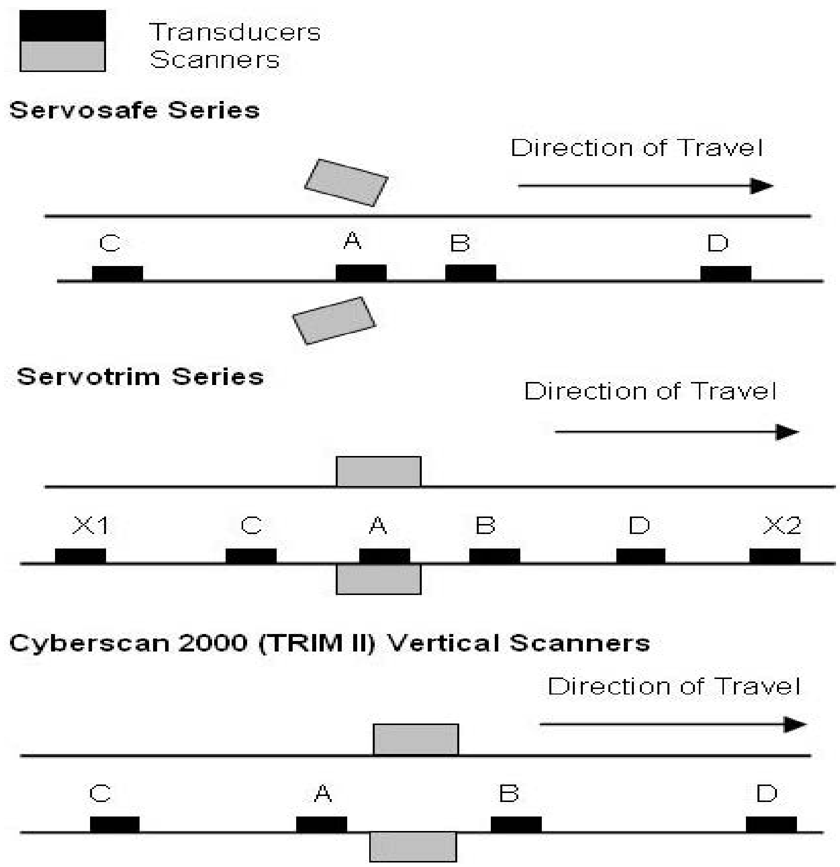


Generic Layout of Scanners and Transducers (Not to Scale)

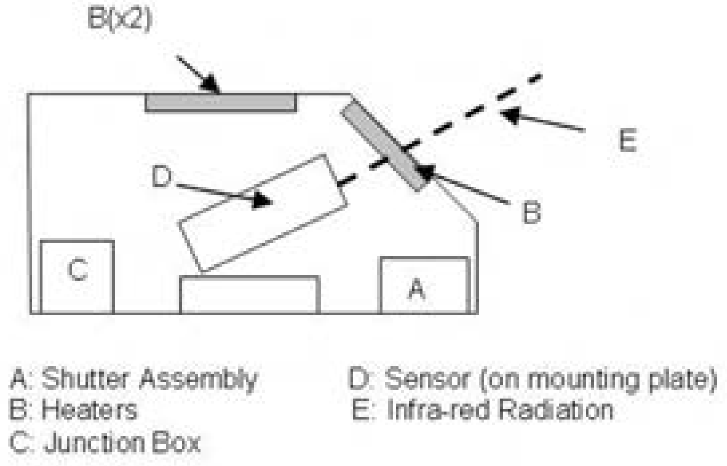
Distances between each piece of equipment are detailed in NR/SMS/Test/087.

Note: Transducer D & X2 are fitted for bi-directional working only.

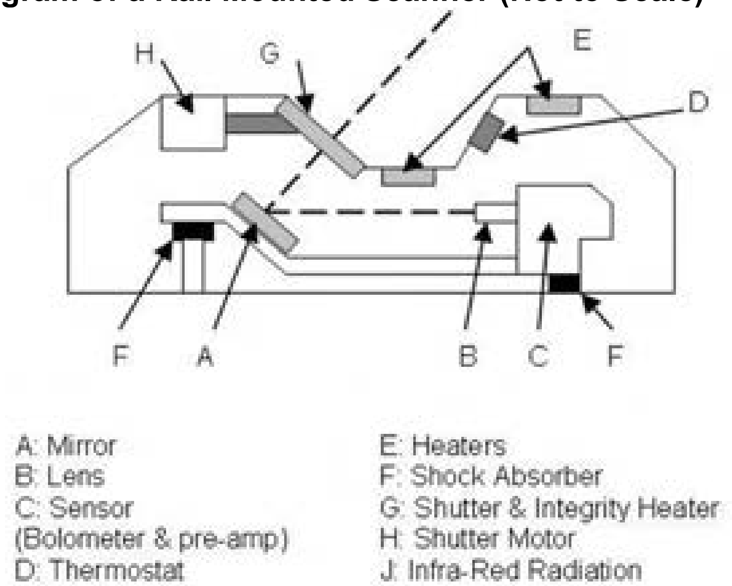
Note: Servosafe diagram shows ballast mounted scanners



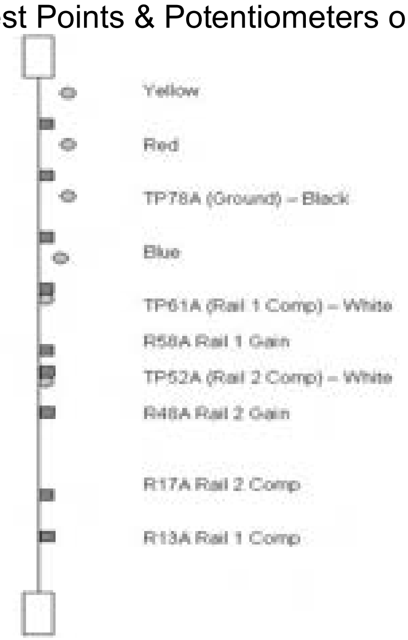
Generic Block Diagram of a Ballast Mounted Scanner (Not to Scale)



Generic Block Diagram of a Rail Mounted Scanner (Not to Scale)



Servotrim 9909: Position of Test Points & Potentiometers on Board 2 (I/O)



Additional Equipment Required for Conducting Tasks & Tests (not exhaustive)

Servosafe 7788/7788R7789/8889 Series

a) Suitable Digital Multimeter and Frequency Meter Tape Measure (non metallic)

b) Chalk or Marking Crayon

c) Thermometer (alcohol or digital type, range 0° to 100°F) Function Simulator and Cable

d) Function Simulator Saddle (7788R only) Manuals and Drawings (as available) Servo Alignment Jig

e) Spirit level

f) Target Mirror (size as appropriate to the system) Telephone 'ear piece' (for system alarm levels)

g) Allen Keys:

- 1/2 & 3/4 inch (for Transducers)
  5/16 inch (for Scanners)
- 5/64 inch (for Knobs & Switches)

Servotrim 9909 and Cyberscan 2000 Series

a) Suitable Digital Multimeter Extended Socket Set

b) 10ft tape measure (non-metallic) Thermometer (1 per site) Torque wrench

c) Function Simulator and Cable Scanner Saddle

d) Servo Alignment Jig

e) Allen Keys:

- 1/2, 3/8 & 5/16 inch (for Transducers)

GETS FUS Series

a) Train simulator (GETS part No. 1001581-901) Heat Source (GETS part No. 1001603-901) Wheel Sensor Gauge SSPV9 & Test Box Alignment Matrix

b) Digital Thermometer

c) 19mm Socket Torque Wrench 10mm Spanner/Socket

d) Suitable cleaning Fluid for Lenses and Mirrors

End

General

The System is divided into three subassemblies, which are briefly described below.

FÜES Sub Assembly	Description
Location Electronics	Contains the entire evaluation electronics for processing the measured data. It can be located in any building that is in close proximity to the railway line.
Measuring Sleeper	A hollow steel sleeper, into which the measuring sensors are integrated. The sensors measure the infra-red from the wheels and wheel bearings labelled: HOAL – Hot wheel bearing (Left) HOAR – Hot wheel bearing (Right) FBOA – Hot wheel There is only one hot wheel sensor as it is assumed that both wheels on an axle will be hot if the brakes remain on.
Wheel Sensors	They enable the system to measure the number of axles and speed of the train. They are labelled: RR – Advance sensor MK – Measuring sensor GR – Rear sensor (for bi-directional traffic).

Table 1 - Sub Assemblies

Where there is a need to replace an IR sensor, an internal and external calibration of the sensor is required (See Appendix A).

Any problems or defects that cannot be rectified during maintenance shall be reported to your SM(S).

Certain tasks can be carried out by other teams or equipment specialists at a different time/frequency to routine maintenance.

You shall reach an understanding with the Signaller before any tasks are carried out that affects the normal operation of the equipment.

As some of the tasks require simulations of passing trains with excessive heat sources, it is advisable to disable the alarms during maintenance.

On completion of maintenance and reconnection, the last alarm on the system should be checked.

Tasks and tests are advised to be carried out under a possession or a no train period.

When navigating menus in the software check that all programs are exited correctly: if a “Quit” button is available then that is the desired option to close the program. If this is not an option then left click the dash in the top left corner of the program screen and select “Destroy”.

SERVICE A

1. Equipment Room Cubicle Equipment

1.1 Check the security of the plugs and connections on the front and rear of the cubicle, including:

a) 240V supply connection.

b) UPS inputs and interface connections.

c) IR unit.

1.2 Check internal and external temperature sensors for damage and security.

1.3 Check that both voltage arresters (referred to as DEHN guards) show a green indicator. If a red indicator is shown, replace the DEHN guard.

1.4 Check the green LEDs on all six power supplies are illuminated. Investigate and rectify any that are extinguished. Any LED not illuminated might indicate a defective power supply or short circuit on the power supply output.

1.5 Check the following LEDs are correctly indicating with no trains present:

LWL Simplex Card:

One Green LED illuminated.
One Red LED extinguished.

Figure 1 - LWL Simplex Card

LWL Duplex Card:

Two Green LEDs illuminated.
Two Red LEDs extinguished.

Figure 2 - LWL Duplex Card

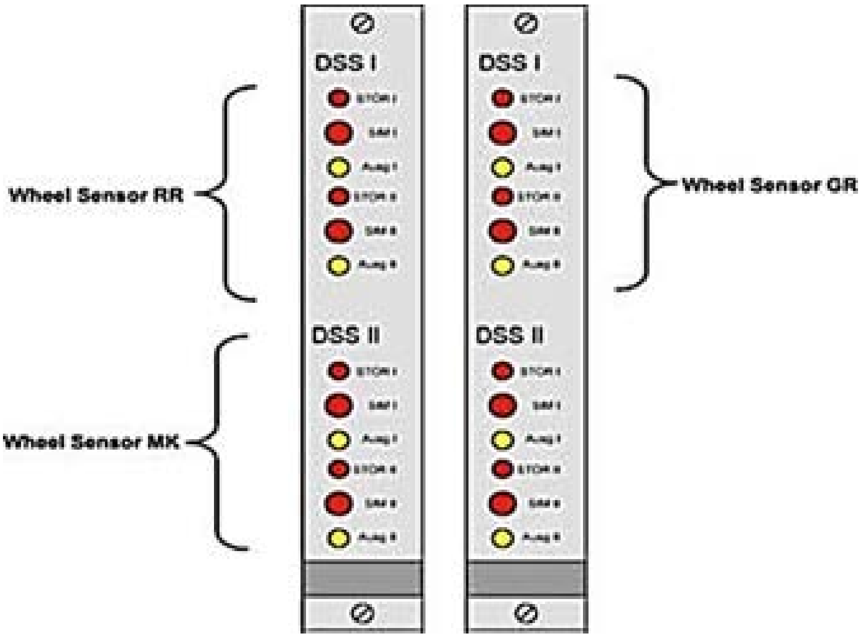


Figure 3 - Wheel Sensor Card

Wheel Sensor Card - All four LEDs are off for each wheel sensor.

NOTE: *If only one-wheel sensor is connected to a wheel sensor board e.g. GR board, the LEDs of the second wheel sensor indications permanently glow, indicating no equipment connected.*

Fibre Optic Interface Card (FOIC):

Green LED Illuminated.
Two yellow LEDs illuminated.
Red LED flashing.

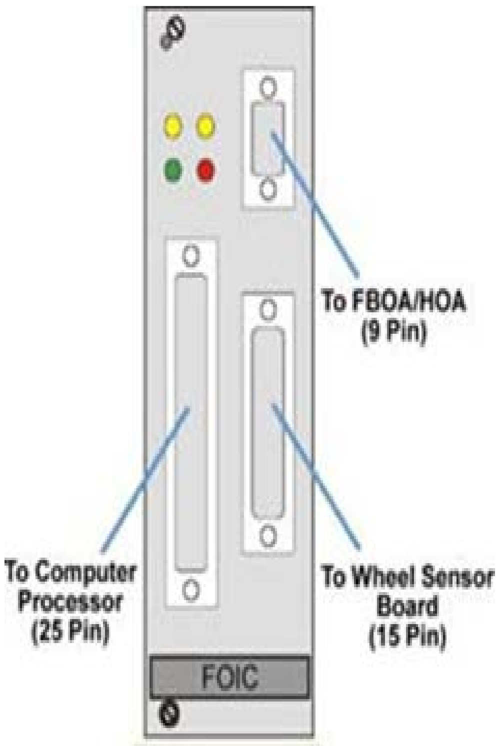


Figure 4 - Fibre Optic Interface Card

1.6 Check operation of the IR unit by, either simulating a train by passing a metal object over a wheel sensor or observing the passage of a train and check the following LEDs are correctly lit:

Card	State	When
Wheel Sensor Ausg1	Illuminated	Throughout simulation
FOIC (Green)	Extinguished	Start of simulation
	Illuminated	End of simulation
FOIC (Yellow)	Illuminated	Start of simulation
	One flash	End of simulation

Table 2 – IR Unit LED Indications

1.7 Check the following UPS LEDs are indicating correctly:

LED	Colour	State
Line	Green	Illuminated
Battery	Orange	Extinguished

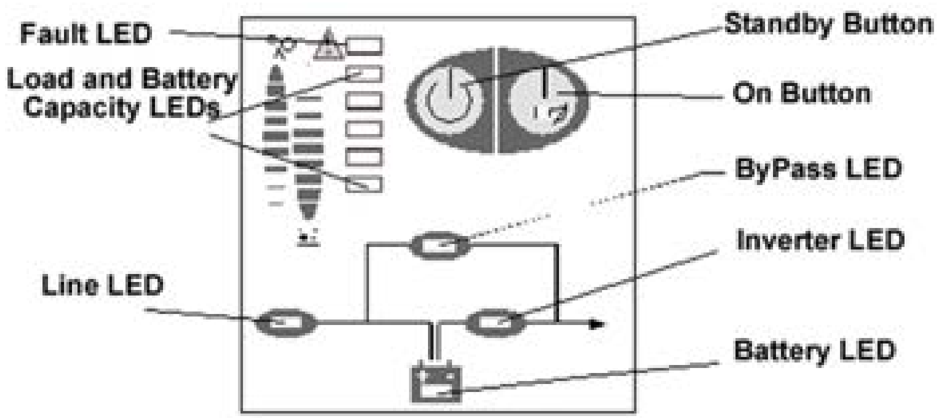


Figure 5 – UPS Module and Indications

1.8 Check that the monitor display is satisfactory, in particular look for:

a) Stable and bright of the display.

b) No visible distortion of the image or geometry settings.

c) Correct colouring i.e. no colours missing (Red, Blue or Green).

Inform your SM(S)if there are any problems.

1.9 Check that each fan is working correctly and if necessary clean the filters.

1.10 Check the keyboard for correct operation. Where fitted, check the tracker ball for smooth operation and clean if necessary. Keyboard operation can be checked as part of using it for other checks. Problems with the keyboard or tracker ball shall be reported.

NOTE: *If the keyboard or mouse are found to be unresponsive, unplug and reinsert both the connectors in the rear of the PC. If the keyboard or mouse remain unresponsive after reconnection the PC should be powered down and back up after 1 minute, using the PC power switch.*

1.11 Log into the system using the USERNAME – "**rabo**" and the PASSWORD "**product**".

1.12 Open the CAN Tool menu (left click on the background and hold, and select "CAN TOOL"). Once the screen has loaded, left click to place it in the required position, before selecting any options, wait for "CAMMOD43" to be displayed in the status bar.

Check the correct operation of the following for each operational assembly (HOAL, HOAR and FBOA):

Reading	**Check**
Shutter	Operate shutter Open and Close.
VCC	23 V < shutter operating voltage < 25 V
I-Shutter	400 mA < current < 1000 mA
I-Heating	1500 mA < current < 2000mA
Mirror	Operate rotating mirror
I-Mirror	5 mA < current < 100 mA
Temp	Check temp of REB is correct using a digital thermometer
Nom Temp	Check outside temp is correct using a digital thermometer

Table 3 – Operational Checks

It is also important to check the components for free movement of mirrors, no damaged or obstruction to the shutter units and that there are no loose or damaged cables/connections.

1.13 Open the Utilities menu (Left click and hold, and select "Terminal". Once the screen has loaded, left click to place it in the required position). At the Terminal prompt: type: Menu -x (*Note: there is a space following the word Menu*).

Figure 6 – Selection

Select option “b” to view the last train and then option “e” on the next window to view train.

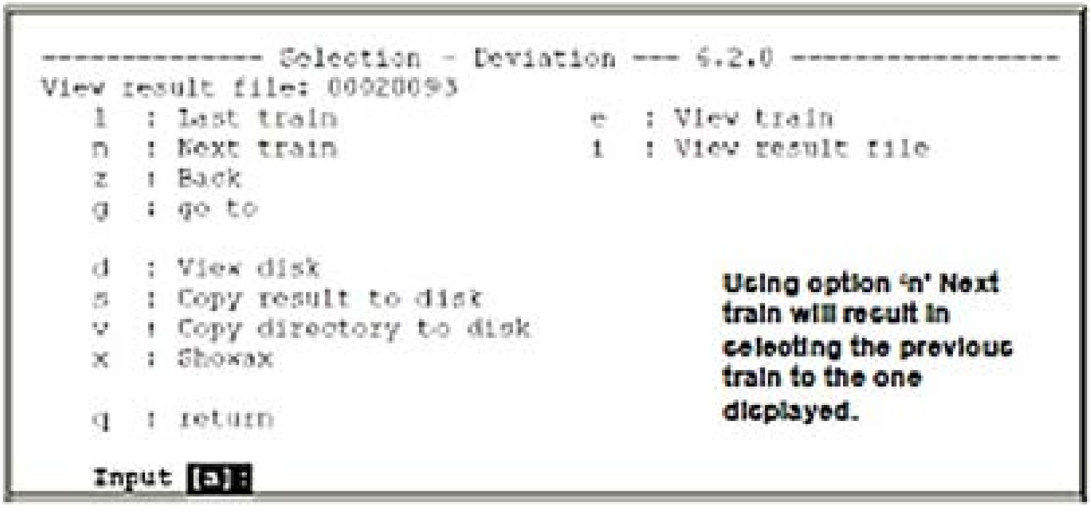


Figure 7 – Selection Deviation Menu

NOTE*: the train number shown, the train history can be toggled using the options available and then selecting “e” to view a particular train. If the system has been rebooted: no train files are stored.*

1.14 Check the deterioration of optical parts like the mirror and lenses by selecting a report of the last train and checking the Attenuation e.g.

```
Train number  :   00499
*****************************************************************************
16.09.2006 21:42:01  System_name                     non-standard   axles: 110
speed    :    92 km/h      Ref1: +025    Mirror1: 015 015 015 015     RR: 110
Ambient  : +007 °C         Ref2: +022    Mirror2: 001 001 001 001     MK: 110
Train end recognized       Ref3: +020    Mirror3: 000 000 002 000     GR: 110
*****************************************************************************
Alarm      0061 3 04 0 +322 axle info:  +040 +025 +322 xxxx -094   warm alarm
Alarm      0062 3 04 0 +285 axle info   +034 +028 +285 xxxx -094   warm alarm
Info       Alarm telegrams: HOAL 0   HOAR 0   FBOA1 2  FBOA2 0
Info       FUES Softwarerelease 6.2.0
```

a) Mirror 1 = HOAL

b) Mirror 2 = HOAR

c) Mirror 3 = FBOA

The fourth and third figures, these values represent the deterioration of elements one through to four. The last value shown is the highest value for the four elements.

Values higher than 050 require the lens and mirror of the sensor shall be cleaned.

NOTE: *Reading above 050 result in the corresponding beam being ignored by the software as being unreliable, several unreliable beams result in the sensor being shut down.*

1.15 Clean all operational mirrors by opening the shutters using the CAN Tool (See clause 1.12 and figure 8).

It is recommended that a soft bristled brush and water are used to clean the mirrors as they rotate.

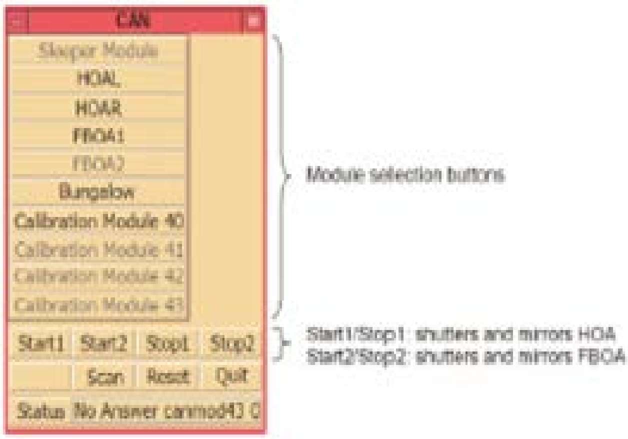


Figure 8 – CAN Tool Screen

1.16 Once the mirrors have been cleaned, it is necessary to observe the passage of 1 or 2 trains or train simulations (using the Train Simulator card) before the attenuation values are accurately represented on the newest train file.

1.17 Check the 4 elements values for the FBOA are close together (<50 apart approximately) and that they are all between 200 and 300.

If the values are outside of this range, then a Triggerbox (See Clause 1.19) shall be carried out as corrective maintenance. Any values that are not consistent after a Triggerbox can indicate a failed sensor.

1.18 Check the EIT values in the righthand column are reasonably consistent.

NOTE: *These represent the temperature sensors at each HOA and FBOA unit. If they are high but falling, it can indicate that the system is cooling following an auto calibration. If one is consistently not in line with the other sensors or the ambient temperature it can indicate a shutter failure.*

1.19 The Triggerbox initiates an offset adjustment of the IR Sensors controlled by the software. The offset adjustment is performed if A/D values (digits) of the single detector elements are shifted by an amount which affects the evaluation of the measured temperature. The Triggerbox is only to be used if the values in clauses 1.16 and 1.17 are not met.

Open the CAN tool menu (Left click on the background and hold, select “CAN TOOL”). Once the screen has loaded, left click to place it into the required position. Before selecting any options, wait for “CANMOD43” to be displayed in the status bar. Select <Calibration Module 40>

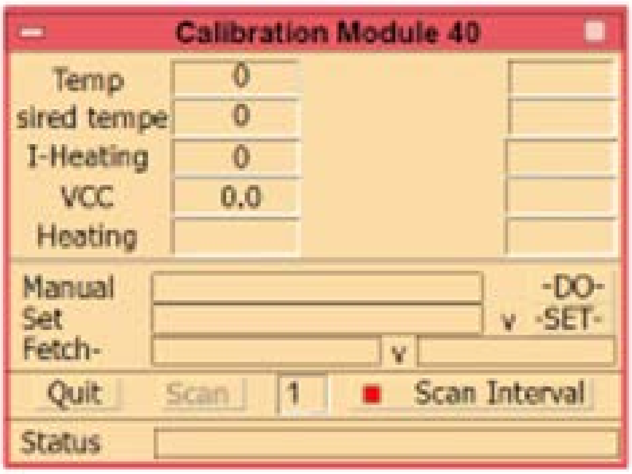


Figure 9 - Calibration Module 40 Screen

Click on the symbol “V” on the righthand side of the input box “Set” and a pulldown menu opens. Select <Heating50%> and click “Set” and perform the offset adjustment. The status bar displays “00007d” and a letter “H” appears in the Heating window for 8 seconds whilst this is taking place.

1.20 If the Evaluation PC has not been rebooted as part of the maintenance visit then it shall be rebooted at this point. Open the Utilities Menu select “Terminal”. Once the screen has loaded at the terminal prompt type “presscad” to reboot the system and wipe the volatile memory. Check the system returns to the log in screen following the reboot and switch off the monitor using the rocker switch.

2. Wheel Sensor

2.1 Remove all fire risks and potential obstructions from or near the Sensors and Disconnection Box.

2.2 Visually check the tail cables to the disconnection box and Wheel sensor. Confirm they are secured and not damaged or deteriorated such that it might lead to a failure.

2.3 Clean the wheel sensors.

2.4 Check each Sensor and fixings for damage. Rectify where necessary.

2.5 Check cable protection for damage or wear. Rectify where necessary.

2.6 Check disconnection box for damage and stability.

3. Measuring Sleeper

NOTE: *If an IR sensor is replaced an internal and external calibration is required, See Appendix A.*

3.1 Remove all fire risks and potential obstructions from or near the sleeper.

3.2 Visually check the tail cables from the cess to the sleeper. confirm they are secure and not damaged or deteriorated such that it can lead to a failure.

3.3 Visually check the cable protection arrangements ensuring cables passing under the rails are not damaged, rectify as necessary.

3.4 Visually check the outside of the sleeper, including the shutter units and cable entries for damage.

3.5 Check the following PWay components:

a) Security of rail clips.

b) Damage to rail fixings.

c) Damage to the Rail.

Report loose or damaged components and excessive track movement as corrective maintenance.

4. Signal Box RAD

4.1 Clean the monitor screen with a proprietary anti-static dry screen cleaner. Use cleaning products in accordance with the manufacturer's instructions.

4.2 Check that the monitor display is satisfactory, in particular look for:

a) Stable and brightness of the display.

b) No visible distortion of the image or geometry settings.

c) Correct colouring i.e. no colours missing (Red, Blue or Green).

Report if there are any problems.

4.3 Check the security of connections to computer and monitor.

SERVICE B

5. REB Cubicle

5.1 Using a meter measure, the DC output voltage of each power supply module. Check they are within the tolerances stated.

Power Supply Modules	Voltages
+ 12 V Measuring Head	+12 V ± 0.5 V
- 12 V Measuring Head	+12 V ± 0.5 V
+ 12 V Peltier Cooler CAN (Controller Area Network)	+12 V ± 0.5 V
- 12 V CAN (Controller Area Network)	+12 V ± 0.5 V*
+ 24 V CAN (Controller Area Network) Shutter & Heater Unit	Min + 24 V Max + 27 V
+ 5 V CAN (Controller Area Network)	Min 5V Max 5.6V

*Internal wiring provides a positive voltage on the output

Figure 10 - Method for taking voltage readings on the power supply modules.

5.2 Check the capacity of the battery back-up by the following method:

a) Disconnect the UPS from the AC input supply by setting the rocker switch of the automatic circuit breaker in the rear of the cubicle to “AUS” (OFF).

b) Check the “Battery” LED turns on to indicate power supply from the batteries. Table 5 lists the indications.

c) Check that the remaining battery capacity is greater than 50%.

d) Return the power to the UPS by setting the rocker switch of the automatic circuit breaker to “EIS (ON)”.

LED Illuminated	Battery Capacity
5th	95% to 100%
4th	75% to 95%
3rd	55% to 75%
2nd	35% to 55%
1st	1% to 35%

Table 4 - Battery Capacity

6. Wheel Sensors

6.1 Measure the rail wear by calculating the distance from the top of the wheel sensor to the highest point of the rail head >37mm.

If this < 37mm the wheel sensor requires to be lowered (using the upper fixing holes) to achieve a minimum of 37mm. If one-wheel sensor has to be lowered, the others are likely to require lowering as well.

6.2 Check security of each sensor ensuring sensor head is parallel to the rail head. Torque rail fixings to 50Nm.

6.3 Examine the inside the disconnection box, check the following:

a) Condition of seal (check for moisture in box).

b) Condition of internal wiring.

c) Condition of connections.

6.4 Remove foreign objects and clean as necessary.

6.5 Use the SSPV 9 test plate and test unit to check for the correct switching gap. Where necessary use the adjustment tool to achieve the correct setting. Details of this test are provided in Appendix C.

7. Measuring Sleeper

7.1 Remove shutter units and put to one side. Do not remove the earth cable and other connecting cables.

7.2 Check the rubber end stops of the shutter unit are not ruptured or worn out at the limit stop. Replace the buffers as necessary.

7.3 Clean the shutter unit as follows:

a) Remove any dirt from the top surface of the shutter segments with brush or cloth.

b) Remove any dirt on the inner surface (reference heater) with a soft brush.

7.4 Clean the inner surface of the shutter unit with a damp cloth.

7.5 Use the CAN tool menu to open and close the shutter and check for smooth operation. Damaged or defective shutters require to be replaced.

7.6 Check the mirror for:

a) Damage;

b) Chipping;

c) Scratches;

d) Security of fixings.

Replace the mirror if chipped, damaged, or heavily scratched. If the mirror fixings are loose check the mirror alignment with the alignment matrix (See Appendix B).

7.7 Pre-clean the mirror surface with a soft brush to remove loose dirt.

7.8 Using the CAN tool menu and switch on the rotating mirrors. If the mirror is not rotating or rotating slowly, it requires to be replaced.

7.9 Soak a smooth lint-free cloth or cleaning paper for optical devices with ethanol (or equivalent cleaning fluid) and remove the dirt by moving from the middle to the edge without using any force. Follow manufactures instructions when using the cleaning fluid.

7.10 Switch off the rotating mirror.

7.11 Check the shock absorbers for signs of rupture or wear. Check their operation by applying pressure to the housing. The movement should be minimal and when released return to the previous position without any noticeable oscillations. Where necessary, replace the shock absorbers.

7.12 Check the security of the shock absorbers to the housing.

7.13 Check the security of the CAN modules and connections.

7.14 Check the wiring and connections for damage.

7.15 Clean the Hot Axle (HOA) IR sensors using the following method:

a) Check the IR sensors for scratches and damage.

b) Without removing the IR sensor, clean the lens with a soft brush.

c) Soak a smooth lint-free cloth or cleaning paper for optical devices with ethanol (or equivalent cleaning fluid) and remove the dirt by moving from the middle to the edge without using any force. Follow manufactures instructions when using the cleaning fluid.

7.16 Clean the Hot Wheel (FBOA) IR sensor using the following method:

a) Remove the four fastening screws of the Sensor.

b) Separate the upper parts of the clamping cradle and remove the IR sensor.

c) Check the IR sensors for scratches and damage.

d) Clean the lens with a soft brush.

e) Soak a smooth lint-free cloth or cleaning paper for optical devices with ethanol (or equivalent cleaning fluid) and remove the dirt by moving from the middle to the edge without using any force; Follow manufactures instructions when using the cleaning fluid.

f) Re-install the sensor into the cradle.

g) Replace the upper parts of the cradle ensuring the cradle makes direct contact with the cooling jacket.

h) Fasten the four screws hand tight.

7.17 Check the security of the IR sensor fixings. If they appear loose check the sensor alignment with the alignment matrix (see Appendix B).

7.18 Check the security of the IR connectors. They should be screwed together tightly to prevent moisture entering the connector.

7.19 Reassemble the shutter units and cover plate ensuring no objects have fallen into the housing. Also check the connecting cables of the shutter units are not clamped nor obstructing the mirror or sensor path. Torque the cover plate fixings to 70Nm.

7.20 For each of the IR sensors re-calibrate the system following lens and mirror cleaning by:

a) Disconnect the FOIC 15-pin connector to the wheel sensor board. This is to prevent passing trains disrupting the calibration.

b) Use the CAN tool menu to select ‘calibrate after cleaning mirrors.

c) Re-connect the 15-pin connector from the FOIC.

8. Measuring Sleeper Functions Test

8.1 Carry out NR/SMS/PartB/Test/087 (HABD GETS FÜES FunctionS Test).

APPENDIX A - Calibration

A calibration shall be carried out following the replaced or modified components of the optical system (e.g. IR sensor) or shutter heating unit.

The calibration is performed in 2 steps:

1. Internal calibration
2. External calibration

The internal calibration uses the shutter heaters to measure the amount of attenuation in the mirror and lens surfaces and also any drift in the sensors themselves.

The external calibration uses a heat source to optimize and verify the internal calibration. The calibration should be carried in a no train period.

The measuring heads shall have been operating for at least two hours before a calibration takes place.

1. Internal Calibration

1.1 Check that the lens and mirror are cleaned.

1.2 Check that the measuring heads and mirrors are correctly aligned (See Appendix B).

1.3 Select “Super Calibration” on the computer terminal (via terminal viewer).

1.4 Select the sensor to be calibrated. (It may be possible to select both HOAL and HOAR to be calibrated at the same time, if required).

1.5 Select “Internal Calibration”.

1.6 After starting the calibration procedure, the temperature values appear on the screen.

1.7 After a successful calibration select ‘Yes’ to use the new characteristic curve.

1.8 Repeat this for all the sensors that have been replaced or modified.

1.9 Perform one train or two train simulation (as necessary) for the acceptance of the new characteristic curves.

2. External Calibration

Check the 'Temperature Output' of the 'evaluation' submenu within the FÜES Configuration is set to 'absolute'. If it is currently set to 'relative', change the setting and re-boot the system to activate it.

2.1 Select external calibration for selected sensor.

HOAL

2.2 Set the heat source to 60OC. Once the temperature is reached, place the heat source on the HOAL sensor.

2.3 Perform a train simulation (wait 10 seconds after the simulation).

2.4 Set the heat source to 100 OC. Once the temperature is reached, place the heat source on the HOA sensor.

2.5 Perform a train simulation (wait 10 seconds after the simulation).

2.6 Select 'Calculate Characteristic Curve'.

2.7 Following a successful calibration select 'Yes' to use the new characteristic curve.

2.8 Perform one train or two train simulations (as necessary) for the acceptance of the new characteristic curves.

HOAR

2.9 Repeat steps 2.2 to 2.8 with the heat source on the HOAR sensor.

FBOA

2.10 Perform steps 2.3 to 2.8 using the following heat source temperatures.

a) 200°C

b) 300°C

c) 400°C

Note that the Heat source is to be placed on its end for the FBOA Calibration.

APPENDIX B - Adjust Sensor Alignment

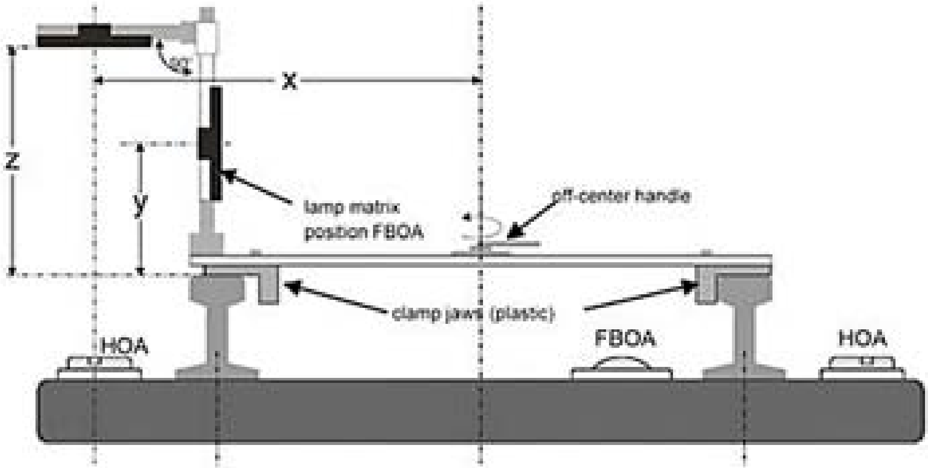


Figure 11 – Sensor alignment

	X	Y	Z
Dimensions (mm)	878 ± 5	267 ± 10	500 ± 10

Table 5 - Dimensions

1. Switch on the alignment matrix system

2. Set the switch HOA/FBOA at the front panel of the control device to HOA or FBOA depending on the sensor being tested.

3. Open the shutter from the CAN Tool Menu (Start 1 for HOA and Start 2 for FBOA).

HOAL

4. Pre-select Channel ‘0’ (Element 1 of the sensor on HOAL) with the push-button at the front panel of the control device.

5. Start the measurement procedure by pressing ‘Start’ on the control device. This causes the LEDs on the top side of the matrix to light up one after the other. Wait until a flashing LED shows the position of maximum sensitivity.

6. Repeat step 5 for the remaining Channels 1, 2 and 3.

7. The position of the elements 0, 1, 2 and 3 should be evenly distributed. Where necessary undertake any corrective actions and re-test.

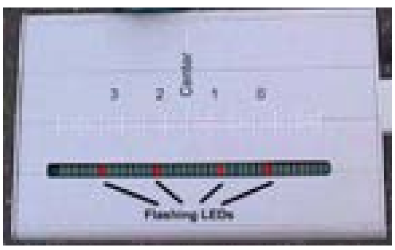


Figure 12 – Element Positions

HOAR

8. Pre-select channel '5' (element 1 of the sensor on HOAR) with the push button on the front panel of the control device.

9. Start the measurement procedure and wait until a flashing LED shows the position of maximum sensitivity.

10. Repeat step 8 for the remaining channels (6, 7 & 8).

FBOA

11. Set the HOA/FBOA switch on the front panel of the control device to FBOA (check the 'remote electronic finger' is moved to the FBOA position).

12. Pre-select channel '0' (element 1 of the senor on FBOA) with the push button on the front panel of the control device.

13. Start the measurement procedure and wait until a flashing LED shows the position of maximum sensitivity.

14. Repeat steps 12 and 13 for the remaining channels (1, 2 & 3).

APPENDIX C - Check/Adjust Wheel Sensor

NOTE: *Watch the 'Battery' LED of the test for battery condition. If the LED illuminates, the battery needs charging.*

1. Open the cover of the corresponding signal cable disconnection box and disconnect the wheel sensor from the Trackside Apparatus Case electronics.

2. Connect the cables of the wheel sensor with those of the same colour of the test instrument.

3. Set the SSPV 9 gauge to a switching gap of 43.5mm +/- 0.5mm. 43mm to 45mm can be used to achieve the correct switching gap.

4. Place the slip gauge onto the middle of the wheel sensor with its pedestal.

5. Screw off the knurled lock nuts of the adjustment screws (one for each system of the wheel sensor).

6. Attach the adjustment tool with the threaded joint without pushing the adjuster out of the alignment retention. Push the adjustment tool upwards. DO NOT use force to turn the adjustment screws as you might damage the adjustment retention or the adjustment tool.

7. Using the adjustment tool, turn the adjustment screws to the right until the function LED is lit. Then turn the screws to the left until the LED just turns off. At this point the measuring systems of the wheel sensor are aligned to their reference value 6.45 V +- 0.05V. (Clockwise turn – switch gap increases. Counter clockwise – switch gap decreases).

8. Screw the knurled nuts hand-tight.

9. Disconnect the test instrument from the disconnection box and reconnect the wheel sensor to the Trackside Apparatus Case electronics.

10. Close and secure the cover of the disconnection box.

END

Includes:	Phoenix MB
Excludes:	All other types of Hot Axle Box Detector

The Signaller shall be informed before maintenance is carried out. Agreement with the Signaller shall be reached before any tasks are carried out that will affect the normal operation of the equipment.

Normally a possession of the equipment or a no train period would be required.

Sub-Assemblies

The system is divided into three sub-assemblies, see table1.

SST Phoenix MB Sub	Description
The Electronics Cabinet	Contains the Modem, UPS, Service Monitor & Keyboard, Heater, PC, Passive Board, Active Board and Power Supplies. The PC contains a Windows Operating System with programs for processing measured data and on-site calibration etc.
Measuring Sleeper (incorporating the sensors)	A hollow steel sleeper where the measuring sensors are housed. The sensors measure the infra-red heat from the wheels and wheel bearings. There are three sensors namely:- HBD1: Hot Box Detector 1 HBD2: Hot Box Detector 2 HWD1: Hot Wheel Detector 1
Rail Contacts	Detect the passage of a wheel due to changes in the current flow through their coils. A system may comprise of up to three wheel sensors namely:- RC1: System initiated, sensor shutters open, time stamp (t0). RC2: Starts the measurement of axles, speed calculation, time stamp (t1) RC4 – For bi-directional moves

Table 1 – Sub-Assembly Descriptions

All sensors are integrated into the measuring sleeper. They are precisely positioned at the time of installation with the fitment of the sensor frame. If the frame is not disturbed a sensor can be replaced in a few minutes without distorting the optical geometry.

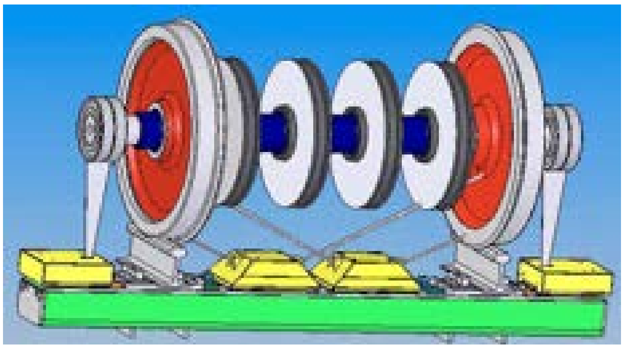


Fig 1: A line drawing of the trackside Phoenix MB equipment

SERVICE A

1. Rail Contacts

1.1 Remove obstructions and fire risks.

1.2 Check each rail contact and fixings for damage, security and alignment.

1.3 Visually check the tail cables of each rail contact for damage and deterioration at vulnerable and exposed positions.

1.4 Check that each rail contact and bracket is clear of the ballast.

2. Sleeper Mounted Sensors (Hot Axle Box and Hot Wheel Detectors)

2.1 Remove obstructions and fire risks from around the sensors and measuring sleeper.

2.2 Examine all sensors checking for physical damage, effectiveness of the rubber dampers and security of the sensor and associated lid. Apply pressure to the sensor housing and check the effectiveness of the shock absorbers.

The movement shall be smooth and minimal returning to its previous position without any noticeable misalignment.

2.3 Examine the measuring sleeper for physical damage, misalignment or signs of voiding.

2.4 Check on each sensor that the cover heater is working if the ambient temperature is below 5°C.

2.5 Check that all sensors are clear of the ballast.

2.6 Remove any debris from the sensor openings.

2.7 Clean the sensor covers.

2.8 Visually check the tail cables of each sensor for damage and deterioration at vulnerable and exposed positions e.g. under rails, entry and exit from troughing route etc.

2.9 Visually check the cable protection arrangements between the measuring sleeper and the electronic cabinet.

3. The Electronics Cabinet

3.1 Check that all fans within the cabinet are operational.

3.2 Check the status of the UPS indications.

3.3 Using the SCT program check that the status information for all system components are showing green on the Technicians' Monitor (i.e. rail contacts, sensors, etc).

If the "V Factor" of HBD1, HBD2 or HWD1 is less than 60, clean the optical components as per Service B.

4. Signal Box Office End Equipment

4.1 Check with the signaller that the SB equipment is working correctly, i.e. keyboard, monitor, printer and PC.

SERVICE B

5. Sleeper Mounted Sensors

To undertake the following tests pass a metal object over rail contact 1 twice in the normal train direction.

This will open the sensor shutters and start the mirrors rotating for a period of 60 seconds.

After 60 seconds the shutters will close and the above will have to be repeated if the work is not complete within that time.

5.1 Using a torch check the sensor mirrors for damage. E.G. cracks or scratches.

5.2 Using only the approved cleaning kit clean the rotating mirror on each sensor.

Permanent irreversible damage can result if any other unapproved cleaning products are used. Use a one-wipe motion.
Do not reapply dirty cleaning materials as they will damage the mirror.

6. The Electronics Cabinet

6.1 Clean the fan filters in the door and roof of the electronics cabinet.

6.2 Check the output voltage from the PSU. This voltage shall be 26.5v (minimum 23.0v, maximum 27.0v).

6.3 Check the keyboard, tracker ball and monitor for correct operation.

6.4 Using the SCT program check the status of the rail contacts, hot box detectors, hot wheel detector and SCT components.

6.5 Check a sample of recent train logs from the screen view for the correct train data and no alarms.

6.6 Test the operation of the UPS by disconnecting the supply to the electronics cabinet:

a) The monitor should automatically switch off and the UPS should take the load.

b) The HABD equipment should remain operational with no alarms reported to the signaller.

c) A buzzer will sound twice approximately every 8 seconds.

d) The status of the battery will be displayed on the UPS LED panel showing the battery voltage level in discharge condition.

e) Leave the supply disconnected for 10 minutes to observe the battery discharge rate.

f) If the buzzer signal changes from sounding twice every 8 seconds to once a second before the 10 minutes has elapsed the batteries are exhausted and require replacing.

6.7 Check the deterioration of the optical parts such as the mirror, lens and optical module by carrying out NR/SMS/Test 212 – HABD Phoenix MB Accuracy Test.

6.8 If any of the recorded values recorded in step 6.7 was found outside the tolerance of its “Nominal Value” shown in the table below then a full calibration shall be carried out as defined in NR/SMS/Test211 - HABD Phoenix MB Full Calibration Test.

Sensor	Nominal Value (Low)	Nominal Value (High)
HDB 1	70°C ± 3°C	120°C ± 5°C
HDB 2	70°C ± 3°C	120°C ± 5°C
HWB 1	300°C ± 10°C	400°C ± 20°C
HWB 2	300°C ± 10°C	400°C ± 20°C

Table 2 – Nominal Values

6.9 Return to the overlay screen and check the status of the system components.

6.10 Contact the signaller and check that there are no outstanding alarms on the system and the HABD site appears to be working correctly.

Where practicable:

6.11 Observe the passage of a train over the site.

PERIODIC TASKS

7. Filters

7.1 Change all fan filters within the electronics cabinet.

END

Includes:	FUES EPOS - Hot Axle Box Detector system
Excludes:	All other types of HABD system

GENERAL

The Signaller shall be informed before maintenance work on the system is started and after it is completed.

When maintenance is completed the maintenance mode shall be reset.

SERVICE B

1. Login

1.1 Switch on the monitor. The FUES-EPOS operating system login window is displayed.

1.2 Select user “rabo” and enter the password.

Figure 1 - FUES-EPOS system desktop (example)

1.3 Start the web browser by using the browser icon shown in the red box in Figure 1. The FUES-EPOS user interface login window opens See Figure 2. This page has been defined as the web browser home page.

Figure 2 - FUES-EPOS user interface login window

1.4 Enter the name and password. The FUES-EPOS user interface home page opens Figure 3.

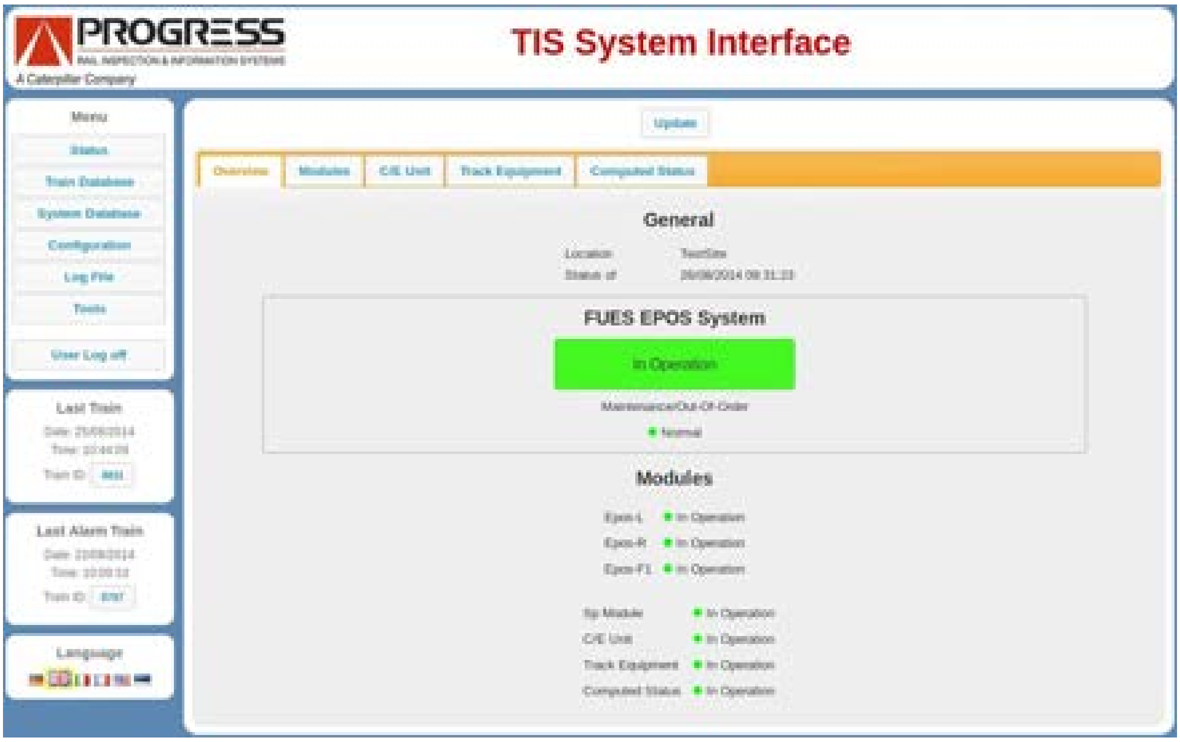


Figure 3 - FUES-EPOS user interface home page

2. Activating the "Maintenance Mode"

2.1 "Maintenance Mode" shall be activated before beginning the annual maintenance or repair works, to suppress alarm and fault messages during these works.

The FUES-EPOS system then sends a corresponding telegram to the remote announcement system.

When this operating mode is selected, the system performs all the standard functions. However, no telegrams (alarm telegram, malfunction telegram or information telegram) are sent to the remote announcement system.

2.2 To activate the "Maintenance Mode" proceed as follows:

a) Log in to the FUES-EPOS GUI.

b) Click on menu item "Configuration" See Figure 4.

Figure 4 - Maintenance mode in FUES-EPOS GUI

2.3 Click on the “Enable Maintenance Mode” button in the “General” tab.

The activation will be displayed in the System Status display (see “Status” menu item - “General” tab) See Figure 5.

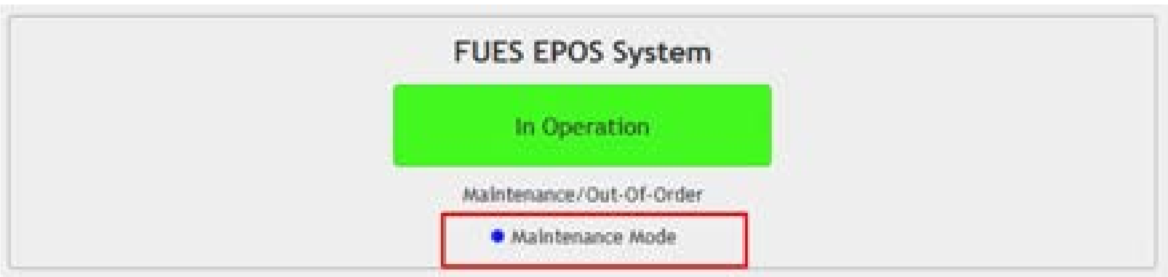


Figure 5 - Display of Operating mode “Maintenance Mode” in the System Status display

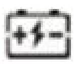
3. UPS

The UPS batteries have a limited service life, which is specified as 3 to 5 years by the manufacturer. Since the service life depends on the ambient and operating conditions, the UPS bypass time must be checked annually.

3.1 Carry out the following:

a) Disconnect the supply voltage for the FUES-EPOS system (230 V AC – supply in the distribution station).

The UPS therefore switches to battery operation. The FUES-EPOS system remains in operation without interruption. The switching operation is displayed on the UPS operating and display panel:

NOTE: *The display changes from charging mode*  *to battery mode*  *.*

b) Wait for the configured bypass time (the standard setting is 10 minutes).

c) Observe the “Charge Level” on the control and display panel.

3.2 Reconnect the supply voltage for the FUES-EPOS system (230 V AC – supply in the distribution station).

4. Control and Evaluation Unit

Residual current circuit breaker (RCD)

4.1 Check the function of the residual current circuit breaker by carrying out the following:

a) Press the power button on the uppers side of the DE computer.

The DE computer will be shut down safely (duration approx. 1 min.). Wait until the blue light on the power button disappears.

NOTE: *For double system shut down both DE's.*

NOTE: *Damage to the evaluation computer, the sudden power shutdown by the RCD can damage the hard disc of the evaluation computer!*

b) Press the "QF1" test button of the residual current circuit breaker (see position (2) in Figure 6).

(1) Residual current circuit breaker.
(2) Test button.

Figure 6 - Residual current circuit breaker test button

The FUES-EPOS system reacts as follows:

c) The residual current circuit breaker and all other circuit breakers tilt to the "OFF" position (switch position at the bottom).

d) The UPS switches off, with the exception of the 230V input terminals and the batteries inside the UPS all components of the cabinet are voltage free now.

4.2 Move the rocker switches back to the "ON" position.

a) The control and evaluation computer boots automatically.

b) Hold the “ON / 🔇 / ▲” button on the UPS system down until you hear a beep.

c) The UPS system is starting, the display then shows the battery status and supplies the load connected with reliable power.

If the ⚠ display is lit, fix all warnings and restart the UPS system.

d) The FUES-EPOS system is now ready for operation.

Temperature sensors

4.3 Because the external temperature has a direct influence on alarm evaluation, the plausibility of the external temperature measured value shall be checked.

To do this, perform the following steps:

a) Change to the "System Database" menu in the user interface.

The chronological sequence of the ambient temperature measurement can be inspected here See Figure 8.

Figure 7 - Chronological sequence of the ambient temperature

b) Compare the current measured value of the ambient temperature using a thermometer.

c) In addition, the chronological sequence of the ambient temperature can be used for the evaluation.

NOTE: *If the measured value is not plausible, a precise analysis of all ambient temperature measurement components must be made.*

5. Measuring sleeper

5.1 Visually check the measuring sleeper for the following:

a) Check track equipment carriers for visible damage.

b) No loose or missing screws visible.

c) Check cable hoses for damage.

d) Check cable entry points for secure clamping, tighten up screws if necessary.

6. Maintenance of EPOS Unit

<u>Damping elements (HBD only)</u>

Figure 8 - HBD EPOS-Unit damping elements

6.1 Check the condition of the HBD EPOS-Unit damping elements on crack formation and other damages. See arrows in Figure 9.

<u>Rotating mirror (HBD only)</u>

Do not switch on the rotating mirror.

6.2 Soak a cleaning paper for optical devices or a lint-free cloth with ethyl alcohol (e.g. 2-propanol, ethanol), allow it to act on the mirror surfaces for a short time, then gently remove the dirt.

NOTE: *Pressure should not be applied to mirror, to avoid damaging the rotating mirror motor shaft. A bent motor shaft affects the measuring geometry.*

6.3 Check the rotating mirror surface. Is the mirror oxidized or badly scratched?

Detector lenses

6.4 Soak a cleaning paper for optical devices or a lint-free cloth with ethyl alcohol, then remove the dirt by making a circular motion, starting from the centre of the objective lens and moving towards the edges.

NOTE: *The lenses could get scratched, so exert the minimum pressure when cleaning.*

Shutters

6.5 Pre-clean the inner surface of each shutter (surface heating) with a soft brush.

NOTE: *Do not use any cleaning agents that contain alcohol. Otherwise the black paint of the heating surface or the vulcanization of the temperature sensor could be damaged.*

6.6 Clean the inner surface of the shutters using a damp cloth. Use a detergent containing soap to remove stubborn dirt.

6.7 Carry out the following checks:

a) Are the rubber mounts (end stops) of the shutter segment cracked or worn? See Figure 10.

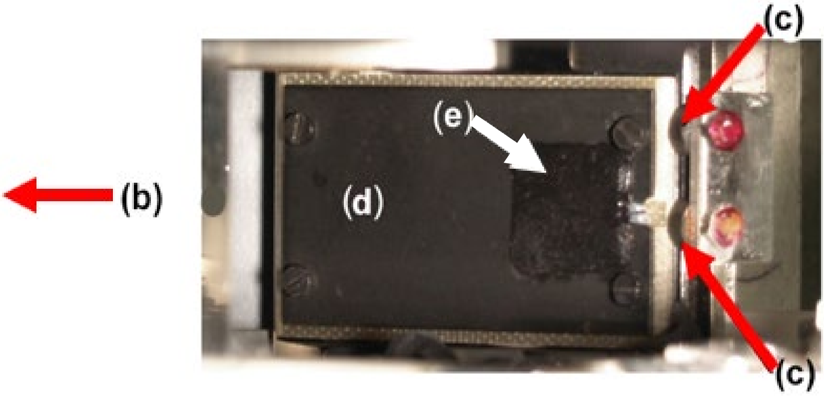


Figure 9 - Shutter – view reference heating surface

b) Rubber mount end stop position open (not visible).

c) Rubber mount end stop position closed.

d) Reference heating surface for internal calibration.

e) Pt100 temperature sensor.

6.8 Confirm the black surface of the reference heating surface Figure 10 item (d) is undamaged, any damage shall be reported to your SM(S).

7. Functional test - EPOS-Units

7.1 After cleaning the optical components, the EPOS-Units shall be adjusted to the changed optical properties.

7.2 Carry out NR/SMS/PartB/Test/180 (EPOS - Manual Post Calibration Test) on each of the EPOS Units.

7.3 Carry out NR/SMS/PartB/Test/182 (EPOS - Verification of Measurement Accuracy

7.4 The measuring accuracy of the IR sensors shall be verified after calibration.

7.5 During this check, the measurement accuracy of at least one temperature for each measuring point shall be checked using the calibration heating device.

7.6 If during verification of the measured values, these are shown to be outside the nominal range, an external and internal calibration followed by a verification shall be performed for the measured measuring point in question.

8. Final Check

8.1 Log in to the FUES-EPOS GUI.

8.2 Check the system status in the "Status" menu. See Figure 11.

8.3 After completion of the maintenance work, check no further system faults are be present.

Figure 10 - System Status – Overview

9. Deactivating the "Maintenance Mode"

9.1 After completion of the maintenance work the "Maintenance Mode" shall be deactivated, otherwise the transmission of alarm and fault messages are permanently suppressed!

9.2 To deactivate the "Maintenance Mode" proceed as follows.

a) Log in to the FUES-EPOS GUI.

b) Click on menu item "Configuration" See Figure 12.

Figure 11 - Maintenance mode in FUES-EPOS GUI

9.3 Click on the "Disable Maintenance Mode" button in the "General" tab.

The deactivation of the "Maintenance Mode" into "Normal" operation will be displayed in the System Status display see Figure 13.

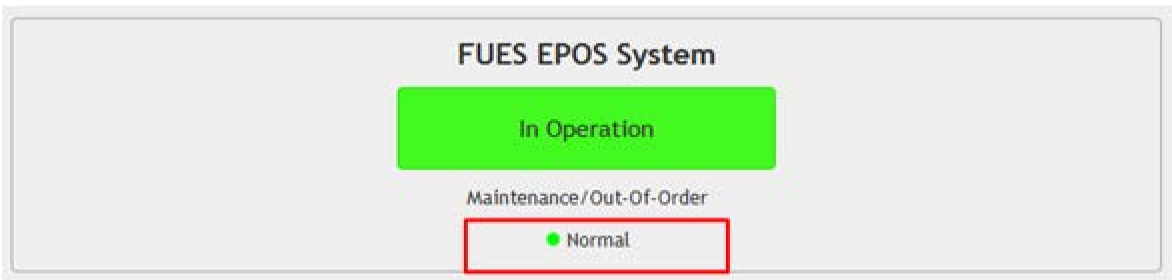


Figure 12 - Display of Operating mode "Normal" in the System Status display

END

Includes:	RSR123 Wheel Sensor as part of an EPOS HABD System ONLY
Excludes:	All other uses of the RSR123 Wheel Sensor and all other type of Sensor

SERVICE B

1. Remote Occupancy Detection Test

1.1 Observe that all sensors in the system have been traversed by a track vehicle or a PB200 testing plate within the last two years.

NOTE: *This can be verified by looking at the 'Timeline' within the Train database of the Mozilla GUI.*

1.2 Where the timeline does not prove the successful passage of an on-track vehicle, a work order shall be raised to carry out NR/SMS/PartB/Test/181 – EPOS - Wheel Sensor Occupancy Detection Capability Test, for each of the sensors which have not been traversed.

2. Wheel Sensor Height Check

2.1 Measure the distance between the wheel sensor top surface and top of rail (distance "A" as shown in Figure 2). This shall be between 40 and 45mm. Adjust height if required. The measurement shall be consistent along the entire length of the wheel sensor.

It is recommended to adjust measurement A between 43 and 45 mm (optimal range).

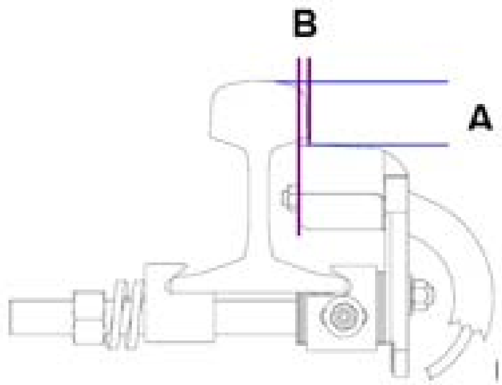


Figure 1 – Maintenance Measurements

NOTE: *Measurement "B" is not checked during maintenance, but only after replacement or installation of a wheel sensor.*

2.2 Measure the distance between the wheel sensor inside edge and inside edge of the of rail head (distance “B” as shown in Figure 2). The wheel sensor is positioned slightly below and under the head of the rail. The measurement shall be between 0mm and 6mm. Adjust as required. The measurement shall be consistent along the entire length of the wheel sensor.

3. Mechanical and visual check of Wheel Sensor RSR123

3.1 Examine the wheel sensor mounting plates and bolts for heavy soiling, security and external damage.

3.2 Check the area around the wheel sensor (within 2m) are free of items such as:

- Visible P/way defects.
- Metallic debris.
- New/scrap rails in the four/six foot or cess.
- Traction bonds.
- Excessive ballast.

Any problems that cannot be rectified shall be reported as corrective maintenance.

3.3 Observe exposed tail cables (protection tube), plug couplers and connections for security and damage.

4. Head Sensor Security

4.1 Check the wheel sensor securing nuts are tightened to correct torque values using an approved torque wrench tool as follows:

a) Figure 3 Allen Screws to 25Nm

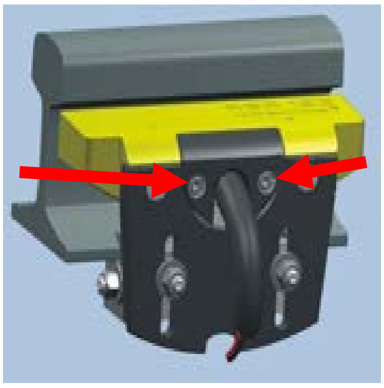


Figure 2 - Allen Screws

b) Figure 4 M10 nuts to 15Nm (Checked during installation/replacement only).

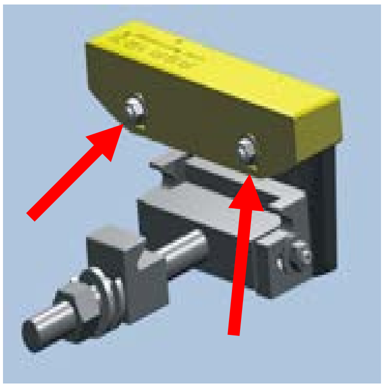


Figure 3 - M10 Nuts

c) Figure 5 M12 nuts to 40Nm.

Figure 4 - M12 Nuts

d) Figure 6 The Rail claw nut shall be tightened until the ends of the spring washer touch the main body of the washer at this point the nut shall be tightened a further 360°.

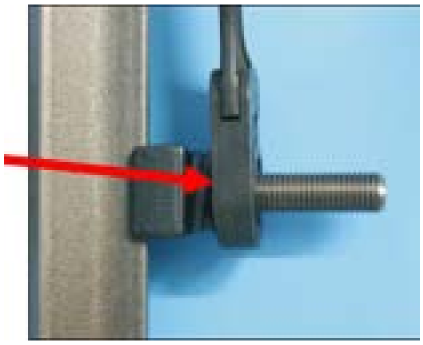


Figure 5 – Rail Claw Nut

4.2 The spring washer shall be replaced every time it is removed. Previously used/fitted Rail claw spring washers shall not be reused.

END

This module collates local instuctions specified by the S&TME and approved by the Route Asset Manager [Signals].

INDEX

Reference	Route/Area
LP100	Ipswich
LP101	Tottenham
LP102	Romford
LP201	Sussex
LP202	Kent
LP251	Preston
LP252	Warrington
LP253	Carlisle
LP254	Liverpool
LP255	Manchester
LP300	Birmingham
LP350	LNE and EM
LP351	Middlesbrough, Sheffield, Leeds and York
LP400	Cardiff
LP401	Shrewsbury
LP450	Wessex
LP500	Reading
LP501	Swindon
LP502	Bristol
LP503	Plymouth
LP550	Scotland

END

Local Policies					
Part B					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	No direction

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	2 Yearly or Failure
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	2 Yearly or Failure
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annual or Failure
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annual or Failure
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annual or Failure
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annual or Failure
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Annual or Failure
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Annual or Failure
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	Annual or Failure
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Annual or Failure
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Annual or Failure
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Annual or Failure
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Annual or Failure

END

Local Policies					
Part B					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	On renewal or repair.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Annual or Failure.
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Annual or Failure.
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annual or Failure.
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annual or Failure.
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annual or Failure.
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Annual or Failure.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Annual or Failure.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	Annual or Failure.
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Annual or Failure.
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Annual or Failure.
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	No direction.
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	No direction.

END

Local Policies					
Part B					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	No direction

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	2 Yearly
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Annual
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	12 Weekly Liverpool Street area only
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annual
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annual
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	6 Weekly
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	6 Weekly
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	6 Weekly
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	No direction
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	No direction
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	No direction
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	At every maintenance visit.

Local Clarifications					
Part C					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
PB11	Clamp Lock Hydraulic Points	11. Final Tests and Checks	11.6	Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).	Mandatory to perform on PB11 service.
PC05	Point Machine HW Style	11. Tests & Final Checks	11.6	Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).	Mandatory to perform on PC05 service.

END

Local Policies

Part B

SMS/ Service	Name	Section No.	Clause	Text from Standard	S&TME Direction
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Carry out as part of a Full Test when readings or scope of work requires.

Local Policies

Part C

SMS/ Service	Name	Section No.	Clause	Text from Standard	S&TME Direction
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Test only when directed to by specific W/O.
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Test only when directed to by specific W/O.
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Perform when attending suspected detection circuit failure.
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Perform when attending suspected detection circuit failure.
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Perform when attending suspected detection circuit failure.
PC05	Point Machine HW Style	15	15.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Perform when attending suspected detection circuit failure.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Perform when attending suspected detection circuit failure.
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	Quarterly (Section 2 only).
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	No direction.
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	No direction.
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Only undertake if track circuit is unstaggered. Test/041 Section 2 DC tracks
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Only undertake if track circuit is unstaggered. Test/041 Section 2 DC tracks

Local Clarifications					
Part A					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
A04	Method Statement Summary	5. Protection Arrangements and Equipment	d)	Where all tail cables are connected to the point machine by plug coupler(s), disconnect all tail cable plug coupler(s) at the machine	Do not use this method unless all others impractical.
A04	Method Statement Summary	5. Protection Arrangements and Equipment	f)	Apply a documented local operating arrangement that has been agreed with the Route Asset Manager (S&T).	There is no local operating arrangement agreed.

Local Clarifications					
Part B					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 001	FPL Test (Machine)	1. Test	1.3	Place the 1.5mm FPL gauge between the switch and stock rail at a point in line with the bolt securing the stock rail to the first slide chair.	Task to be undertaken using 2.0mm gauge vice 1.5mm gauge.
Test 002	FPL Test (Mechanical)	1. Test	1.5	Place the 1.5mm FPL gauge between the switch and stock rail at a point in line with the bolt securing the stock rail to the first slide chair.	Task to be undertaken using 2.0mm gauge vice 1.5mm gauge.
Test 003	Facing Point Lock Tests (Clamp lock)	1. FPL Safety Test	1.5	Place the 1.5mm gauge between the switch and stock rail in line with the lock arm.	Task to be undertaken using 2.0mm gauge vice 1.5mm gauge.
Test 022	Signal Lamp & Light Module Proving Tests	10. Junction Indicators with Five Lamps (Filament Lamps, not SIMIS-W Interlockings)	10.3	Check the lamp-proving relay de-energises and the main signal shows a red aspect. On CBI areas check that an alarm has been raised. If these checks fail, with only two lamps remaining fitted, have the Junction Indicator extinguished and re- illuminated. Repeat the checks	If signal fails to return to danger when 3rd lamp removed but, remains at danger when the route is cancelled and re- set with 3 lamps still removed then endorse Work Order closure with comment.
Test 022	Signal Lamp & Light Module Proving Tests	12. Junction Indicators fitted with Five Dorman LED Light Modules	12.3	Check the lamp-proving relay de-energises and the main signal shows a red aspect. On CBI areas check that an alarm has been raised.	If signal fails to return to danger when 3rd JIM is disconnected but, remains at danger when the route is cancelled and re- set with 3 JIM still disconnected then endorse Work Order closure with comment.

Local Clarifications

Part B

SMS/ Service	Name	Section	Clause	Text from Standard	S&TME Direction
Test 051	Busbar Earth Tests	Earth Values	N/A	Earth test values are detailed in NR/SMS/Part/Z07. The Reportable earth test result is the value that shall be reported to your SM(S).	Reportable values are 1v earth reading on AC busbars & 5v earth reading on DC busbars If above 1v/5v investigate & report findings to SM. A good practice is to carry out SMS Test 054 on spare cores in affected cables.
Test 251	DC Track Circuit Test	1. Maintenance Test	All	Driven by TC03 or TC04 Section 7 - Local Policy Requirement.	Carry out maintenance test Section 1 and complete residual voltage test (section 3). Only
Test 255	HVI Track Circuit Test	General	All	Warning & Safety sections	Where disconnection points are provided between the rails and the Bread-Bin, and these are isolated prior to work, work may be carried out in the 'Bread Bin' without 3rd rail isolation.

Local Clarifications

Part C

SMS/ Service	Name	Section	Clause	Text from Standard	S&TME Direction
AX40	Frauscher Advanced Axle Counter	Periodic Task 3	3	Rail Sensor Height Check	Use dedicated plastic RSR123 gauge. If Sensor requires replacing or height requires adjusting, report as corrective maintenance.
EL21	Trackside Apparatus Case	2. Internal inspection	6.2	Check that wire deg signs are in place if this is present in the apparatus case	Signs only required if cat 3-5.
EL21	Trackside Apparatus Case	2. Internal inspection	5.2	Check site copy diagrams are available, properly stored and fit for purpose. Submit a request for replacements as required. Report to your SM(S) any handwritten or temporary alterations to the site copy.	Plastic maintenance copies are to be present.

Local Clarifications					
Part C					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	3. Power supplies	2.1	Measure the power supply and busbar voltages (±10% of rating) for all signalling supplies. Your SM(S) shall advise you if current readings are required. Current readings should only be taken if it is practical to do so.	No requirement to take currents.
EL21	Trackside Apparatus Case	4. Earth Tests	3.5	If any earth fault is found with the voltage below the reportable voltage (NR/SMS/Part/Z07) but the trend is worsening significantly from previous results, report to your SM(S). Make the report within 24 hours. Your SM(S) will decide if any further action is required.	Sussex reportable values are 1v earth reading on AC busbars & 5v earth reading on DC busbars. If above 1v/5v investigate & report findings to SM, carry out SMS Test 054 on spare cores in affected cables.
EL21	Trackside Apparatus Case	Main/Standby power change over	Additional	Where there is duplicated Supply Undertake in Power Pillars annually	Where there are more than one duplicated supplies available. Annual changeover between supplies 364 frequency and left Odd years = supply no.1, even years = supply no. 2. Not to be undertaken where fuse/link removal required for changeover. Separate W/O generated for this task

Local Clarifications					
Part C					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
EL31	Equipment and Relay Rooms	12. Power Supplies	12.3	Where an alternative supply is provided (main/standby) change over the load to the alternative supply	Where there are more than one "Normal" supplies available. Annual changeover between supplies 364 frequency and left Odd years = supply no.1, even years = supply no. 2. Not to be undertaken where fuse/link removal required for changeover. Separate W/O generated for this task and not to be undertaken with EL21.
EL31	Equipment and Relay Rooms	13. Cables & Cable Terminations	13.9	Carry out NR/SMS/PartB/Test/054 (Cable Insulation Tests). Test lineside cables containing single cut safety critical circuits, safety critical reed circuits and earth return circuits which are not monitored by an ELD.	Single Cut vital circuits should be tested annually. Spare cores in cables also to be tested. If via binding posts, non-intrusive earth testing to be used. If in any doubt, contact your SM(S).
EL31	Equipment and Relay Rooms	15. Relays and Rack Mounted Electrical Apparatus	15.2	If not managed by a relay re-servicing database, check a sample of relays to see they are within their service date. Report any missing labels to your SM(S). Details on relay servicing which may be carried out as a separate exorcise can be found in NR/SMS/EL00. Track circuit relays shall be serviced at 10 yearly intervals. TC relays on Ebitrack200 installations are not covered by this requirement, other types of frequency track circuits are. See NR/L2/SIG/11129 for further details.	All relays should be managed by relay database. check all relays for labels missing & any cracks / damage to relay cases.

Local Clarifications					
Part C					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
EL31	Equipment and Relay Rooms	3. Power Supplies	3.5	Measure the power supply and busbar voltages (±10% of rating) for all signalling supplies. Your SM(S) shall advise you if current readings are required. Current readings should only be taken if it is practical to do so.	No requirement to take currents.
EL31	Equipment and Relay Rooms	4. Earth Tests	4.5	If any earth fault is found with the voltage below the reportable voltage (NR/SMS/Part/Z07) and the trend is worsening significantly from previous results, report to your SM(S). The report shall be made within 24 hours. Your SM(S) will decide if any further action is required.	Sussex reportable values are 1v earth reading on AC busbars & 5v earth reading on DC busbars. If above 1v/5v investigate & report findings to SM, carry out SMS Test 054 on spare cores in affected cables.
EL31	Equipment and Relay Rooms	Main/Standby power change over	Additional	Where there is duplicated Supply Undertake in Power Pillars annually	Where there are more than one duplicated supplies available. Annual changeover between supplies 364 frequency and left Odd years = supply no.1, even years = supply no. 2. Not to be undertaken where fuse/link removal required for changeover. Separate W/O generated for this task
TV02	Level Crossing CCTV Digital Systems	2. CCD Cameras	Preamble	Where the cameras are a CCD type mounted in a modern housing designed specifically for CCD cameras, then there is usually no requirement to lower the cameras at this service. if in doubt, ask your SM(S).	No requirement to lower on service A.
TV02	Level Crossing CCTV Digital Systems	4. CCD Cameras	4.12	Carry out NR/SMS/PartB/Test/046 (Level Crossing CCTV Camera Tests).	Undertaken by S&T Technical Support Group.
TV02	Level Crossing CCTV Digital Systems	4. CCD Cameras	4.17	If provided, carry out NR/SMS/PartB/Test/047 (CCTV Transmission System Tests).	Undertaken by S&T Technical Support Group.

END

Local Policies					
Part B					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Carry out as part of a Full Test when readings or scope of work requires.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Test only when directed to by specific W/O.
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Test only when directed to by specific W/O.
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Perform when attending suspected detection circuit failure.
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Perform when attending suspected detection circuit failure.
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Perform when attending suspected detection circuit failure.
PC05	Point Machine HW Style	15	15.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Perform when attending suspected detection circuit failure.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Perform when attending suspected detection circuit failure.
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	Quarterly (Section 2 only).
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Quarterly
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Only undertake if track circuit is unstaggered. Carry out IRJ test RIA 021 Test 7.1.
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Only undertake if track circuit is unstaggered. Carry out IRJ test RIA 021 Test 7.1.

Local Clarifications					
Part A					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
A04	Method Statement Summary	5. Protection Arrangements and Equipment	d)	Where all tail cables are connected to the point machine by plug coupler(s), disconnect all tail cable plug coupler(s) at the machine	Do not use this method unless all others impractical.
A04	Method Statement Summary	5. Protection Arrangements and Equipment	f)	Apply a documented local operating arrangement that has been agreed with the Route Asset Manager (S&T).	There is no local operating arrangement agreed.

Local Clarifications					
Part B					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 001	FPL Test (Machine)	1. Test	1.3	Place the 1.5mm FPL gauge between the switch and stock rail at a point in line with the bolt securing the stock rail to the first slide chair.	Task to be undertaken using 2.0mm gauge vice 1.5mm gauge.
Test 002	FPL Test (Mechanical)	1. Test	1.5	Place the 1.5mm FPL gauge between the switch and stock rail at a point in line with the bolt securing the stock rail to the first slide chair.	Task to be undertaken using 2.0mm gauge vice 1.5mm gauge.
Test 003	Facing Point Lock Tests (Clamp lock)	1. FPL Safety Test	1.5	Place the 1.5mm gauge between the switch and stock rail in line with the lock arm.	Task to be undertaken using 2.0mm gauge vice 1.5mm gauge.
Test 003	Facing Point Lock Tests (Clamp lock)	1. FPL Safety Test	1.5	Place the 1.5mm gauge between the switch and stock rail in line with the lock arm.	Task to be undertaken using 2.0mm gauge vice 1.5mm gauge.
Test 022	Signal Lamp & Light Module Proving Tests	10. Junction Indicators with Five Lamps (Filament Lamps, not SIMIS-W Interlockings)	10.3	Check the lamp-proving relay de-energises and the main signal shows a red aspect. On CBI areas check that an alarm has been raised. If these checks fail, with only two lamps remaining fitted, have the Junction Indicator extinguished and re- illuminated. Repeat the checks	If signal fails to return to danger when 3rd lamp removed but, remains at danger when the route is cancelled and re- set with 3 lamps still removed then endorse Work Order closure with comment.

Local Clarifications

Part B

SMS/ Service	Name	Section	Clause	Text from Standard	S&TME Direction
Test 022	Signal Lamp & Light Module Proving Tests	12. Junction Indicators fitted with Five Dorman LED Light Modules	12.3	Check the lamp-proving relay de-energises and the main signal shows a red aspect. On CBI areas check that an alarm has been raised.	If signal fails to return to danger when 3rd JIM is disconnected but, remains at danger when the route is cancelled and re- set with 3 JIM still disconnected then endorse Work Order closure with comment.
Test 051	Busbar Earth Tests	Earth Values	N/A	Earth test values are detailed in NR/SMS/Part/Z07. The Reportable earth test result is the value that shall be reported to your SM(S).	Reportable values are 1v earth reading on AC busbars & 5v earth reading on DC busbars If above 1v/5v investigate & report findings to SM. A good practice is to carry out SMS Test 054 on spare cores in affected cables.
Test 251	DC Track Circuit Test	1. Maintenance Test	All	When referred to by TC03 or TC04 Section 7 - Local Policy Requirement.	Carry out Section 1 (maintenance test) & Section 3 (residual voltage test) only
Test 255	HVI Track Circuit Test	1. Maintenance Test	All	Driven from TC12 step 7.2	Carry out Section 1 (Maintenance test) only.

Local Clarifications

Part C

SMS/ Service	Name	Section	Clause	Text from Standard	S&TME Direction
AX40	Frauscher Advanced Axle Counter	Periodic Task 3	3	Rail Sensor Height Check	Use dedicated plastic RSR123 gauge. If Sensor requires replacing or height requires adjusting, report as corrective maintenance.
EL21	Trackside Apparatus Case	2. Internal inspection	6.2	Check that wire deg signs are in place if this is present in the apparatus case	Signs only required if cat 3-5.

Local Clarifications

Part C

SMS/ Service	Name	Section	Clause	Text from Standard	S&TME Direction
EL21	Trackside Apparatus Case	2. Internal inspection	5.2	Check site copy diagrams are available, properly stored and fit for purpose. Submit a request for replacements as required. Report to your SM(S) any handwritten or temporary alterations to the site copy.	Plastic maintenance copies are to be present.
EL21	Trackside Apparatus Case	3. Power supplies	2.1	Measure the power supply and busbar voltages (±10% of rating) for all signalling supplies. Your SM(S) shall advise you if current readings are required. Current readings should only be taken if it is practical to do so.	No requirement to take currents.
EL21	Trackside Apparatus Case	4. Earth Tests	3.5	If any earth fault is found with the voltage below the reportable voltage (NR/SMS/Part/Z07) but the trend is worsening significantly from previous results, report to your SM(S). Make the report within 24 hours. Your SM(S) will decide if any further action is required.	Sussex reportable values are 1v earth reading on AC busbars & 5v earth reading on DC busbars. If above 1v/5v investigate & report findings to SM, carry out SMS Test 054 on spare cores in affected cables.
EL31	Equipment and Relay Rooms	12. Power Supplies	12.3	Where an alternative supply is provided (main/standby) change over the load to the alternative supply	Where there are more than one "Normal" supplies available. Annual changeover between supplies 364 frequency and left Odd years = supply no.1, even years = supply no. 2. Not to be undertaken where fuse/link removal required for changeover. Separate W/O generated for this task.
EL31	Equipment and Relay Rooms	13. Cables & Cable Terminations	13.9	Carry out NR/SMS/PartB/Test/054 (Cable Insulation Tests). Test lineside cables containing single cut safety critical circuits, safety critical reed circuits and earth return circuits which are not monitored by an ELD.	Single Cut vital circuits should be tested annually. Spare cores in cables also to be tested. If via binding posts, non-intrusive earth testing to be used. If in any doubt, contact your SM(S).

Local Clarifications					
Part C					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
EL31	Equipment and Relay Rooms	15. Relays and Rack Mounted Electrical Apparatus	15.2	If not managed by a relay re-servicing database, check a sample of relays to see they are within their service date. Report any missing labels to your SM(S). Details on relay servicing which may be carried out as a separate exorcise can be found in NR/SMS/EL00. Track circuit relays shall be serviced at 10 yearly intervals. TC relays on Ebitrack200 installations are not covered by this requirement, other types of frequency track circuits are. See NR/L2/SIG/11129 for further details.	All relays should be managed by relay database. On the racks that 10% wire deg check has been carried out, check all relays for labels missing & any cracks in/damage to relay cases.
EL31	Equipment and Relay Rooms	3. Power Supplies	3.5	Measure the power supply and busbar voltages (±10% of rating) for all signalling supplies. Your SM(S) shall advise you if current readings are required. Current readings should only be taken if it is practical to do so.	No requirement to take currents.
EL31	Equipment and Relay Rooms	4. Earth Tests	4.5	If any earth fault is found with the voltage below the reportable voltage (NR/SMS/Part/Z07) and the trend is worsening significantly from previous results, report to your SM(S). The report shall be made within 24 hours. Your SM(S) will decide if any further action is required.	Sussex reportable values are 1v earth reading on AC busbars & 5v earth reading on DC busbars. If above 1v/5v investigate & report findings to SM, carry out SMS Test 054 on spare cores in affected cables.
TV02	Level Crossing CCTV Digital Systems	2. CCD Cameras	Preamble	Where the cameras are a CCD type mounted in a modern housing designed specifically for CCD cameras, then there is usually no requirement to lower the cameras at this service. if in doubt, ask your SM(S).	All crossing cameras are CCD. No requirement to lower on service A.
TV02	Level Crossing CCTV Digital Systems	4. CCD Cameras	4.12	Carry out NR/SMS/PartB/Test/046 (Level Crossing CCTV Camera Tests).	Undertaken by S&T Technical Support Group.
TV02	Level Crossing CCTV Digital Systems	4. CCD Cameras	4.17	If provided, carry out NR/SMS/PartB/Test/047 (CCTV Transmission System Tests).	Undertaken by S&T Technical Support Group.

END

Local Policies					
Part B					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	No direction.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	5 Yearly.
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	5 Yearly.
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annual.
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annual.
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	Quarterly.
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly.
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Quarterly.
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	To be performed during any service being conducted between 1st March and 30th June.
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	To be performed during any service being conducted between 1st March and 30th June.

END

Local Policies					
Part B					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	No direction.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	SM will advise if required. CE, WBQ, EH.
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Relay timer test to be performed on a 48-week cycle. CE, WBQ.
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	48 weekly CE, WBQ.
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	48 weekly CE, WBQ.
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	48 Weekly.
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No equipment of this type on the Crewe DU area.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	48 weekly CE, WBQ.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	48 weekly CE, WBQ.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	48 weekly CE, WBQ.
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Not required to be done during routine SMS. CE, WBQ.
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Not required to be done during routine SMS. CE, WBQ.
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Not required to be done as part of routine SMS.
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Not required to be done as part of routine SMS.

END

Local Policies					
Part B					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	No equipment of this type on the Carlisle DU area.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	5 Yearly.
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	5 Yearly.
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	Annually.
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly.
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Quarterly.
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	No direction.
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	No direction.

END

Local Policies					
Part B					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Not required to be performed.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	5 Yearly.
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	5 Yearly.
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Not required to be performed.
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Not required to be performed.
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annual.
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annual.
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	None on Liverpool STME area.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Annual.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Annual.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	Annual.
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	None on Liverpool STME area.
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	None on Liverpool STME area.
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Not required to be performed.
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Not required to be performed.

END

Local Policies					
Part B					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	None on Manchester STME area.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	5 Yearly.
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	5 Yearly.
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	None on Manchester STME area.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	Quarterly.
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly.
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Quarterly.
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Annually.
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Annually.

END

Local Policies					
Part B					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	No direction.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Managed by ELLIPSE.
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Managed by ELLIPSE.
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	No direction.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	No direction.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	No direction.
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	No direction.
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	No direction.
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	No direction.
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	No direction.

END

Local Policies					
Part B					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Not required non on Area.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Annually.
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Annually.
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Not required at Service A, with the exception of Trainman Operated Points and Yard Points where Clause 5.1 and 5.3 to be completed at service A.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Not required at Service A, with the exception of Trainman Operated Points and Yard Points where Clause 5.1 and 5.3 to be completed at service A.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	Not required at Service A, with the exception of Trainman Operated Points and Yard Points where Clause 5.1 and 5.3 to be completed at service A.
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Not required at Service A, with the exception of Trainman Operated Points and Yard Points where Clause 5.1 and 5.3 to be completed at service A.
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Not required at Service A, with the exception of Trainman Operated Points and Yard Points where Clause 5.1 and 5.3 to be completed at service A.
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Annually.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Annually.

Local Clarifications					
Part B					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 001	FPL Test (Machine)	1. Test	1.3	Place the 1.5mm FPL gauge between the switch and stock rail at a point in line with the bolt securing the stock rail to the first slide chair.	Performance Additional Test Complete an additional test of 2mm gauge after the 1.5mm and ensure the Lock enters.
Test 003	Facing Point Lock Tests (Clamp lock)	1. FPL Safety Test	1.5	Place the 1.5mm gauge between the switch and stock rail in line with the lock arm.	Complete an additional test of 2mm gauge after the 1.5mm and ensure the Lock enters.
Test 089	SSI Datalinks Test	Health Check Tests	All	Datalink Testing	Not required on Interfaced SSI per EL31

Local Clarifications					
Part C					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
AX15	Axle Counter Thales AzLM & AzLE	Service A and B	1.1 - 1.3 2.1 - 2.3	Perform a diagnostic download from the system.	Required 3 Monthly.
TC04	Track Circuits: DC Medium Voltage	8. Residual Voltage Check	8.1	Carry out NR/SMS/PartB/Test/251 (DC Track Circuit Test) - Residual Voltage Check (Clause 3).	PT to be taken at 6-year frequency

END

Local Policies					
Part B					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Required with Service B

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Six yearly
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Six yearly
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Not required at Service A to be completed with Service B
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Not required at Service A to be completed with Service R2
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Not required at Service A to be completed with Service B
PC05	Point Machine HW Style	15	15.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Not required at Service A to be completed with Service B

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Not required at Service A, with the exception of Trainman Operated Points and Yard Points where Clause 5.1 and 5.3 to be completed at service A.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Not required at Service A, with the exception of Trainman Operated Points and Yard Points where Clause 5.1 and 5.3 to be completed at service A.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	Not required at Service A, with the exception of Trainman Operated Points and Yard Points where Clause 5.1 and 5.3 to be completed at service A.
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Not required at Service A, with the exception of Trainman Operated Points and Yard Points where Clause 5.1 and 5.3 to be completed at service A.
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Not required at Service A, with the exception of Trainman Operated Points and Yard Points where Clause 5.1 and 5.3 to be completed at service A.

Local Policies

Part C

SMS/ Service	Name	Section No.	Clause	Text from Standard	S&TME Direction
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Required with Service B
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Required with Service B

Local Clarifications

Part B

SMS/ Service	Name	Section	Clause	Text from Standard	S&TME Direction
Test 001	FPL Test (Machine)	1. Test	1.3	Place the 1.5mm FPL gauge between the switch and stock rail at a point in line with the bolt securing the stock rail to the first slide chair.	Performance Additional Test Complete an additional test of 2mm gauge after the 1.5mm and ensure the Lock enters.
Test 003	Facing Point Lock Tests (Clamp lock)	1. FPL Safety Test	1.5	Place the 1.5mm gauge between the switch and stock rail in line with the lock arm.	Complete an additional test of 2mm gauge after the 1.5mm and ensure the Lock enters.
Test 089	SSI Datalinks Test	Health Check Tests	All	Datalink Testing	Not required on Interfaced SSI per EL31

Local Clarifications

Part C

SMS/ Service	Name	Section	Clause	Text from Standard	S&TME Direction
AX15	Axle Counter Thales AzLM &	Service A and B	1.1 - 1.3 2.1 - 2.3	Perform a diagnostic download from the system.	Required 3 Monthly.
IS11	Solid State Interlockings	13	13.2	Signal Group Replacement Control Test is an Operations driven task and will be carried under their guidance and set frequency. The review should consider replacement test by the Functionality of GSMR All Signals On.	Required at Service B
PC05	Point Machine	15	15.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry	Not required at Service A to be completed with

Local Clarifications					
Part C					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
				out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Service R2
SB12	Signal Box Operating Floor & Block Shelf	Service A	8.4	Carry out a Function Test(NR/SMTH defined test B17 steps 4 to 14	Service A
SB12	Signal Box Operating Floor & Block Shelf	Service B	15.1. – 15.2	Break the seal and Test for correct operation	Service B
TC04	Track Circuits: DC Medium Voltage	8. Residual Voltage Check	8.1	Carry out NR/SMS/PartB/Test/251 (DC Track Circuit Test) - Residual Voltage Check (Clause 3).	PT to be taken at 6-year frequency

Addendum to LP350 LNE N&E Route		
SMS/Service	Instruction – Text from standard	Direction
LV99	(Clause 5.1 "Pull Through Test", Required at least 3 yearly) (Full SMS Required at least 5 yearly) Testing Regime part of SMS: • Direct Lever Locking 3 Yearly. • Catch Handle Locking 3 Yearly. • LNW Tappet 3 Yearly. • LNW Tumbler 2 Yearly. • Midland Tappet Yearly. Overhaul regime part of SMS: Lever Frames overhauls to be completed: • 3 years to 5 years for frames over 50 years of age • 5 years for frames under 50 years of age.	Specifications not included within this document – the LV99 is the responsibility of the MELF (Locking Fitters)
SB12	SERVICE B Additional Clause 16: 16.1 Carry out Function Test(s) (NR/SMTH defined Test B09) as applicable.	Required at Service B
Part Z05	Cable Insulation Resistance Values: Readings below 200k ohms and above:20kohms delegated authority to SFI L3. Notification to Route Engineer by next working day. Details and Authority Number required maintaining compliance for cable to remain in service.	

Local Policies					
Part B					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Annually or during a full test.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Annually.
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Annually.
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Annually.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	Quarterly.
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly.
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Annually.
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Annually.
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Annually.

Local Clarifications					
Part B					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 075	MCB Operational Sequence Test	3. Barrier Sequence Operation (Local Control)	3	Barrier Sequence Operation (Local control) These tests are "If Provided".	To be carried out Annually if provided.

Local Clarifications					
Part C					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
AX15	Axle Counter Thales AzLM & AzLE	Service A and B	1.1 - 1.3 2.1 - 2.4	Perform a diagnostic download from the system.	To be carried out every 91 days.
EL21	Trackside Apparatus Case	6. Primary Cells	6.2	Carry out NR/SMS/PartB/Test/058 (Primary Cell Test) if required. Continually loaded cells should be replaced if their obtained readings indicate they can fail before the next maintenance visit. See NR/SMS/EL00.	AS10 cells to be changed at 24 Month interval with exception of Track Cct. cells which are to be changed Annually. All Cells to be annotated with date of installation.
LC21	Barrier Machine BR Spec 843	Service B	6.1 (c)	Both motor brushes shall be replaced when any one reaches a minimum length of 7mm. Tuscan motors: remove screw caps with care as brushes may spring out. Brushes shall slide freely in their holders and seat fully on the commutator.	Motor Brushes to be Replaced Annually Regardless of Min. Length M40 or PG12X style brushes shall be used.
TC08	Track Circuits: 50Hz AC	6. Track Circuit Tests	6.1	Carry out NR/SMS/PartB/Test/260 (50Hz AC Track Circuit Test) Maintenance Test.	To be carried out Annually during "B" Service.
TC10	Track Circuits: Aster SF15 / U Type	3. Throughout the Length of Each Track Circuit	3.0	TCs on CWR under certain conditions and circumstances may not have to be inspected by a full walk through.	It is not necessary to inspect the full length of a track circuit under the following conditions: The track circuit is completely made up of CWR (IRJ to IRJ/ TZ to TZ). There are no signal wires, point rodding or Other metallic services that pass under the rails. There are no level crossings within the track circuit. 4 Record card readings haven't altered since last full test.

END

Local Policies					
Part B					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	To be carried out Annually or during a full test.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	5 Yearly.
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	5 Yearly.
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction.
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Do not carry out.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	Quarterly.
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly.
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Quarterly.
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	To be carried out Annually at Specific Signal box Areas – Holyhead, Bangor, Llandudno Jct, Croes Newydd, Crewe Jct Severn bridge Jct, Abbey Foregate, Sutton Bridge, Hereford Incl Shelwick Jct.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	To be carried out Annually at Specific Signal box Areas – Holyhead, Bangor, Llandudno Jct, Croes Newydd, Crewe Jct Severn bridge Jct, Abbey Foregate, Sutton Bridge, Hereford Incl Shelwick Jct.

Local Clarifications					
Part B					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 075	MCB Operational Sequence Test	3. Barrier Sequence Operation (Local Control)	3	Barrier Sequence Operation (Local control) These tests are “If Provided”.	To be carried out Annually if provided

Local Clarifications					
Part C					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	6. Primary Cells	6.2	Carry out NR/SMS/PartB/Test/058 (Primary Cell Test) if required. Continually loaded cells should be replaced if their obtained readings indicate they can fail before the next maintenance visit. See NR/SMS/EL00.	AS10 cells to be changed 2 Yearly intervals with exception of Track Cct cells which are to be changed to be carried out Annually All Cells to be annotated with date of installation.
EL31	Equipment and Relay Rooms	6. Primary Cells	6.2	Carry out NR/SMS/PartB/Test/058. Continually loaded cells shall be replaced if their obtained readings indicate they could fail before the next maintenance visit. See NR/SMS/EL01	AS10 cells to be changed at 24 Month interval with exception of Track Cct cells to be changed Annually All Cells to be annotated with date of installation.
SG12	Semaphore Signals	15. Signal Lamp (Electrically Lit Filament Lamps)	15.4	Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests).	HQ Policy applies Annual

END

Local Policies					
Part B					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Carry out as part of full test when readings or scope of work require.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Timers associated with Level Crossings shall be tested annually. All other timers to be tested 5 Yearly.
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Timers associated with Level Crossings shall be tested annually. All other timers to be tested 5 Yearly.
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No direction – none installed on Wessex.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PC05	Point Machine HW Style	15	15.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	Applicable to all BR998 detectors, but only undertake section 2, microswitch tests quarterly (Service B, task 5.3 will conduct the rest of Test 010 annually).
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly.

Local Policies

Part C

SMS/ Service	Name	Section No.	Clause	Text from Standard	S&TME Direction
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Quarterly.
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Only undertake if track circuit is unstaggered. To be undertaken Quarterly. Carry out IRJ test as per RIA 021, Issue 4, section 7.
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Only undertake if track circuit is unstaggered. To be undertaken Quarterly. Carry out IRJ test as per RIA 021, Issue 4, section 7.

Local Clarifications

Part B

SMS/ Service	Name	Section	Clause	Text from Standard	S&TME Direction
Test 001	FPL Test (Machine)	1. Test	1	Place the 1.5mm FPL gauge between the switch and stock rail at a point in line with the bolt securing the stock rail to the first slide chair.	Task to be undertaken using 2.0mm gauge vice 1.5mm gauge.
Test 002	FPL Test (Mechanical)	1. Test	1.3	Place the 1.5mm FPL gauge between the switch and stock rail at a point in line with the bolt securing the stock rail to the first slide chair.	Task to be undertaken using 2.0mm gauge vice 1.5mm gauge.
Test 003	Facing Point Lock Tests (Clamp lock)	1. FPL Safety Test	1.5	Place the 1.5mm gauge between the switch and stock rail in line with the lock arm.	Task to be undertaken using 2.0mm gauge vice 1.5mm gauge.

END

Local Policies					
Part B					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	No direction.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Annually.
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	Annually.
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	To be completed Annually and during any fault investigation.
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	To be completed Annually and during any fault investigation.
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	None on Reading area.
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	To be completed Annually and during any fault investigation.
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	None on Reading area.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	To be completed Annually and during any fault investigation.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	To be completed Quarterly and during any fault investigation.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	No direction.
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	To be carried out Annually.
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	To be carried out Quarterly or on fault Investigation.
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	After P-way repair or replacement of the Insulations or upon failure of TC.
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	After P-way repair or replacement of the Insulations or upon failure of TC.

Local Clarifications					
Part C					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
GF01	Ground Frames	Service B	Preamble	The tasks in this section are mandatory.	These assets are in ELLIPSE and currently carried out by the Locking Fitters Section Quarterly and Annually.
IS11	Solid State Interlocking (SSI)	13. Function Tests	13.1	If relay controlled, apply the NR/SMS/PartB/Test/060 where provided. Confirm correct operation. This task is not required where the emergency signals on control is hard wired in the power circuit. The 'All Signals On' button should be pressed for a minimum of 15 seconds.	This will be carried out by the Box Technicians at Didcot Annually.
SB11	Signallers Control & Indication Panels or Displays	1. Alarms	1.1	Check first filament failure alarms, system alarms, power supply alarms etc.	These alarms should be tested by the box technician at TVSC and is not required to be completed by Reading DU.
SB12	Signal Box Operating Floor and Block Shelf	14. Systems	14.4	As provided, Test other electronic systems.	Test Annually.

END

Local Policies

Part B

SMS/ Service	Name	Section No.	Clause	Text from Standard	S&TME Direction
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	No Direction - not on Swindon/Didcot area.

Local Policies

Part C

SMS/ Service	Name	Section No.	Clause	Text from Standard	S&TME Direction
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	No Direction
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	5 Yearly - driven by ELLIPSE work orders for asset.
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	To be completed Annually and during any Fault Investigation.
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	To be completed Annually and during any Fault Investigation.
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No Direction - not on Swindon/Didcot area.
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	To be completed Annually and during any Fault Investigation.
PC05	Point Machine HW Style	15	15.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	To be completed Annually and during any Fault Investigation.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	No Direction - not on Swindon/Didcot area.
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	To be completed Annually and during any Fault Investigation.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	To be completed Annually and during any Fault Investigation.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	To be completed Annually and during any Fault Investigation.
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	To be completed Annually and during any Fault Investigation.
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	To be completed Annually and during any Fault Investigation.
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	No Direction - not on Swindon/Didcot area.
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Do not carry out.

Local Clarifications					
Part B					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 001	Facing Point Lock Tests (Machine)	1	1.2 step C Step D	The 3.5mm test shall be repeated using the 5mm gauge. If the lock fails to enter the lock notch, then this shall be recorded. The gauge of the points shall now be adjusted to bring them back to a position where they fail the 3.5mm test.	**Addition text to Step D:** If the lock fails to enter the lock notch, then this shall be recorded **and reported to ICC**. The gauge of the points shall now be adjusted to bring them back to a position where they fail the 3.5mm test.
Test 002	Facing Point Lock Tests (Mechanical)	1	1.4 step C Step D	The 3.5mm test shall be repeated using the 5mm gauge. If the lock plunger fails to enter the lock notch, then this shall be recorded. The gauge of the points shall now be adjusted to bring them back to a position where they fail the 3.5mm test.	**Addition text to Step D:** If the lock plunger fails to enter the lock notch, then this shall be recorded **and reported to ICC**. The gauge of the points shall now be adjusted to bring them back to a position where they fail the 3.5mm test.
Test 003	Facing Point Lock Test (RCPL)	1	1.4 Step D Step E	The 3.5mm test shall then be repeated using a 5mm gauge. If the lock slide fials to complete its travel, this shall be recorded. The packing of the points shall now be adjusted to bring them back to a position where they fail the 3.5mm test.	**Addition text to Step E:** If the lock slide fails to complete its travel, this shall be recorded **and reported to ICC**. The packing of the points shall now be adjusted to bring them back to a position where they fail the 3.5mm test.
Test 003	Facing Point Lock Test (IBCL)	1	1.8 Step B Step C	If the lock slide fails to complete its travel, then this is a pass, proceed to step 1.9. this result shall be recorded. If the lock slide completes its travel, then this is a failure and shall be recorded and investigated	**Addition text to Step C:** If the lock slide completes its travel, then this is a failure and shall be recorded, **reported to ICC** and investigated

Local Clarifications					
Part B					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 003	Facing Point Lock Test (IBCL)	1	1.8 Step D Step E	The 3.5mm test shall then be repeated using a 5mm gauge. If the lock slide fails to complete its travel, then this shall be recorded, reported to ICC and investigated. The packing of the points shall now be adjusted to bring them back to a position where they fail the 3.5mm test.	**No Direction -** requirement to report failure of lock slide to complete its travel (pass) with a 5mm gauge between switch and stock is already mandated in 1.8 Step E.
Test 055	Secondary Cell Test When replacing DD835 use Part 4.	4	4.4	4.4 Record the time on "on load" on the record card. An Ideal time for the batteries to be on load is 30 minutes, although this might not be possible in all circumstances	"On Load" time for DD835 AZLM Remote Fed UPSs to be 4 minutes only.
Test 055	Secondary Cell Test When replacing ACE UPS Cells use Part 4**.**	4	4.4	4.4 Record the time on "on load" on the record card. An Ideal time for the batteries to be on load is 30 minutes, although this might not be possible in all circumstances	"On load" time for 60v ACE UPS DD820s to be 2 minutes only.
Test 260	50Hz AC Track Circuit test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed	No Direction - not on Swindon/Didcot Area

Local Clarifications					
Part C					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	13	13.1	ON Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	5 Yearly - driven by ELLIPSE work orders for asset.
EL21	Trackside Apparatus Case	23	23.1	ON Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	5 Yearly - driven by ELLIPSE work orders for asset.

Local Clarifications					
Part C					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
GF01	Ground Frames	Service B	Preamble	The Tasks in this section are mandatory	These Assets are in Ellipse. Annual & Quarterly Mtce is currently carried out by the Locking Fitters Section.
IS11	Solid State Interlocking (SSI)	13. Function Tests	13.1	If relay controlled, apply the NR/SMS/PartB/Test/060 where provided. Confirm Correct Operation. This task is not required where the emergency signal on control is hard wired in the power circuit. The "All Signals On" button should be pressed for a minimum of 15 seconds.	This will be carried out by the TVSC Box TOs Annually.
PC05	Point Machine HW Style	13	13.14	Lubricate the Lock & Detector Blades, Throw-Bar, Gear teeth, Crank Handle Cut-Out Mechanism & Padlock	Ensure Lithium Grease is used for Lubricating the Lock & Detector Blades, Throw Bar & Gear Teeth.
SB11	Signallers Control & Indication Panels or Displays	1. Alarms	1.1	Check first filament failure alarms, system alarms, power supply alarms etc.	Daily, Weekly & Periodic - Driven by ELLIPSE Work Order to be completed by TVSC Box TOs.
SB12	Signal Box Operating Floor and Block Shelf	14. Systems	14.4	As provided, Test other electronic systems.	No Direction - not required on Swindon/Didcot area.

Local Clarifications					
Part 04					
SMTH Test Plan	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
CE01	Replace a Secondary Cell or Battery	After Installation Work	21. (New Step - Additional Testing)	No Requirement in SMTH Test Plan CE01 to carry out NR/SMS/PartB/Test/055 - Secondary Cell Test	To be completed for all Cyclon, DD835, ACE UPS DD820 & TVSC System Secondary Cells & recorded on SMTH Log Slip as an additional Step - Step 21. *Refer to 10661 Part L for "time on load" guidance for DD835 & ACE UPS DD820s

Local Clarifications
Part R – Record Cards
In Accordance with NR/SMS/Part/R Maintenance Record Cards - S&TME guidance for Swindon, Didcot & TVSC Signalling sections shall be that records are reviewed when retired and then stored for 5 years.

END

Local Policies					
Part B					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	None on Bristol area.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	5 Yearly.
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	5 Yearly.
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Not required.
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Not required.
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	None on Bristol area.
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Not required.
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	None on Bristol area.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	Quarterly.
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly.
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Quarterly.
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	No direction.
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	No direction.

END

Local Policies

Part B

SMS/ Service	Name	Section No.	Clause	Text from Standard	S&TME Direction
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Do not carry out.

Local Policies

Part C

SMS/ Service	Name	Section No.	Clause	Text from Standard	S&TME Direction
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	5 Yearly.
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	5 Yearly.
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Do not carry out.
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Do not carry out.
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	None on Plymouth area.
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Do not carry out.
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Do not carry out.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Quarterly.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	Quarterly.
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Quarterly.
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Quarterly.
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Do not carry out.
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Do not carry out.

Local Clarifications					
Part C					
SMS/ Service	**Name**	**Section**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	6. Primary Cells	6.2	Carry out NR/SMS/PartB/Test/058 (Primary Cell Test) if required. Continually loaded cells should be replaced if their obtained readings indicate they can fail before the next maintenance visit. See NR/SMS/EL00.	AS10 cells to be changed at 18-month intervals or upon failure of a single cell in a bank the entire bank shall be changed. Each cell in the bank shall be annotated to show date of installation.
EL31	Equipment and Relay Rooms	6. Primary Cells	6.2	Carry out NR/SMS/PartB/Test/058. Continually loaded cells shall be replaced if their obtained readings indicate they could fail before the next maintenance visit. See NR/SMS/EL00	AS10 cells to be changed at 18 month intervals or upon failure of a single cell in a bank the entire bank shall be changed. Each cell in the bank shall be annotated to show date of installation
SB11	Signallers Control & Indication Panels or Displays	1. Alarms	1.1	Check first filament failure alarms, system alarms, power supply alarms etc.	Daily
SB12	Signal Box Operating Floor and Block Shelf	1. Alarms	1.1	Check first filament failure alarms, system alarms, power supply alarms etc.	Reported by Signaller.

END

Local Policies					
Part B					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
Test 260	50Hz AC Track Circuit Test	5	5.1	If applicable and only during a B service, Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Required to be performed under faulting or when P/Way repair or change any insulation.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
EL21	Trackside Apparatus Case	8	8.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	3 Yearly.
EL31	Equipment and Relay Rooms	16	16.1	On Non-Thermal Timers, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.	3 Yearly.
PB11	Clamp Lock Hydraulic Points	12	12.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PB11	Clamp Lock Hydraulic Points	22	22.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PB17	JOSS Lock Points	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	None on Scotland route.
PC05	Point Machine HW Style	10	10.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	Annually.
PC42	Point Machine WRSL Styles M3 & M3A	16	16.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.	None on Scotland route.

Local Policies					
Part C					
SMS/ Service	**Name**	**Section No.**	**Clause**	**Text from Standard**	**S&TME Direction**
PD01	BR998 Detector	5	5.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Annually.
PD01	BR998 Detector	5	5.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Annually.
PD01	BR998 Detector	5	5.3	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.	Annually. For Train Operated Points Only.
PD02	Electrical Point Detectors	8	8.1	Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.	Annually.
PD02	Electrical Point Detectors	8	8.2	Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.	Annually.
TC03	Track Circuits: DC Low Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Required to be performed under faulting or when P/Way repair or change any insulation.
TC04	Track Circuits - DC Medium Voltage	7	7.1	Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.	Required to be performed under faulting or when P/Way repair or change any insulation.

END

Care shall be taken with record cards stored in signal heads so that they do not obstruct any light output from the signal. They shall also not be stored behind the lamp as this could lead to a phantom aspect being displayed. Cards shall not be left in a position where the heat given out by a piece of equipment can pose a fire risk.

Maintenance record cards from any source other than those contained in NR/L3/SIG/10663 shall not be used to record NR/SMS tasks or tests.

Check previous information/data entered on a record card each time a new entry is made to see if there is any significant variation from previous entries or if there is a trend occurring in the readings.

This information may indicate a fault or problem starting which may be identified and rectified before the failure of the equipment.

Maintenance record cards are provided for each item of equipment where the task/test asks you to measure or record. There are also cards provided to enter information on particular equipment (e.g. lever frames).

Record cards are either paper or digital format and relate to the NR/SMS task/test named at the top of the sheet. They do not relate to any other maintenance system.

Enter details of all preventative or corrective maintenance test results on the appropriate maintenance record card.

Copies of each card will be available from your SM(S), My work app or they can be downloaded from Connect by clicking the ‘Network Rail Standards’ link on the Connect home page, then clicking ‘search’ and entering the standard number (10663) in the reference number box.

Enter your name and the company you work for on the card every time you enter details. If a measurement is taken using a meter or other test equipment, enter the identity and calibration details of the instrument(s).

If access to the asset is refused, fill in the record card and write the word ‘refused’ in the comments column.

Record cards shall be kept in the trackside apparatus case or equipment room information file if provided and practicable. If one of these is not provided or if it is not practicable, they shall be kept adjacent to the equipment they relate to. In both cases, they shall be protected by a plastic wallet.

Point system cards that relate to multiple ends of points shall be stored in the location nearest the ‘A’ end of the points to which they apply.

When a card is full, transfer the information and last data entry to a new card. If the old card is no longer needed on site, return it to your SM(S).

Record cards shall be reviewed and stored in accordance with local instructions.

INDEX OF NR/SMS MAITENANCE RECORD CARDS

All record card numbers start with NR/SMS/

INDEX

Card No.	Title
RC08 RC01	RC System: WBS Type TDM 69 Test
RC09 RC01	RC System: WBS Type S2 TDM Test
RC10 RC01	RC System: Westronic F1 TDM Test
RC11 RC01	RC System: Vaughan Harmon Type DM11 Test
RC12 RC01	RC System: Telecode 80 Test
RC13 RC01	RC System: AP Datalink TDM Test
RC16 RC01	RC System: Westronic 1024 TDM Test
SW20 T059 RC01	Severn Tunnel Pull Wire
T021 RC01	Junction Indicator and Position Light Signal - All Types
T021 RC02	Route Indicator - non LED
T021 RC03	Route Indicator - LED
T021 RC04	Signal - (Filament / Light Engine)
T021 RC05	Signal - LED
T021 RC06	Signal SMIS type
T026 RC01	Trainstop (Electro-Hydraulic) Calibration
T029 RC01	ATP (Chilterns)
T041 RC01	IRJ - DC & BR-WR Quick Release TC
T041 RC02	IRJ - DC & BR-WR Quick Release TC
T042 RC01	Axle Counter AzL70 Evaluator Single Rail Contacts
T042 RC02	Axle Counter AzL70 Evaluator Double Rail Contacts
T042 RC03	Axle Counter AzL70/30 Evaluator EAK30 Junction Box
T043 RC01	Track Circuit Aid (TCAID)
T044 RC01	Treadle Timing & Adjustment
T045 RC01	AzLM & AzLE Axle Counters
T046 RC01	Level Crossing CCTV Camera
T047 RC01	CCTV HF Tx System (Marconi/GEC 14.5MHz AM)
T047 RC02	CCTV HF Tx System (Philips FM)
T051 RC01	AC Busbar & Earth Test
T051 RC02	DC Busbar & Earth Test
T052 RC01	Dynamic Earth Test (Power Worked Points)

END

Network Rail	**ATP Equipment (GWML)** **Record Card (Front)** **NR/SMS/AP11**	**Form: NR/SMS/AP11/RC/01** **Date: December 2009** **Issue: 01**

Signal Box:	Signal Number:

Number		Loop	Enclosure								Ground Tester Tests		
		Infill Loop Resistance	Main Power Supply Fuses	Main Beacon Feedback	Infill Beacon Feedback	Additional Beacon Feedback	* Encoder LED's Flashing 50% duty cycle				Beacon Strength	Infill Loop Strength	Message Correct
	Units	Ohms	AC(V)	DC(V)	DC(V)	DC(V)							
	Limits	360 to 400	99 to 121	15 to 25	10 to 25	15 to 25					Number of bars above minimum		Yes / No
	Terms	3 & 4	2 & 3	27(+) 28(-)	31(+) 32(-)	40(+) 41(-)	AH1	AH2	BH1	BH2			
1													
2													
3													
4													
5													
6													
7													
8													

Number	Comments	Test Equipment Identity	Signature	Name & Company	Date
1					
2					
3					
4					
5					
6					
7					
8					

*: Insert tick if LED indications are correct

Network Rail	ATP Equipment (GWML) Record Card (Front) NR/SMS/AP11	Form: NR/SMS/AP11/RC/01 Date: December 2009 Issue: 01

Number		Loop	Enclosure								Ground Tester Tests		
		Infill Loop Resistance	Main Power Supply Fuses	Main Beacon Feedback	Infill Beacon Feedback	Additional Beacon Feedback	* Encoder LED's Flashing 50% duty cycle				Beacon Strength	Infill Loop Strength	Message Correct
	Units	Ohms	AC(V)	DC(V)	DC(V)	DC(V)							
	Limits	360 to 400	95 to 125	15 to 25	10 to 25	15 to 25					Number of Bars Above Minimum		Yes / No
	Terms	3 & 4	2 & 3	27(+) 28(-)	31(+) 32(-)	40(+) 41(-)	AH1	AH2	BH1	BH2			
9													
10													
11													
12													
13													
14													
15													
16													
17													

Number	Comments	Test Equipment Identity	Signature	Name & Company	Date
9					
10					
11					
12					
13					
14					
15					
16					
17					

*: Insert tick if LED indications are correct

AWS Test - Electro and Permanent

Maintenance Test

Form: NRSMS/AW11/T024/RC01
Date: 01/09/2018
Issue: 03

Signal Box / Interlocking:	Location:	Signal / AWS Number

No	Electro-Magnet								Permanent Magnet	
	SP Meter Reading		Voltage Reading			Height from rail top (mm)	Current when Signal at G (A)	Spark Quench Diode/ Resistor		
	Signal at R, Y or YY	Signal at G	Earth Test (V) (Magnet Energised)					Resista- -nce (Ohms)	SP Meter Reading	Height from rail top (mm)
			B-E	N-E	BN					
1										
2										
3										
4										
5										
6										
7										
8										

No	S&P Meter Identity	Voltmeter Identity	Comments	Signature	Name & Company	Date
1						
2						
3						
4						
5						
6						
7						
8						

Network Rail	**AWS Test - Electro and Permanent** Maintenance Test	**Form: NRSMS/AW11/T024/RC01** **Date: 01/09/2018** **Issue: 03**

No	Electro-Magnet								Permanent Magnet	
	SP Meter Reading		Voltage Reading			Height from rail top (mm)	Current when Signal at G (A)	Spark Quench Diode/ Resistor		
	Signal at R, Y or YY	Signal at G	Earth Test (V) (Magnet Energised)					Resista- -nce (Ohms)	SP Meter Reading	Height from rail top (mm)
			B-E	N-E	BN					
9										
10										
11										
12										
13										
14										
15										
16										
17										

No	S&P Meter Identity	Voltmeter Identity	Comments	Signature	Name &Company	Date
9						
10						
11						
12						
13						
14						
15						
16						
17						

Network Rail	# AWS Test - Suppressed Permanent and Electro-Magnet Maintenance Test	**Form: NR/SMS/AW11/T024/RC02** **Date: 01/09/2018** **Issue: 03**

Signal Box / Interlocking:	Location:	Signal / AWS Number

No	Suppressed Permanent Magnet							Electro-Magnet							
	De-energised	Energised				Height from rail top (mm)	Spark Quench Diode/ Resistor	SP Meter Reading		Voltage Reading			Height from rail top (mm)	Current when Signal at G (A)	Spark Quench Diode/ Resistor
	SP Meter Reading	SP Meter Reading	Voltage Reading Earth Test (V)				Resistance (Ohms)	Signal at R, Y or YY	Signal at G	Earth Test (V) (Magnet Energised)					Resistance (Ohms)
			B-E	N-E	BN					B-E	N-E	BN			
1															
2															
3															
4															
5															
6															
7															
8															

No	S&P Meter Identity	Voltmeter Identity	Comments	Signature	Name & Company	Date
1						
2						
3						
4						
5						
6						
7						
8						

Network Rail	**AWS Test - Suppressed Permanent and Electro-Magnet** Maintenance Test	**Form: NR/SMS/AW11/T024/RC02** **Date: 01/09/2018** **Issue: 03**

No	Suppressed Permanent Magnet							Electro-Magnet							
	De-energised	Energised				Height from rail top (mm)	Spark Quench Diode/ Resistor	SP Meter Reading		Voltage Reading			Height from rail top (mm)	Current when Signal at G (A)	Spark Quench Diode/ Resistor
	SP Meter Reading	SP Meter Reading	Voltage Reading Earth Test (V)				Resistance (Ohms)	Signal at R, Y or YY	Signal at G	Earth Test (V) (Magnet Energised)					Resistance (Ohms)
			B-E	N-E	BN					B-E	N-E	BN			
9															
10															
11															
12															
13															
14															
15															
16															
17															

No	S&P Meter Identity	Voltmeter Identity	Comments	Signature	Name & Company	Date
9						
10						
11						
12						
13						
14						
15						
16						
17						

Network Rail	**AWS Test - Permanent Magnet Only** Maintenance Test	**Form: NRSMS/AW11/T024/RC03** **Date: 01/09/2018** **Issue: 02**

Signal Box / Interlocking:	Location:	Signal / AWS Number

SP Meter Reading	Height from rail top (mm)	SP Meter Identity	Comments	Signature	Name & Company	Date

AWS Test - Permanent Magnet Only

Maintenance Test

Form: NRSMS/AW11/T024/RC03
Date: 01/09/2018
Issue: 02

SP Meter Reading	Height from rail top (mm)	SP Meter Identity	Comments	Signature	Name & Company	Date

Signal Box / Interlocking / Location:	Detection Point Name:	Axle Counter Section(s):

	Incoming Supply NS	Output Voltage	TX 1 Frequency Terminals 6 & 7	TX 2 Frequency Terminals 8 & 9	Receiver Voltage UE1 Terminals 1 & 2	Receiver Voltage UE2 Terminals 3 & 4
Desired Value	60V DC	Min 1V AC	43kHz	43kHz	-	-
Tolerance Range	30 to 72V	0.48 to 1.8V	41.5 to 44.5 kHz	41.5 to 44.5 kHz	60 to 150 mV	60 to 150 mV
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						
13						

	Siemens Axle Counter: AzS ZPD 43 Wheel Detector Equipment	Form: NR/SMS/AX28/RC01 Date: 02/12/2023 Issue: 02

No	P/way condition at head. Detail as per SMS AX28 Service A 1.3 & 1.5	Comments: *Adjustments, Condition Etc*	Head removed, replaced or renewed?	Meter(s) Identity	Name & Company	Date
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						
13						

General Comments

	Siemens Axle Counter: AzS ZP 43 V Wheel Detector Equipment	Form: NR/SMS/AX29/RC01 Date: 02/12/2023 Issue: 03

Signal Box / Interlocking / Location:	**Detection Point Name:**	**Axle Counter Section(S):**

	Supply U60	Operating Voltage U24	Wheel Detector Frequency FS	Receiver Voltage UE1	Receiver Voltage UE2	Standard Voltage Ur1	Standard Voltage Ur2	Frequency F1	Frequency F2	Output Voltage UL
Desired Value	60V DC	22V DC	43kHz	-	-	5.5V DC	5.5V DC	3.60kHz	6.52kHz	Min 1.0 V AC
Tolerance Range	30 to 72V	21.3 to 22.4V	42.8 to 43.2 kHz	60mV to 150mV	60mV to 150mV	5.3V to 6.0 V	5.2V to 5.9 V	3.55 to 3.65 kHz	6.42 to 6.62kHz	0.48-1.8V
01										
02										
03										
04										
05										
06										
07										
08										
09										
10										
11										
12										
13										

Network Rail	Siemens Axle Counter: AzS ZP 43 V Wheel Detector Equipment	Form: NR/SMS/AX29/RC01 Date: 02/12/2023 Issue: 03

No	Date	Name & Company	Meter(s) Identity	Comments:	Head removed, replaced, or renewed?	P/way condition at head
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						
13						

Network Rail	**Siemens Axle Counter – AzSM (E) Evaluator Record Card**	**Form: NR/SMS/AX30/RC01** **Date: 04/06/2022** **Issue: 03**

Signal Box / Interlocking:	Location	Evaluator Name:

	ZAN Ident																
	Head Ident																
Entry No	Date	Volts U1	Freq f1	Volts U2	Freq f2	Volts U1	Freq f1	Volts U2	Freq f2	Volts U1	Freq f1	Volts U2	Freq f2	Volts U1	Freq f1	Volts U2	Freq f2
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	

		Form: NR/SMS/AX30/RC01 Date: 04/06/2022 Issue: 03
Network Rail	**Siemens Axle Counter – AzSM (E) Evaluator Record Card**	**Form: NR/SMS/AX30/RC01** **Date: 04/06/2022** **Issue: 03**

No	Date	Name & Company	Meter(s) Identity	Comments:	Head removed/ replaced or renewed?	P/way condition at head
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

NetworkRail	Siemens Axle Counter: AzS 350U Evaluator	Form: NR/SMS/AX31/RC01 Date: 02/12/2023 Issue: 02

Signal / Interlocking / Location	ACE Location / Number

	VESBA Card Slot No				VESBA Card Slot No				VESBA Card Slot No			
	Detection Point Name				Detection Point Name				Detection Point Name			
	Voltage Ur1	Frequency F1	Voltage Ur2	Frequency F2	Voltage Ur1	Frequency F1	Voltage Ur2	Frequency F2	Voltage Ur1	Frequency F1	Voltage Ur2	Frequency F2
Desired Value	3V DC	3.6kHz	3V DC	6.52kHz	3V DC	3.6kHz	3V DC	6.52kHz	3V DC	3.6kHz	3V DC	6.52kHz
Tolerance Range	2.9 to 3.1 V	3.55 to 3.65kHz	2.9 to 3.1 V	6.42 to 6.62kHz	2.9 to 3.1 V	3.55 to 3.65kHz	2.9 to 3.1 V	6.42 to 6.62kHz	2.9 to 3.1 V	3.55 to 3.65kHz	2.9 to 3.1 V	6.42 to 6.62kHz
01												
02												
03												
04												
05												
06												
07												
08												
09												
10												
11												
12												

NetworkRail	Siemens Axle Counter: AzS 350U Evaluator	Form: NR/SMS/AX31/RC01 Date: 02/12/2023 Issue: 02

	VESBA Card Slot No				VESBA Card Slot No							
	Detection Point Name				Detection Point Name							
	Voltage Ur1	Frequency F1	Voltage Ur2	Frequency F2	Voltage Ur1	Frequency F1	Voltage Ur2	Frequency F2				
Desired Value	3V DC	3.6kHz	3V DC	6.52kHz	3V DC	3.6kHz	3V DC	6.52kHz	Date	Name & Company	Signature	Meter ID
Tolerance Range	2.9 to 3.1 V	3.55 to 3.65kHz	2.9 to 3.1 V	6.42 to 6.62kHz	2.9 to 3.1 V	3.55 to 3.65kHz	2.9 to 3.1 V	6.42 to 6.62kHz				
01												
02												
03												
04												
05												
06												
07												
08												
09												
10												
11												
12												

Network Rail	Wheel Sensor – RSR 123 Maintenance Tests	Form: NR/SMS/AX40-41/RC01 Date: 05/12/2020 Issue: 01

Signal Box / Interlocking / Equipment Room:	Location:		Detection Point / Name:
AEB/IMC ID:	FAdC EBI Gate 200 Vamos (#)	Cable Length:	No of Plug Couplers:

This Record Card is not mandated, as some systems have in built Data Recording Capabilities. You are only required to complete the sections of this card related to the service that you are undertaking

					AX40 Periodic Task 3				AX41 LC70 LC71 Service B		AX41 Periodic Task 2			
					Sensor Height		Sensor Depth		Lifecycle Readings		Rail Sensor Torque Adjusted ?			
Date	Name	Company	Signature	Meter ID	40-45mm	Adjusted	0 – 6mm	Adjusted	System 1 - 475 to 525mv	System 2 - 475 to 525mv	Allen Screws - 25Nm	M10 Nuts - 15Nm	M12 Nuts – 40Nm	Spring Washer in contact
						Y / N		Y / N			Y / N	Y / N	Y / N	Y / N
						Y / N		Y / N			Y / N	Y / N	Y / N	Y / N
						Y / N		Y / N			Y / N	Y / N	Y / N	Y / N
						Y / N		Y / N			Y / N	Y / N	Y / N	Y / N
						Y / N		Y / N			Y / N	Y / N	Y / N	Y / N
						Y / N		Y / N			Y / N	Y / N	Y / N	Y / N
						Y / N		Y / N			Y / N	Y / N	Y / N	Y / N
						Y / N		Y / N			Y / N	Y / N	Y / N	Y / N
						Y / N		Y / N			Y / N	Y / N	Y / N	Y / N
						Y / N		Y / N			Y / N	Y / N	Y / N	Y / N
						Y / N		Y / N			Y / N	Y / N	Y / N	Y / N
						Y / N		Y / N			Y / N	Y / N	Y / N	Y / N
						Y / N		Y / N			Y / N	Y / N	Y / N	Y / N

(#) Indicate type of Use

NetworkRail	**Siemens Axle Counter ACM 100,** **WSD Wheel Detector Record Card (Front)** **NR/SMS/AX51 - NR/SMS/Test/ 038, 039**	**Form: NR/SMS/AX51/ /RC/01** **Date: 03/03/18** **Issue: 01**

Signal Box / Interlocking:	**REB / Location**:	**WSD Identity**:	**WSD powered by ACM**:
WSD information used by ACM: **ACM Identity** **REB/Location**			

NR/SMS/Test/039 – In Service Functional Test of the Wheel Detector

1 – Mark a line to note the position of the centre marking in relation to "OFF 1" when current = 4.75mA to 5.25mA 2 - Mark a line to note of the centre marking in relation to "ON 1" when current = 1.3mA to 2.99mA	1 - Mark a line to note position of the centre marking in relation to "OFF 2" when current = 4.75mA to 5.25mA 2 - Mark a line to note position of the centre marking in relation to "ON 2" when current = 1.3mA to 2.99mA

Note: The acceptable "pass" area on the test block is marked by both the area within the two vertical lines and the full length of the marker arrows.

FAIL | PASS | FAIL

←| Off 1 |←

If outside this area – Check Height of WSD (43mm and 45mm from rail head throughout) – Check for Metal Debris – Check WSD Fixings.

If "fail" Recalibrate WSD – Follow NR/SMS/Test/038

Date	Technician Name	←| Off 1 |← 1.5	Step	→| On 1 |→ 1.6	Step	→| Off 2 |→ 1.10	Step	←| On 2 |← 1.11	Step	Recalibration Undertaken

		←| Off 1 |←	→| On 1 |→	→| Off 2 |→	←| On 2 |←	Yes/No
		←| Off 1 |←	→| On 1 |→	→| Off 2 |→	←| On 2 |←	Yes/No
		←| Off 1 |←	→| On 1 |→	→| Off 2 |→	←| On 2 |←	Yes/No
		←| Off 1 |←	→| On 1 |→	→| Off 2 |→	←| On 2 |←	Yes/No
		←| Off 1 |←	→| On 1 |→	→| Off 2 |→	←| On 2 |←	Yes/No
		←| Off 1 |←	→| On 1 |→	→| Off 2 |→	←| On 2 |←	Yes/No

	Siemens Axle Counter ACM 100, **WSD Wheel Detector Record Card (Rear)** **NR/SMS/AX51 - NR/SMS/Test/ 038, 039**	**WSD ID:**	**Form: NR/SMS/AX51/T038,039/RC/01** **Date: 03/03/18** **Issue: 01**

NR/SMS/Test/039 – In Service Functional Test of the Wheel Detector - Continued

Date	Technician Name	←| Off 1 |← Step 1.5	→| On 1 |→ Step 1.6	→| Off 2 |→ Step 1.10	←| On 2 |← Step 1.11	Recalibration Undertaken
		←| Off 1 |←	→| On 1 |→	→| Off 2 |→	←| On 2 |←	Yes/No
		←| Off 1 |←	→| On 1 |→	→| Off 2 |→	←| On 2 |←	Yes/No
		←| Off 1 |←	→| On 1 |→	→| Off 2 |→	←| On 2 |←	Yes/No

		←| Off 1 |←	→| On 1 |→	→| Off 2 |→	←| On 2 |←	Yes/No

NR/SMS/Test/038 – Calibration of Wheel Detector										
Date	Technician Name	Step 1.4. Record Current (1.3 - 7mA)	Step 1.5 Record Current (1.2 – 2.99mA)	Step 1.6. Record Current (4.75 – 5.25mA)	Pass / Fail	Step 1.9. Record Current (1.3 - 7mA)	Step 1.10. Record Current (1.2 – 2.99mA)	Step 1.11 Record Current (4.75 – 5.25mA)	Pass / Fail	Comments (e.g Is WSD Changed?)

	Train Entering Terminal Station (TETS) Record Card – Service B	Form: NR/SMS/AX99 - TETS Date: March 2018 Issue: 01

Site Name :	Mileage: m ch

No	Date		T1				T2			T3					T4				Supply Voltage (45-72 VDC)	Name / Signature
			Channel 1	Channel 2	Channel 3	Channel 4	Channel 1	Channel 2	Channel 3	Channel 4	Channel 1	Channel 2	Channel 3	Channel 4	Channel 1	Channel 2	Channel 3	Channel 4		
1		Lower																		
		Upper																		
2		Lower																		
		Upper																		
3		Lower																		
		Upper																		
4		Lower																		
		Upper																		
5		Lower																		
		Upper																		
6		Lower																		
		Upper																		
7		Lower																		
		Upper																		
8		Lower																		
		Upper																		
9		Lower																		
		Upper																		
10		Lower																		
		Upper																		

NetworkRail	Control System: TEML41	**Form: NR/SMS/CS02/RC01** **Date: 05/12/2020** **Issue: 01**

Signal Box:	Remote Control / Panel Multiplexer *Delete as appropriate*	PSB System Name*:	Interlocking Name*:

Service A Tests					
System Status Indications OK**	Outstanding Faults	Comments	Signature	Name & Company	Date

* For RC systems enter details to indicate system or interlocking

** Insert tick if all correct, problems to be listed in the comment's column

NetworkRail	Control System: TEML41	Form: NR/SMS/CS02/RC01 Date: 05/12/2020 Issue: 01

Number	Service B Tests																	
	Power Supply Voltages																	
	Supply 1						Supply 2						Dual Feed					
	Logic Shelve1		Logic Shelve2		Comms		Logic Shelve1		Logic Shelve 2		Comms		Logic Shelve1		Logic Shelve 2		Comms	
	DC Level	AC Ripple	DC Level	AC Ripple	DC Level	AC Ripple	DC Level	AC Ripple	DC Level	AC Ripple	DC Level	AC Ripple	DC Level	AC Ripple	DC Level	AC Ripple	DC Level	AC Ripple
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		

Number	Power Supply Voltages						Line Levels (dB)		Comments	Test Equipment Identity	Signature	Name & Company	Date
	Other Supplies												
	1:		2:		3:								
	DC Level	AC Ripple	DC Level	AC Ripple	DC Level	AC Ripple	Tx	Rx					
1													
2													
3													
4													
5													
6													
7													
8													

* Insert tick if all correct, problems to be detailed

	Control System: GETS DM11	**Form: NR/SMS/CS03/RC01** **Date: 05/12/2020** **Issue: 01**

PSB:	TDM/Pnmulx:	PSB System Name*:	Interlocking Name/SSI Location*:

Service A Tests															
Cubicle		Power Supplies						External Channel Counts			Comments	Meter Identity	Signature	Name & Company	Date
System Status Indications OK**	System C/over OK**	5V Logic		7V Logic		12V Interface									
		DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	ack	nak	No Response					

* Enter details as appropriate to system

** Insert tick if all correct, problems to be listed in the comment's column

NetworkRail	**Control System: GETS DM11**	**Form: NR/SMS/CS03/RC01** **Date: 05/12/2020** **Issue: 01**

Service B Tests (TDM systems Only)					Comments	Test Equipment Identity	Signature	Name & Company	Date
Line levels (dBm)		PSU O/P to TDM							
Tx	Rx	V (Max)	V (min)	Waveform*					

* Insert tick if all correct, problems to be detailed

General System Comments and Observations	Name	Company	Date

NetworkRail	**Control & Interface System: GETS Delphin 1024**	**Form: NR/SMS/CS04/RC01** **Date: 05/12/2020** **Issue: 01**

PSB:	Delphin1024 System*: RC/TDM PIIU PMUX TDMUX	PSB System Name**:	Interlocking Name/SSI Location**:

Service A Tests											
Cubicle		Mains Surge Protectors			External Channel Counts			Comments	Signature	Name & Company	Date
System Status Indications OK***	System Change Over OK***	Status Indications ***									
		OK	Partial	Failed	ack	nak	No Response				

* Delete as appropriate

** Enter details as appropriate to system

*** Insert tick, problems to be listed in the comment’s column

	Control & Interface System: GETS Delphin 1024	Form: NR/SMS/CS04/RC01 Date: 05/12/2020 Issue: 01

Service B Tests

Line levels (dBm)		Power Supplies (DC Volts)**						PSU Comments	Test Equipment Identity	Signature	Name & Company	Date
Tx	Rx	7V Logic	12V interface	24 V Interface	12V External	24V External	48V External					

General System Comments and Observations	Name	Company	Date

** Enter details as appropriate to system

NetworkRail	Control & Interface System: GETS Sapphire T48	**Form: NR/SMS/CS05/RC01** **Date: 05/12/2020** **Issue: 01**

PSB:	Sapphire T48 System*: CBI Interface / TD Interface / SPAD Alert	PSB System Name**:	Remote Interlocking Name **:

Service A Tests

Cubicle		Mains Surge Protectors			External Channel Counts			Comments	Signature	Name & Company	Date
System Status Indications OK***	System Change Over OK***	Status Indications ***									
		OK	Partial	Failed	ack	nak	No Response				

* Delete as appropriate

** Enter details as appropriate to system

*** Insert tick, problems to be listed in the comment’s column

Service B Tests

Power Supplies (DC Volts)**		Comments	Test Equipment Identity	Signature	Name & Company	Date
6V	5V					

	Wiring Degradation Record Card (Front) NR/SMS/EL21 - EL31	Form: NR/SMS/EL21/31/RC/01 Date: August 2004 Issue: 01

Signal Box:	Equipment/ Relay Room Name/Number:	Location Name/Number:

Initial Inspection

Degradation Type (Wet or Dry)	Wire Identity (Date and/or manufacture)	Wire Location (Rack, Relay etc)	Degree of Degradation#	Comments	Initial Inspection By	Company	Date

Maintenance Inspections

Degree of Degradation#	Comments	Signature	Name & Company	Date

#: Insert a number between 1 and 5 (1 Normal; 2 Fair; 3 Poor; 4 severe; 5 extreme)

Network Rail	**Wiring Degradation Record Card (Rear) NR/SMS/EL21 - EL31**	**Form: NR/SMS/EL21/31/RC/01** **Date: August 2004** **Issue: 01**

Maintenance Inspections				
Degree of Degradation#	Comments	Signature	Name & Company	Date

#: Insert a number between 1 and 5 (1 Normal; 2 Fair; 3 Poor; 4 severe; 5 extreme)

Network Rail	**Relay Plugboard Checks** **Record Card (Front)** **NR/SMS/EL21 - EL31**	**Form: NR/SMS/EL21/31/RC/02** **Date: August 2004** **Issue: 01**

Signal Box:	Equipment/ Relay Room Name/Number:	Location Name/Number:	Location Conditions *Inland, Costal, Industrial etc*

Rack / Unit:	Row:	Number of Plugboards*:*	Percentage Sample:	Heating Provided: Yes / No *Delete as appropriate*

Maintenance Inspections

Relay Function	Plugboard Colour	Plugboard Type	Comments *Including contamination type, internal conditions, action taken etc*	Signature	Name & Company	Date

Network Rail	**Relay Plugboard Checks** **Record Card (Rear)** **NR/SMS/EL21 - EL31**	**Form: NR/SMS/EL21/31/RC/02** **Date: August 2004** **Issue: 01**

Maintenance Inspections

Relay Function	Plugboard Colour	Plugboard Type	Comments *Including contamination type, internal conditions, action taken etc*	Signature	Name & Company	Date

Network Rail	**Site Attendance Record Card** Location Case	**Form: NR/SMS/EL21/RC/01** **Date: Sept 2018** **Issue: 02**

Signal Box: Location Name/Number:

Date	Time	Name (Print)	Signature	Company	Reason For Visit #	Comments

: If applicable enter a code for the visit [1/Maintenance 2/Faulting 3/Inspection Visit 4/Engineering Work 5/Wire Degradation Checks 6/Siver Migration Checks]

Network Rail	**Site Attendance Record Card** **Location Case**	**Form: NR/SMS/EL21/RC/01** **Date: Sept 2018** **Issue: 02**

Date	Time	Name (Print)	Signature	Company	Reason For Visit #	Comments

: If applicable enter a code for the visit [1/Maintenance 2/Faulting 3/Inspection Visit 4/Engineering Work 5/Wire Degradation Checks 6/Siver Migration Checks]

Network Rail	**Site Attendance Record Card** Equipment Room	**Form: NR/SMS/EL31/RC/01** **Date: Sept 2018** **Issue: 03**

Signal Box: Location Name/Number:

Date	Time	Name (Print)	Signature	Company	Reason For Visit #	Temp On Arrival	Comments

: If applicable enter a code for the visit [1/Maintenance 2/Faulting 3/Inspection Visit 4/Engineering Work 5/Wire Degradation Checks 6/Siver Migration Checks]

Network Rail	**Site Attendance Record Card** Equipment Room	**Form: NR/SMS/EL31/RC/01** **Date: Sept 2018** **Issue: 03**

Date	Time	Name (Print)	Signature	Company	Reason For Visit #	Temp On Arrival	Comments

: If applicable enter a code for the visit [1/Maintenance 2/Faulting 3/Inspection Visit 4/Engineering Work 5/Wire Degradation Checks 6/Siver Migration Checks]

Network Rail	**Instead Signalling Event Recorder Record Card (Front) NR/SMS/ER11**	**Form: NR/SMS/ER11/RC/01** **Date: August 2004** **Issue: 01**

Signal Box / Interlocking:	Location:	Instead Type:	Identity Number:

Service A Tests*		Comments	Signature	Name & Company	Date
Correct Indications	Correct Time & Date				

*: Insert tick if correct

Network Rail	**Instead Signalling Event Recorder Record Card (Rear) NR/SMS/ER11**	**Form: NR/SMS/ER11/RC/01** **Date: August 2004** **Issue: 01**

Service B Tests						Comments	Signature	Name & Company	Date
Self Test Routine *	Disk Drive Cleaned **	Disk Interrogated **	Functions Operating **	Cyclon Battery Renewed **	Clock Battery Renewed **				

* Insert tick if correct **: Insert Yes / No as appropriate

Network Rail	HABD Equipment: GETS FÜES Record Card (Front) NR/SMS/HO11 – T/087	Form: NR/SMS/HO11/T087/RC/01 Date: April 2006 Issue: 01

Signal Box / Interlocking:	Location:

Number	Service A Tests							Service B Tests						
	Field End							Field End						
	REB Cubicle Checks *							REB Cubicle Voltage Tests [5.1]						
	Voltage Arresters [1.3]	Power Supplies [1.4]	Simplex/ Duplex Cards [1.5]	Wheel Sensor Cards [1.6]	UPS [1.7]	CAN Tool Tests [1.10]	Optical Deterioration [1.11]	+ 12V Measuring Head	-12v Measuring Head	+12v Cooler CAN	-12v CAN	+24 CAN	+5v CAN	UPS Test Note Max Batt. Capacity [5.2]
1														
2														
3														
4														
5														
6														
7														
8														

Number	Service B Tests										Meter Identity	Signature	Name & Company	Date
	Field End													
	Wheel Sensor Checks * [6.5]	Mirror Checks		Function Tests * [8.1]	Calibration (Appendix A) * [7.21]									
		Cleaned Yes/No	Recalibrated Yes/No [7.20]		Internal			External						
					HOAL	HOAR	FBOA	HOAL	HOAR	FBOA				
1														
2														
3														
4														
5														
6														
7														
8														

*: Insert tick if correct to NR/SMS steps   Note: numbers in the [] brackets refer to the NR/SMS steps

Network Rail	HABD Equipment: GETS FÜES Record Card (Rear) NR/SMS/HO11 – T/087	Form: NR/SMS/HO11/T087/RC/01 Date: April 2006 Issue: 01

Number	Service B Tests																		
	Field End																		
	Sensor Alignment (Appendix B)												Wheel Sensor Alignment (Appendix C) *			Components Replaced			
	HOAL(Element)				HOAR(Element)				FBOA(Element)				Sensor RR	Sensor MK	Sensor GR	Component Details & Serial No	Signature	Name & Company	Date
	0	1	2	3	5	6	7	8	0	1	2	3							
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			

Number	Comments	Meter Identity	Signature	Name & Company	Date
1					
2					
3					
4					
5					
6					
7					
8					

*: Insert tick if correct to NR/SMS steps

Network Rail	HABD Equipment: Phoenix MB Record Card - Accuracy Test	Form: NR/SMS/HO12 Date: March 2018 Issue: 01

SCT	Mileage: m ch	Serial No:	Software Version:	Track: From To

	Nominal Values	Actual Values					
Accuracy of Sensors		HDB1 Left	HDB2 Right	HWB1 Left	HWB1 Right	HWB2 Left	HWB2 Right
Sensor Serial No:							
HBD Test temp.1	70ºC +- 3ºC						
HBD Test temp.2	120ºC +- 5ºC						
HWD Test temp.1	300ºC +- 10ºC						
HWD Test temp.2	400ºC +- 20ºC						
	Date						
	Signature & Initials						

	Nominal Values	Actual Values					
Accuracy of Sensors		HDB1 Left	HDB2 Right	HWB1 Left	HWB1 Right	HWB2 Left	HWB2 Right
Sensor Serial No:							
HBD Test temp.1	70ºC +- 3ºC						
HBD Test temp.2	120ºC +- 5ºC						
HWD Test temp.1	300ºC +- 10ºC						
HWD Test temp.2	400ºC +- 20ºC						
	Date						
	Signature & Initials						

	Nominal Values	Actual Values					
Accuracy of Sensors		HDB1 Left	HDB2 Right	HWB1 Left	HWB1 Right	HWB2 Left	HWB2 Right
Sensor Serial No:							
HBD Test temp.1	70ºC +- 3ºC						

	Nominal Values	Actual Values					
Accuracy of Sensors		HDB1 Left	HDB2 Right	HWB1 Left	HWB1 Right	HWB2 Left	HWB2 Right
Sensor Serial No:							
HBD Test temp.1	70ºC +- 3ºC						
HBD Test temp.2	120ºC +- 5ºC						
HWD Test temp.1	300ºC +- 10ºC						
HWD Test temp.2	400ºC +- 20ºC						
	Date						
	Signature & Initials						

	Nominal Values	Actual Values					
Accuracy of Sensors		HDB1 Left	HDB2 Right	HWB1 Left	HWB1 Right	HWB2 Left	HWB2 Right
Sensor Serial No:							
HBD Test temp.1	70ºC +- 3ºC						
HBD Test temp.2	120ºC +- 5ºC						
HWD Test temp.1	300ºC +- 10ºC						
HWD Test temp.2	400ºC +- 20ºC						
	Date						
	Signature & Initials						

	Nominal Values	Actual Values					
Accuracy of Sensors		HDB1 Left	HDB2 Right	HWB1 Left	HWB1 Right	HWB2 Left	HWB2 Right
Sensor Serial No:							
HBD Test temp.1	70ºC +- 3ºC						

HBD Test temp.2	120ºC +- 5ºC						
HWD Test temp.1	300ºC +- 10ºC						
HWD Test temp.2	400ºC +- 20ºC						
	Date						
	Signature & Initials						

HBD Test temp.2	120ºC +- 5ºC						
HWD Test temp.1	300ºC +- 10ºC						
HWD Test temp.2	400ºC +- 20ºC						
	Date						
	Signature & Initials						

Network Rail	**HABD Equipment: Phoenix MB Record Card – Calibration Test**	**Form: NR/SMS/HO12** **Date: March 2018** **Issue: 01**

Site Name :	**Mileage: m ch**	**Serial No:**	**Software Version:**	**Track: From To**

Date	**Temp Range**	**HBD1 (left)**	**HBD2 (right)**	**HDW1 (left, rail)**				**HWD1 (left, centre)**				**HWD2 (right, rail)**				**HWD2 (right, centre)**				**Signature**
				Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	
	Lower																			
	Upper																			
	Lower																			
	Upper																			
	Lower																			
	Upper																			
	Lower																			
	Upper																			
	Lower																			
	Upper																			
	Lower																			
	Upper																			
	Lower																			
	Upper																			

	Lower																			
	Upper																			
	Lower																			
	Upper																			
	Lower																			
	Upper																			

NetworkRail	Ansaldo-STS Interlocking System Colour Light Signalling System (SEI-CLSS)	Form: NR/SMS/IE29/RC/01 Date: March 2018 Issue: 01

Signal Box / Interlocking:	Location:	

No.	Battery						
	Serial No	Active Card	Installed Date	Expiry Date	Comments	Signature	Name & Company
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							

Signal Box / Interlocking:	Location:	

NetworkRail	**Ansaldo-STS Interlocking System Colour Light Signalling System (SEI-CLSS)**	**Form: NR/SMS/IE29/RC/01** **Date: March 2018** **Issue: 01**

No.	Battery Serial No	Spare Card	Installed Date	Expiry Date	Comments	Signature	Name & Company
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							

Network Rail	RETB Fixed Station Tests Record Card (Front) NR/SMS/IR11	Form: NR/SMS/IR11/RC/01 Date: August 2004 Issue: 01

Signal Box:	Location / Site:

Station Type*: CA /CB / SC / CD / CE	Adjacent Station (1):	Adjacent Station (2):

Number	Power Supply (V)				Aerial System (dBm)		Receiver Tests							Transmitter Tests		
	Battery Charger (Mains On)	Battery Charger (F/S on Key)	Internal 5V	Internal 24V	Signal Strength From Station (1)	Signal Strength From Station (2)	Rf Rx Frequency (MHz)	12dB SINAD	Squelch Threshold (dBm)	Af O/P @ 1.5KHz (dBm)	Rx Af Distortion (%)	3825Hz SAT Sensitivity (Hz)	3825Hz SAT Frequency B/W (Hz)	Rf Tx Frequency (MHz)	Tx O/P Power (W)	Peak Deviation (KHz)
1																
2																
3																
4																

Number	Transmitter Tests					Duplex Tests				Modem Tests				Duplexor Tests	
	Af level for 1.5KHz Deviation		Tx Af Distortion (%)	3825Hz SAT Level (KHz)	3825Hz SAT Frequency (Hz)	Through Level Deviation (Measured at)		Through Level Deviation (Adjusted to)		Data '1'		Data '2'		O/P from Tx Tray (dBm)	O/P from Duplexor (dBm)
	@1KHz	@1.5KHz				@1KHz	@1.5KHz	@1KHz	@1.5KHz	1200Hz Tx Level	1200Hz Rx Level	1800Hz Tx Level	1800Hz Rx Level		
1															
2															
3															
4															

Number	Duplexor Tests		Functional Tests*					Test Equipment Identities				Signature	Name & Company	Date
	12dB SINAD Tx Off (dBm)	12dB SINAD Tx On (dBm)	Monitor Panel	Token Exchange	Auto Test from SC	Disable/ Enable from SC	Block Bell to/from SC	Multi-Meter	Power Meter	2955A Test Set	Spectrum Analyser			
1			Pass / Fail	Pass / Fail	Pass / Fail	Pass / Fail	Pass / Fail							
2			Pass / Fail	Pass / Fail	Pass / Fail	Pass / Fail	Pass / Fail							
3			Pass / Fail	Pass / Fail	Pass / Fail	Pass / Fail	Pass / Fail							
4			Pass / Fail	Pass / Fail	Pass / Fail	Pass / Fail	Pass / Fail							

*: Delete as Applicable   Note: Details to be filled in as applicable to the installation under test

Network Rail	**RETB Fixed Station Tests** **Record Card (Rear)** **NR/SMS/IR11**	**Form: NR/SMS/IR11/RC/01** **Date: August 2004** **Issue: 01**

Number	Comments
1	
2	
3	
4	

Network Rail	**Vital Harmon Logic Controller (VHLC)** Maintenance Record Card	**Form: NR/SMS/IS15/RC/VHLC** **Date: Sept 2018** **Issue: 02**

Signal Box:	**Location / Equipment Room:**	**Number of Vital Input / Output Modules:**

Date	Name /Company	Signature	Meter ID	PS Module + & - Terminals of TB1 (DC)	PS Module TP1 & TP2 (DC)	VLP Module TP1 & TP 2 (DC)	VLP Module TP1 & TP 2 (DC) minus PS Module TP1 & TP2 (DC)	ACP Module TP1 and TP2 (DC) Battery Voltage	NVIO Module TP1 & TP3 (DC) #	Comments

Interlocking Only

Network Rail	**Vital Harmon Logic Controller (VHLC)** Maintenance Record Card	**Form: NR/SMS/IS15/VHLC** **Date: Sept 2018** **Issue: 02**

Date	**Name /Company**	**Signature**	**Meter ID**	**PS Module** + & - Terminals of TB1 (DC)	**PS Module** TP1 & TP2 (DC)	**VLP Module** TP1 & TP 2 (DC)	**VLP Module** TP1 & TP 2 (DC) minus **PS Module** TP1 & TP2 (DC)	**ACP Module** TP1 and TP2 (DC) **Battery Voltage**	**NVIO Module** TP1 & TP3 (DC) #	**Comments**

Interlocking Only

NetworkRail	Harmon Crossing Processor (HXP-3)	NR/SMS/PartR/IS30/RC01	
		Date:	**05/12/2020**
		Issue No:	**01**

Signal Box:	Level Crossing:

No.	Service A Tasks																		
	Normal Standby Operation	Transfer Operation*		System Parameters (Current)								System Parameters (After any Adjustments)							
		MDR Failure	ISL Failure	RX-POT	RX	PHASE	TC	BC	P-COMP	FS	LP	RX-POT	RX	PHASE	TC	BC	P-COMP	FS	LP
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			

No.	Date	Name	Company	Comments
1				
2				
3				
4				
5				
6				
7				
8				
9				

* Insert tick if transfer operation is correct

Network Rail	WESTeX LCP3000 Crossing Predictor Record Card (Front) NR/SMS/IS35 and NR/SMS/Test/155	Form: NR/SMS/IS35/RC/01 Date: December 2016 Issue: 01

Signal Box:	**Level Crossing:**	**Location Number:**

Service A Test *(Required every 3 Months)*

No	Reading	T1		T2		Comments (Changes, Error Codes, Last WT/Det/Ave/Isl Speeds)
1	Status of EZ and EX	EZ=	EX=	EZ=	EX=	
	Ex at Highest EZ					
	EZ at Lowest EX					
	Transmit (Xmit) Volt/Cur	V	A	V	A	
	+/- 5v Power Supply					
	+/- 8v Power Supply					
	+/- 15v Power Supply					
No	**Reading**	**T1**		**T2**		**Comments (Changes, Error Codes, Last WT/Det/Ave/Isl Speeds)**
2	Status of EZ and EX	EZ=	EX=	EZ=	EX=	
	Ex at Highest EZ					
	EZ at Lowest EX					
	Transmit (Xmit) Volt/Cur	V	A	V	A	
	+/- 5v Power Supply					
	+/- 8v Power Supply					
	+/- 15v Power Supply					
No	**Reading**	**T1**		**T2**		**Comments (Changes, Error Codes, Last WT/Det/Ave/Isl Speeds)**
3	Status of EZ and EX	EZ=	EX=	EZ=	EX=	
	Ex at Highest EZ					
	EZ at Lowest EX					
	Transmit (Xmit) Volt/Cur	V	A	V	A	
	+/- 5v Power Supply					
	+/- 8v Power Supply					
	+/- 15v Power Supply					
No	**Reading**	**T1**		**T2**		**Comments (Changes, Error Codes, Last WT/Det/Ave/Isl Speeds)**
4	Status of EZ and EX	EZ=	EX=	EZ=	EX=	
	Ex at Highest EZ					
	EZ at Lowest EX					
	Transmit (Xmit) Volt/Cur	V	A	V	A	
	+/- 5v Power Supply					
	+/- 8v Power Supply					
	+/- 15v Power Supply					

No Above	Comments 1 to 4 (1) Maintenance (2) Faulting (3) Engineering Work (4) Other		Technicians Name	Company	Date

A Separate Record Card will be completed for each visit to this WESTeX LCP3000 Site (to cover Service B Tests)

Network Rail	WESTeX LCP3000 Crossing Predictor Record Card (Rear) NR/SMS/IS35 and NR/SMS/Test/155	Form: NR/SMS/IS35/RC/01 Date: January 2016 Issue: 01

Signal Box:	**Level Crossing:**	**Location Number:**

No:	**Service B Test** *(Required every 12 Months or After Significant Change to the Infrastructure with the LCP Approach Distances)*												
	80012 TRANSCEIVER MODULE DC VOLTAGE READINGS AFTER CALIBRATION		**CALIBRATION HISTORY**		**LINEARIZATION HISTORY**								
			EZ/EX VALUES TRACK UN-OCCUPIED		**HARDWIRED TEST SHUNT AT TERMINATION SHUNT**			**HARDWIRED TEST SHUNT AT 50 PERCENT POINT OF TRACK APPROACH**					
	T1	**T2**	**EZ**	**EX**	**EZ VALUE (Test)**	**EX VALUE**	**EZ/2 VALUE (Calc) [Not for Sim Inductor] (A)**	**NO LINEARIZATION**		**LINEARIZATION COMPLETE**			
1	Z1=	Z1=						**EZ (Test) (B)**	**EX**	**STEP +/- (A - B) x 2 = C (C)**	**EZ**	**EX**	**Step Value Entered into LCP**
	Z2=	Z2=											
	TRACK 1 (UP)												
	TRACK 1 (DN)												
	TRACK 2 (UP)												
	TRACK 2 (DN)												

Warning Time Selected					**Comments**
	T1(Sec):		**T1(Sec):**		
	T2(Sec):		**T2(Sec):**		
Approach Distance → Selected	**T1(Ft) :**		**T1(Ft) :**		
	T2(Ft) :		**T2(Ft) :**		
→ Computed	**T1(Ft) :**		**T1(Ft) :**		
	T2(Ft) :		**T2(Ft) :**		
UAX1 Pickup Delay (UAX) (0=Off)					

Reading	**T1**	**T2**	**Comments**
Status of EZ and EX	EZ= EX=	EZ= EX=	
Ex at Highest EZ			
EZ at Lowest EX			
Transmit (Xmit) Voltage			
Transmit (Xmit) Current			
+/- 5v Power Supply			
+/- 8v Power Supply			
+/- 15v Power Supply			

Comments	**Technicians Name**	**Company**	**Date**

Network Rail	**Obstacle Detector** **PA05/04485 LB Foster / Optex Redscan RLS3060 series LIDAR Record Card**	**Form: NR/SMS/LC09/RC01** **Date: 07/03/2019** **Issue: 3**

	Date					
HL_____	Beam Height TOP of Beam	mm	mm	mm	mm	mm
	Beam Height BOTTOM of Beam	mm	mm	mm	mm	mm
HL_____	Beam Height TOP of Beam	mm	mm	mm	mm	mm
	Beam Height BOTTOM of Beam	mm	mm	mm	mm	mm

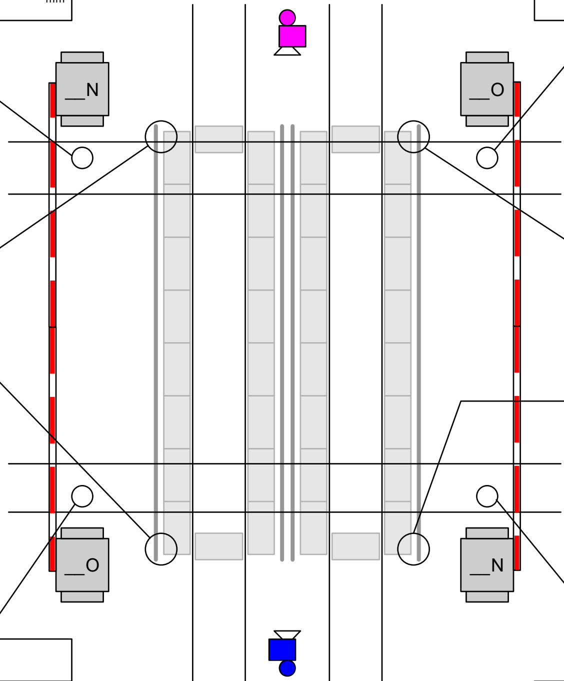
HL NDZ	m
LL NDZ	m

COD/SPOD______

Flip__________

	Date					
HL_____	Beam Height TOP of Beam	mm	mm	mm	mm	mm
	Beam Height BOTTOM of Beam	mm	mm	mm	mm	mm
HL_____	Beam Height TOP of Beam	mm	mm	mm	mm	mm
	Beam Height BOTTOM of Beam	mm	mm	mm	mm	mm

Date					
LL____ Beam Height BoB	mm	mm	mm	mm	mm
LL____ Beam Height BoB	mm	mm	mm	mm	mm
LL____ Walk Test Distance	mm	mm	mm	mm	mm
LL____ Walk Test Distance	mm	mm	mm	mm	mm



Date					
LL____ Beam Height BoB	mm	mm	mm	mm	mm
LL____ Beam Height BoB	mm	mm	mm	mm	mm
LL____ Walk Test Distance	mm	mm	mm	mm	mm
LL____ Walk Test Distance	mm	mm	mm	mm	mm

Date					
LL____ Beam Height BoB	mm	mm	mm	mm	mm
LL____ Beam Height BoB	mm	mm	mm	mm	mm
LL____ Walk Test Distance	mm	mm	mm	mm	mm
LL____ Walk Test Distance	mm	mm	mm	mm	mm

Date					
LL____ Beam Height BoB	mm	mm	mm	mm	mm
LL____ Beam Height BoB	mm	mm	mm	mm	mm
LL____ Walk Test Distance	mm	mm	mm	mm	mm
LL____ Walk Test Distance	mm	mm	mm	mm	mm

	Date					
HL_____	Beam Height TOP of Beam	mm	mm	mm	mm	mm
	Beam Height BOTTOM of Beam	mm	mm	mm	mm	mm
HL_____	Beam Height TOP of Beam	mm	mm	mm	mm	mm
	Beam Height BOTTOM of Beam	mm	mm	mm	mm	mm

COD/SPOD______

Flip__________

HL NDZ	m
LL NDZ	m

	Date					
HL_____	Beam Height TOP of Beam	mm	mm	mm	mm	mm
	Beam Height BOTTOM of Beam	mm	mm	mm	mm	mm
HL_____	Beam Height TOP of Beam	mm	mm	mm	mm	mm
	Beam Height BOTTOM of Beam	mm	mm	mm	mm	mm

Notes:

Beam height measurements are likely to be slightly different when measured each time because the exact spot can not be guaranteed each time. The purpose of the beam height check is to see if the LIDAR scanner has moved inside, therefore action is only required if ALL four beam height measurements indicate the scanner may have moved. Variances of beam height measurements up to 50mm are not uncommon.
This Record Card shows the normal beam height setting locations for LL and HL LIDAR, The Detection Area Diagram will show the shapes of each Detection Area segment and the beam height setting positions (which may be different to the default ones shown on this Record Card).

When measuring the Bottom of Beam lower LAC1 so it is out of the beam (no flashing LED) and raise until an LED flashes rapidly. Then measure to the SENSOR, not the LED (from the crossing surface). To measure the TOP of Beam, raise LAC1 above beam (no flashing LED) and lower into the beam until an LED flashes rapidly. Then measure to the SENSOR, not the LED (from the crossing surface).
BoB = Bottom of Beam.

Crossing	
Date	
Name	

Network Rail

GateCare NR2 : Power Operated Gate Opener (POGO)
Record Card
NR/SMS/LC50-Test 084

Form: NR/SMS/LC50/T084/RC/01
Date: Sept 2014
Issue: 01

Location / Site:	Signal Box Area:

				Gate One		Gate Two					
	Solar Array Output Volts DC	Sunlight level	Battery Voltage Volts DC	Dynamic Time Exceeded	Dynamic Time **Actual**	Dynamic Time Exceeded	Dynamic Time **Actual**	Force Meter Identity	Name	Signature	Date
1		Sunny / Cloudy / Dark		Yes / No		Yes / No					
2		Sunny / Cloudy / Dark		Yes / No		Yes / No					
3		Sunny / Cloudy / Dark		Yes / No		Yes / No					
4		Sunny / Cloudy / Dark		Yes / No		Yes / No					
5		Sunny / Cloudy / Dark		Yes / No		Yes / No					
6		Sunny / Cloudy / Dark		Yes / No		Yes / No					
7		Sunny / Cloudy / Dark		Yes / No		Yes / No					
8		Sunny / Cloudy / Dark		Yes / No		Yes / No					
9		Sunny / Cloudy / Dark		Yes / No		Yes / No					
10		Sunny / Cloudy / Dark		Yes / No		Yes / No					
12		Sunny / Cloudy / Dark		Yes / No		Yes / No					
13		Sunny / Cloudy / Dark		Yes / No		Yes / No					
14		Sunny / Cloudy / Dark		Yes / No		Yes / No					
15		Sunny / Cloudy / Dark		Yes / No		Yes / No					
16		Sunny / Cloudy / Dark		Yes / No		Yes / No					
17		Sunny / Cloudy / Dark		Yes / No		Yes / No					
18		Sunny / Cloudy / Dark		Yes / No		Yes / No					
19		Sunny / Cloudy / Dark		Yes / No		Yes / No					
20		Sunny / Cloudy / Dark		Yes / No		Yes / No					

Network Rail	GateCare NR2 : Power Operated Gate Opener (POGO) Record Card NR/SMS/LC50-Test 084	Form: NR/SMS/LC50/T084/RC/01 Date: Sept 2014 Issue: 01

Location / Site:	Signal Box Area:

				Gate One		Gate Two					
	Solar Array Output Volts DC	Sunlight level	Battery Voltage Volts DC	Dynamic Time Exceeded	Dynamic Time **Actual**	Dynamic Time Exceeded	Dynamic Time **Actual**	Force Meter Identity	Name	Signature	Date
1		Sunny / Cloudy / Dark		Yes / No		Yes / No					
2		Sunny / Cloudy / Dark		Yes / No		Yes / No					
3		Sunny / Cloudy / Dark		Yes / No		Yes / No					
4		Sunny / Cloudy / Dark		Yes / No		Yes / No					
5		Sunny / Cloudy / Dark		Yes / No		Yes / No					
6		Sunny / Cloudy / Dark		Yes / No		Yes / No					
7		Sunny / Cloudy / Dark		Yes / No		Yes / No					
8		Sunny / Cloudy / Dark		Yes / No		Yes / No					
9		Sunny / Cloudy / Dark		Yes / No		Yes / No					
10		Sunny / Cloudy / Dark		Yes / No		Yes / No					
12		Sunny / Cloudy / Dark		Yes / No		Yes / No					
13		Sunny / Cloudy / Dark		Yes / No		Yes / No					
14		Sunny / Cloudy / Dark		Yes / No		Yes / No					
15		Sunny / Cloudy / Dark		Yes / No		Yes / No					
16		Sunny / Cloudy / Dark		Yes / No		Yes / No					
17		Sunny / Cloudy / Dark		Yes / No		Yes / No					
18		Sunny / Cloudy / Dark		Yes / No		Yes / No					
19		Sunny / Cloudy / Dark		Yes / No		Yes / No					
20		Sunny / Cloudy / Dark		Yes / No		Yes / No					

Network Rail	**Lever Frame Record Card (Front) NR/SMS/LV11 to 17**	**Form: NR/SMS/LV11/17/RC/01 Date: August 2004 Issue: 01**

Signal Box:	Frame Make & Type:

Date Installed: (If Known)	Date of Last Overhaul:	Number of Working Levers:	Number of Spare Levers:	Number of Out of Use Levers:

Lever Number	Comments *(Adjustments, Renewals, Loose or Oversize Pins etc)*	Signature	Name & Company	Date

Network Rail	Lever Frame Record Card (Rear) NR/SMS/LV11 to 17	Form: NR/SMS/LV11/17/RC/01 Date: August 2004 Issue: 01

Lever Number	Comments *(Adjustments, Renewals, Loose or Oversize Pins etc)*	Signature	Name & Company	Date

NetworkRail	**SSI Panel Multiplexer: TEML41 (AN)**	**Form: NR/SMS/MP01/RC01** **Date: 05/12/2020** **Issue: 01**

Location of Signallers Control Panel:

Number	Service A Tests										
	Indications						Power Supplies				
	System Status Panel		Signalling Panel**		Card Status		Main Supply		Duplicated Supply**		
	All Correct*	Comments	All Correct*	Comments	All Correct*	Comments	Within Spec*	Comments	Within Spec*	Comments	
1											
2											
3											
4											
5											
6											
7											
8											

No.	General Comments	Test Equipment Identity	Signature	Name & Company	Date
1					
2					
3					
4					
5					
6					
7					
8					

* Insert details of problem or tick if all correct
** If fitted to the system

NetworkRail	SSI Panel Multiplexer: TEML41 (SY/AN)	Form: NR/SMS/MP01/RC01 Date: 05/12/2020 Issue: 01

Number	Service B Tests						
	System Changeover						
	System in Use	Correct Indications*	Changeover Successful*	Correct Indications*	Route Setting Successful*	Panel Alarms ?	Panel Alarm Details
1	A / B						
2	A / B						
3	A / B						
4	A / B						

No.	General Comments	Test Equipment Identity	Signature	Name & Company	Date
1					
2					
3					
4					

* Insert details of problem or tick if all correct

NetworkRail	SSI Panel Multiplexer: WBS Type S2	**Form: NR/SMS/MP02/RC01** **Date: 05/12/2020** **Issue: 01**

Location of Signallers Control Panel:	Location of SSI Interlocking (If remote from Signallers Panel):

Number	Service A Tests											
	Indications										Power Supplies	
	Signallers Panel		Scanner Cards		DIP/DOP Cards		Fuse/Status Panel		Modems**		Duplicated Supply**	
	All Correct*	Comments	All Correct*	Comments	All Correct*	Comments	All Correct*	Comments	All Correct*	Comments	Within Spec*	Comments
1												
2												
3												
4												
5												
6												
7												
8												

No.	General Comments	Test Equipment Identity	Signature	Name & Company	Date
1					
2					
3					
4					
5					
6					
7					
8					

* Insert details of problem or tick if all correct ** If fitted to the system

NetworkRail	**SSI Panel Multiplexer: WBS Type S2**	**Form: NR/SMS/MP02/RC01** **Date: 05/12/2020** **Issue: 01**

Number	Service B Tests					
	Duplicated PSU		Changeover Alarms		Line Levels**	
	Within Spec*	Comments	Correct Indications*	Comments	Within Spec*	Comments
1						
2						
3						
4						

No.	General Comments	Test Equipment Identity	Signature	Name & Company	Date
1					
2					
3					
4					

* Insert details of problem or tick if all correct ** If fitted to the system

NetworkRail	**SSI Panel Multiplexer: Vaughan Harmon**	**Form: NR/SMS/MP03/RC01** **Date: 05/12/2020** **Issue: 01**

Location of Signallers Control Panel:

Number	Service A Tests											
	Indications											
	System Status		On Line Processor		Off Line Processor		Digital Output		Digital Input		Power Supply	
	All Correct*	Comments	All Correct*	Comments	All Correct*	Comments	All Correct*	Comments	All Correct*	Comments	All Correct*	Comments
1												
2												
3												
4												
5												
6												
7												
8												

No.	Service A Tests		General Comments	Test Equipment Identity	Signature	Name & Company	Date
	Power Supplies						
	Within Spec*	Comments					
1							
2							
3							
4							
5							
6							
7							
8							

* Insert details of problem or tick if all correct

	SSI Panel Multiplexer: Vaughan Harmon	**Form: NR/SMS/MP03/RC01** **Date: 05/12/2020** **Issue: 01**

Number	Service B Tests							
	System Changeover						Alarms	
	Correct Indications*	Changeover Successful*	Correct Indications*	Changeover Successful*	Correct Indications*	Comments	Correct Functions*	Comments
1								
2								
3								
4								

No.	General Comments	Test Equipment Identity	Signature	Name & Company	Date
1					
2					
3					
4					

* Insert details of problem or tick if all correct

NetworkRail	SSI Panel Multiplexer: GEC Type RM	Form: NR/SMS/MP04/RC01 Date: 05/12/2020 Issue: 01

Location of Signallers Control Panel:

Service A Tests						General Comments	Test Equipment Identity	Signature	Name & Company	Date
Indications				Power Supplies*						
System Status*		Cards*		Within Spec	Comments					
All Correct	Comments	All Correct	Comments							

* Insert details of problem or tick if all correct

NetworkRail	**SSI Panel Multiplexer: GEC Type RM**	**Form: NR/SMS/MP04/RC01** **Date: 05/12/2020** **Issue: 01**

Service B Tests		General Comments	Meter Identity	Signature	Name & Company	Date
AC Supply (V)	System Changeover					

* Insert tick if correct, problems to be entered in the comments column

NetworkRail	**Hydraulic Derailer** Maintenance Test	**Form: NR/SMS/PB18/RC01** **Date: September 2014** **Issue: 02**

Controlling Signal Box / Ground Frame:	Controlling Loc/Equip. Room:	De-railer Number	De-Railer Actuator Make / Model:	Configuration Comments:

Detection Test: 2mm gauge between derailer and rail head / 4 ft rest		Overload cut out time (6-9 secs)	Dynamic Earth Test (Y/N) NR/SMS/Test/052	Condition of Equipment / Mechanical / Electric / Pneumatic	Meter Identit y	Name	Signed	Date
N	R							

Network Rail	**Point Fittings: Gauge, Free Wheel Passage (FWP), Free Wheel Clearance (FWC), and Residual Switch Opening (RSO) Measurements Record Card (Front) NR/SMS/PF01**	**Form: NR/SMS/PF01/RC/01** **Date: December 2020** **Issue: 03**

Controlling Signal Box / Ground Frame:			Equipment Room / Location Case:		
Point Number:		Switch Type:		Stretcher Bar Type: Fixed Yellow (FY), Fixed Black (FB), Adjustable (AD) Tubular (TSB):	

Number	**Normal**					**Reverse**				
	Measurement from Last Stretcher Bar Towards the Switch Heel			Residual Switch Opening Throughout Planed Length		Measurement from Last Stretcher Bar Towards the Switch Heel			Residual Switch Opening Throughout Planed Length	
	Maximum Free Wheel Passage		Minimum Free Wheel Clearance			Maximum Free Wheel Passage		Minimum Free Wheel Clearance		
	Theoretical FBC check Pass /Fail	Actual	Actual	Max	Min	Theoretical FBC check Pass /Fail	Actual	Actual	Max	Min
01										
02										
03										
04										
05										
06										
07										

Number	Comments	Gauge Identity	Name	Signed	Company	Date
01						
02						
03						
04						
05						
06						
07						

Network Rail

Point Fittings: Gauge, Free Wheel Passage (FWP), Free Wheel Clearance (FWC), and Residual Switch Opening (RSO) Measurements Record Card (Front) NR/SMS/PF01

Form: NR/SMS/PF01/RC/01
Date: December 2020
Issue: 03

Number	Normal					Reverse				
	Measurement from Last Stretcher Bar Towards the Switch Heel			Residual Switch Opening Throughout Planed Length		Measurement from Last Stretcher Bar Towards the Switch Heel			Residual Switch Opening Throughout Planed Length	
	Maximum Free Wheel Passage		Minimum Free Wheel Clearance			Maximum Free Wheel Passage		Minimum Free Wheel Clearance		
	Theoretical FBC check Pass /Fail	Actual	Actual	Max	Min	Theoretical FBC check Pass /Fail	Actual	Actual	Max	Min
08										
09										
10										
11										
12										
13										
14										
15										
16										

Number	Comments	Gauge Identity	Name	Signed	Company	Date
08						
09						
10						
11						
12						
13						
14						
15						
16						

Point System - Hydraulic – Pneumatic

Maintenance Test

Form: NR/SMS/PTS/RC01
Date: 01/09/2018
Issue: 3

Controlling Signal Box / Ground Frame:	Controlling Loc/Equip. Room:	Point Actuator Make/Model:	Point Number:	Configuration Comments:

<table>
<tr><td rowspan="2">No.</td><td rowspan="2">Condition of Equipment & Track</td><td colspan="2" rowspan="2">Switch Opening (mm)</td><td colspan="4">FPL Tests</td><td colspan="8">Detection Test (L)= Lock (T)=Tappet [1st:RCPL, 2nd: IBCL, otherwise both types]</td></tr>
<tr><td colspan="2">Normal*</td><td colspan="2">Reverse*</td><td colspan="4">Left Hand Switch*</td><td colspan="4">Right Hand Switch*</td></tr>
<tr><td rowspan="9">1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">Detection Broken</td><td colspan="2">Detection Made</td><td colspan="2">Detection Broken</td><td colspan="2">Detection Made</td></tr>
<tr><td></td><td>N</td><td>R</td><td>3.5mm</td><td>1.5mm</td><td>3.5mm</td><td>1.5mm</td><td>4/5mm (L)</td><td>2mm (T)</td><td>2.5/3.5 mm (L)</td><td>1.5mm (T)</td><td>4/5mm (L)</td><td>2mm (T)</td><td>2.5/3.5 mm (L)</td><td>1.5mm (T)</td></tr>
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Complete sections as appropriate to system configuration *: Insert tick if correct **: Insert tick if all the point ends are in correspondence giving a N or R detection

Network Rail	Point System - Hydraulic – Pneumatic Maintenance Test	Form: NR/SMS/PTS/RC01 Date: 01/09/2018 Issue: 3

No.	Condition of Equipment & Track	Switch Opening (mm)		FPL Tests				Detection Test (L)= Lock (T)=Tappet [1st:RCPL, 2nd: IBCL, otherwise both types]							
								Left Hand Switch*				Right Hand Switch*			
				Normal*		Reverse*		Detection Broken		Detection Made		Detection Broken		Detection Made	
		N	R	3.5mm	1.5mm	3.5mm	1.5mm	4/5mm (L)	2mm (T)	2.5/3.5 mm (L)	1.5mm (T)	4/5mm (L)	2mm (T)	2.5/3.5 mm (L)	1.5mm (T)
3															

Supplementary Detection [bottom figure = SO]						Detection Loop (Only one entry required for this test on multiple point ends, note in comments)								
Normal*		Reverse*		Flangeway Clearance (mm)		Corresp.**	Voltage Test				Resistance Test			
							Normal		Reverse		Normal		Reverse	
6mm 2mm	8mm 4mm	6mm 2mm	8mm 4mm	Normal	Reverse		Feed End	Relay End	Feed End	Relay End	+Ve Leg	-Ve Leg	+Ve Leg	-Ve Leg

Comments	Meter Identity	Name	Signed	Company	Date

No.	Condition of Equipment & Track	Switch Opening (mm)		FPL Tests				Detection Test (L)= Lock (T)=Tappet [1st:RCPL, 2nd: IBCL, otherwise both types]							
								Left Hand Switch*				Right Hand Switch*			
				Normal*		Reverse*		Detection Broken		Detection Made		Detection Broken		Detection Made	
		N	R	3.5mm	1.5mm	3.5mm	1.5mm	4/5mm (L)	2mm (T)	2.5/3.5 mm (L)	1.5mm (T)	4/5mm (L)	2mm (T)	2.5/3.5 mm (L)	1.5mm (T)
4															

Supplementary Detection [bottom figure = SO]						Detection Loop (Only one entry required for this test on multiple point ends, note in comments)								
Normal*		Reverse*		Flangeway Clearance (mm)		Corresp.**	Voltage Test				Resistance Test			
							Normal		Reverse		Normal		Reverse	
6mm 2mm	8mm 4mm	6mm 2mm	8mm 4mm	Normal	Reverse		Feed End	Relay End	Feed End	Relay End	+Ve Leg	-Ve Leg	+Ve Leg	-Ve Leg

Comments	Meter Identity	Name	Signed	Company	Date

Complete sections as appropriate to system configuration *: Insert tick if correct **: Insert tick if all the point ends are in correspondence giving a N or R detection

Network Rail	**Point System - Machine** Maintenance Test	**Form: NR/SMS/PTS/RC02** **Date: 04/09/2021** **Issue: 3**

Controlling Signal Box / Ground Frame:	Controlling Loc/Equip. Room:	Point Actuator Make/Model:	Point Number:	Configuration Comments:

Number	Condition of Equipment & Track	Switch Opening (mm)		FPL Tests				Detection Test (except WRSL Style 63 Machines)				Detection Test (WRSL Style 63 Machines Only)					
				Normal*		Reverse*		Normal*		Reverse*		Contact Setting*		Normal*		Reverse*	
		N	R	3.5mm	1.5mm	3.5mm	1.5mm	3.5mm	5mm	3.5mm	5mm	N	R	2mm	3.5mm	2mm	3.5mm
1																	

Supplementary Detection						Detection Loop (Only one entry required for this test on multiple point ends, note in comments)								
Normal*		Reverse*		Freewheel Clearance (mm)		Corresp.**	Voltage Test				Resistance Test			
							Normal		Reverse		Normal		Reverse	
6mm	8mm	6mm	8mm	Normal	Reverse		Feed End	Relay End	Feed End	Relay End	+Ve Leg	-Ve Leg	+Ve Leg	-Ve Leg

Comments	Meter Identity	Signature	Name/Company	Date

Number	Condition of Equipment & Track	Switch Opening (mm)		FPL Tests				Detection Test (expect WRSL Style 63 Machines)				Detection Test (WRSL Style 63 Machines Only)					
				Normal*		Reverse*		Normal*		Reverse*		Contact Setting*		Normal*		Reverse*	
		N	R	3.5mm	1.5mm	3.5mm	1.5mm	3.5mm	5mm	3.5mm	5mm	N	R	2mm	3.5mm	2mm	3.5mm
2																	

Supplementary Detection						Detection Loop (Only one entry required for this test on multiple point ends, note in comments)								
Normal*		Reverse*		Freewheel Clearance (mm)		Corresp.**	Voltage Test				Resistance Test			
							Normal		Reverse		Normal		Reverse	
6mm	8mm	6mm	8mm	Normal	Reverse		Feed End	Relay End	Feed End	Relay End	+Ve Leg	-Ve Leg	+Ve Leg	-Ve Leg

Comments	Meter Identity	Signature	Name/Company	Date

Complete sections as appropriate to system configuration *: Insert tick if correct **: Insert tick if all the point ends are in correspondence giving a N or R detection

Network Rail	**Point System - Machine** Maintenance Test	**Form: NR/SMS/PTS/RC02** **Date: 04/09/2021** **Issue: 3**

Number	Condition of Equipment & Track	Switch Opening (mm)		FPL Tests				Detection Test (expect WRSL Style 63 Machines)				Detection Test (WRSL Style 63 Machines Only)					
				Normal*		Reverse*		Normal*		Reverse*		Contact Setting*		Normal*		Reverse*	
		N	R	3.5mm	1.5mm	3.5mm	1.5mm	3.5mm	5mm	3.5mm	5mm	N	R	2mm	3.5mm	2mm	3.5mm
3																	

Supplementary Detection						Detection Loop (Only one entry required for this test on multiple point ends, note in comments)								
Normal*		Reverse*		Freewheel Clearance (mm)		Corresp.**	Voltage Test				Resistance Test			
							Normal		Reverse		Normal		Reverse	
6mm	8mm	6mm	8mm	Normal	Reverse		Feed End	Relay End	Feed End	Relay End	+Ve Leg	-Ve Leg	+Ve Leg	-Ve Leg

Comments	Meter Identity	Signature	Name/Company	Date

Number	Condition of Equipment & Track	Switch Opening (mm)		FPL Tests				Detection Test (expect WRSL Style 63 Machines)				Detection Test (WRSL Style 63 Machines Only)					
				Normal*		Reverse*		Normal*		Reverse*		Contact Setting*		Normal*		Reverse*	
		N	R	3.5mm	1.5mm	3.5mm	1.5mm	3.5mm	5mm	3.5mm	5mm	N	R	2mm	3.5mm	2mm	3.5mm
4																	

Supplementary Detection						Detection Loop (Only one entry required for this test on multiple point ends, note in comments)								
Normal*		Reverse*		Freewheel Clearance (mm)		Corresp.**	Voltage Test				Resistance Test			
							Normal		Reverse		Normal		Reverse	
6mm	8mm	6mm	8mm	Normal	Reverse		Feed End	Relay End	Feed End	Relay End	+Ve Leg	-Ve Leg	+Ve Leg	-Ve Leg

Comments	Meter Identity	Signature	Name/Company	Date

Complete sections as appropriate to system configuration *: Insert tick if correct **: Insert tick if all the point ends are in correspondence giving a N or R detection

Network Rail	**Point System – Mechanical** Maintenance Test	**Form: NR/SMS/PTS/RC03** **Date: 01/09/2018** **Issue: 2**

Controlling Signal Box / Ground Frame:	Point Number:	Configuration Comments:

Number	Condition of Equipment & Track	Switch Opening (mm)		FPL Tests				Detection Test (Distant 'X' details are in NR/SMS/Test/012)					
								Signal Slide Locked				Signal Slide Free	
				Normal*		Reverse*		Distance 'X' in mm		5mm Gauge Between Stock/Slide Rail*		2mm Clearance on Blade*	
		N	R	3.5mm	1.5mm	3.5mm	1.5mm	Normal	Reverse	Normal	Reverse	Normal	Reverse
1													

Supplementary Detection						Detection Loop (Only one entry required for this test on multiple point ends, note in comments)								
Normal*		Reverse*		Flangeway Clearance (mm)		Corresp.**	Voltage Test				Resistance Test			
							Normal		Reverse		Normal		Reverse	
6mm	8mm	6mm	8mm	Normal	Reverse		Feed End	Relay End	Feed End	Relay End	+Ve Leg	-Ve Leg	+Ve Leg	-Ve Leg

Comments	Meter Identity	Name	Signed	Company	Date

Number	Condition of Equipment & Track	Switch Opening (mm)		FPL Tests				Detection Test (Distant 'X' details are in NR/SMS/Test/012)					
								Signal Slide Locked				Signal Slide Free	
				Normal*		Reverse*		Distance 'X' in mm		5mm Gauge Between Stock/Slide Rail*		2mm Clearance on Blade*	
		N	R	3.5mm	1.5mm	3.5mm	1.5mm	Normal	Reverse	Normal	Reverse	Normal	Reverse
2													

Supplementary Detection						Detection Loop (Only one entry required for this test on multiple point ends, note in comments)								
Normal*		Reverse*		Flangeway Clearance (mm)		Corresp.**	Voltage Test				Resistance Test			
							Normal		Reverse		Normal		Reverse	
6mm	8mm	6mm	8mm	Normal	Reverse		Feed End	Relay End	Feed End	Relay End	+Ve Leg	-Ve Leg	+Ve Leg	-Ve Leg

Comments	Meter Identity	Name	Signed	Company	Date

Complete sections as appropriate to system configuration *: Insert tick if correct **: Insert tick if all the point ends are in correspondence giving a N or R detection

Network Rail

Point System – Mechanical

Maintenance Test

Form: NR/SMS/PTS/RC03
Date: 01/09/2018
Issue: 2

Number	Condition of Equipment & Track	Switch Opening (mm)		FPL Tests				Detection Test (Distant ‘X’ details are in NR/SMS/Test/012)					
								Signal Slide Locked				Signal Slide Free	
				Normal*		Reverse*		Distance ‘X’ in mm		5mm Gauge Between Stock/Slide Rail*		2mm Clearance on Blade*	
3		N	R	3.5mm	1.5mm	3.5mm	1.5mm	Normal	Reverse	Normal	Reverse	Normal	Reverse

Supplementary Detection						Detection Loop (Only one entry required for this test on multiple point ends, note in comments)								
Normal*		Reverse*		Flangeway Clearance (mm)		Corresp.**	Voltage Test				Resistance Test			
							Normal		Reverse		Normal		Reverse	
6mm	8mm	6mm	8mm	Normal	Reverse		Feed End	Relay End	Feed End	Relay End	+Ve Leg	-Ve Leg	+Ve Leg	-Ve Leg

Comments	Meter Identity	Name	Signed	Company	Date

Number	Condition of Equipment & Track	Switch Opening (mm)		FPL Tests				Detection Test (Distant ‘X’ details are in NR/SMS/Test/012)					
								Signal Slide Locked				Signal Slide Free	
				Normal*		Reverse*		Distance ‘X’ in mm		5mm Gauge Between Stock/Slide Rail*		2mm Clearance on Blade*	
4		N	R	3.5mm	1.5mm	3.5mm	1.5mm	Normal	Reverse	Normal	Reverse	Normal	Reverse

Supplementary Detection						Detection Loop (Only one entry required for this test on multiple point ends, note in comments)								
Normal*		Reverse*		Flangeway Clearance (mm)		Corresp.**	Voltage Test				Resistance Test			
							Normal		Reverse		Normal		Reverse	
6mm	8mm	6mm	8mm	Normal	Reverse		Feed End	Relay End	Feed End	Relay End	+Ve Leg	-Ve Leg	+Ve Leg	-Ve Leg

Comments	Meter Identity	Name	Signed	Company	Date

Complete sections as appropriate to system configuration *: Insert tick if correct **: Insert tick if all the point ends are in correspondence giving a N or R detection

Point System - HPSS

Maintenance test

Form: NR/SMS/PTS/RC04
Date: 01/09/2018
Issue: 03

UPON ARRIVAL

HPSS Retracted					HPSS Extended					Comments
Retract Side mm From:			Extend Side mm From:		Retract Side mm From:			Extend Side mm From:		
Closed	Open		Closed	Open	Closed	Open		Closed	Open	
		Toe					Toe			
		Supp 1					Supp 1			
		Supp 2					Supp 2			

AFTER COMPLETION OF WORK

HPSS Retracted					HPSS Extended					Comments
Retract Side mm From:			Extend Side mm From:		Retract Side mm From:			Extend Side mm From:		
Closed	Open		Closed	Open	Closed	Open		Closed	Open	
		Toe					Toe			
		Supp 1					Supp 1			
		Supp 2					Supp 2			

HPSA FACING POINT LOCK TEST

Meter Reading on KR Lines with 3.5mm gauge		Meter Reading on KR Lines with 8mm / 10mm gauge**
L/H Switch Closed*	R/H Switch Closed*	*L/H or R/H Switch Closed***
*Insert tick if outgoing KR voltage is not present		
** Delete details of gauge not used *** Delete details of switch not tested		

TIME OF OPERATION TEST

Record Time for Extend / Retract (Nominally 4 seconds)	
Extend	Retract

Signal Box:

Location:

Point ID:

ECU Serial No:

Handset No:

Signature: Date:

UPON ARRIVAL

HPSS Retracted					HPSS Extended					Comments
Retract Side mm From:			Extend Side mm From:		Retract Side mm From:			Extend Side mm From:		
Closed	Open		Closed	Open	Closed	Open		Closed	Open	
		Toe					Toe			
		Supp 1					Supp 1			
		Supp 2					Supp 2			

AFTER COMPLETION OF WORK

HPSS Retracted					HPSS Extended					Comments
Retract Side mm From:			Extend Side mm From:		Retract Side mm From:			Extend Side mm From:		
Closed	Open		Closed	Open	Closed	Open		Closed	Open	
		Toe					Toe			
		Supp 1					Supp 1			
		Supp 2					Supp 2			

HPSA FACING POINT LOCK TEST

Meter Reading on KR Lines with 3.5mm gauge		Meter Reading on KR Lines with 8mm / 10mm gauge**
L/H Switch Closed*	R/H Switch Closed*	* L/H or R/H Switch Closed***
*Insert tick if outgoing KR voltage is not present		
** Delete details of gauge not used *** Delete details of switch not tested		

TIME OF OPERATION TEST

Record Time for Extend / Retract (Nominally 4 seconds)	
Extend	Retract

Signal Box:

Location:

Point ID:

ECU Serial No:

Handset No:

Signature: Date:

Network Rail	**Point System - HPSS** Maintenance test	**Form: NR/SMS/PTS/RC04** **Date: 01/09/2018** **Issue: 03**

USEFUL CHECKS TO BE CARRIED OUT FOLLOWING PERFORMANCE ISSUES			
Track and Constriction Checks	**Further Action Required? (Y/N)**	**Electrical Components**	**Further Action Required? (Y/N)**
1. Check the switch and Stock rail for signs of lipping. This will indicate that tight gauge is having a detrimental effect.		16. Check the condition of the internal cables within the End Lid are free from damage, predominantly near to where the lid rests.	
2. Check the Switch for obvious signs of hogging, dipping or voiding.		17. Check all sensors are secure and smooth in operation. Check that the Drive Peg cannot be rotated by more than a few degrees.	
3. Check the Switch and Stock rail alignment for any variations or abnormal gapping throughout.		18. Check all links and wires are secure at the relays, dis-box and location case.	
4. Check Gauge consistency using a Track gauge, measure, starting at the Toe then at every bearer throughout up to the headcut.		19. Check the cable routing has been installed so that excess cable is looped inside the toughing route and not coiled up.	
5. Check the Switch Rail Toe travel using a rule. The system is designed for optimum performance at 113mm +/- 1mm.		20. Check that the sensor cables are kept away from heating elements, any excess shall be neatly tied from the element and moving parts.	
6. Measure the FWC at the headcut openings with a ‘Bance’ or ‘Geismar’ track gauge. (RT/NR60, 60–66mm, UIC54, 50-56mm).		21. Check the loop resistance of the power cables in accordance with the SMS cable loop resistance test.	
7. Check that all the Fastclips have been correctly fully inserted.		22. Observe the backdrive operation. Check for incorrect set up displayed by lifting, shuddering, laboured movement or gear box noise.	
8. Check the gap between the bearer tops and torque tube for high or trapped ballast.		23. Check the time of operation, ideally it should take approximately 4 seconds. If slower, Clean drive carriage slides.	
Mechanical Component Checks	**Further Action Required? (Y/N)**	**Useful detail to Note and Consider**	**Availability? (Y/N)**
9. Check all nuts and bolts fixings visually, paying particular attention to the stretcher bars, switch rail brackets and sensor brackets.		24. Obtain Information regarding when the tamping, welding and stressing was completed.	
10. Check that there is a minimum 2mm clearance between the Gearbox bush and casing.		25. Obtain Information regarding the installation and commissioning works. Is all documentation is correct, signed off and compliant.	
11. Check the roller height settings and positioning, All rollers should display a light wear mark and freely rotate by hand. (See Appendix of B of Installation Manual ER/R/1/0224)		26. It is advisable to have a known good ECU and LVDT as a spare to eliminate confusion following intermittent loss of detection faults.	
12. Check the stretcher and drive bar condition. Check the serrations are correctly aligned and free from debris.		27. If in doubt, consult with the appropriate installation and maintenance manuals and/or refer to the training documentation.	
13. Observe the drive component condition at the D link. Check the lock nuts are tightened on to the thimbles.		28. If spare parts are being sent back to the manufacturer for investigation it is important to complete the Product Return Form (See Appendix A of Installation Manual ER/R/1/0224).	
14. Check that all moving parts of the HPSA are clean and in good order. Pay particular attention to the Carriage Shafts.		29. You are reminded to record all faults with accuracy of date, time, symptom, point number, attendance, rectification, into a log book.	
15. Check all plug coupler connections for security, moisture, pin damage, corrosion and charring which can be caused by arcing.		30. Good housekeeping is vital, the removal of litter and foliage at each site visit is very important, especially at the sensors.	

Network Rail	**Point System - Operating Current** Maintenance Test	**Form: NR/SMS/PTS/RC05** **Date: 01/09/2018** **Issue: 2**

Controlling Signal Box / Ground Frame:	Controlling Loc/Equip. Room:	Point Actuator Make/Model:	Point Number:	Configuration Comments:

Operating Current (Amps)		Obstruction (points unable to complete travel)		Comments	Meter Identity	Name /Company	Signed	Date
N to R	R to N	Slip Current (Amps)	Cutout Operation (Sec)					

Network Rail	**Point System - Operating Current** Maintenance Test	**Form: NR/SMS/PTS/RC05** **Date: 01/09/2018** **Issue: 2**

Operating Current (Amps)		Obstruction (points unable to complete travel)		Comments	Meter Identity	Name /Company	Signed	Date
N to R	R to N	Slip Current (Amps)	Cutout Operation (Sec)					

NetworkRail	Point System – Unistar HR Maintenance Test	Form: NR/SMS/PTS/RC06 Date: 02/12/2023 Issue: 01

Controlling Signal Box / Ground Frame:	Controlling Loc/Equip. Room:	Point Actuator Make/Model:	Point Number:	Configuration Comments:

No.	Condition of Equipment & Track	Switch Opening (mm)		FPL Tests				Detection Test			
								Left Hand Switch*		Right Hand Switch*	
				Normal*		Reverse*		Detection Broken	Detection Made	Detection Broken	Detection Made
1		N	R	3.5mm	1.5mm	3.5mm	1.5mm	3.5mm	1.5mm	3.5mm	1.5mm

Supplementary Drive Detection						Detection Loop (Only one entry required for this test on multiple point ends, note in comments)								
Normal*		Reverse*		Flangeway Clearance (mm)		Corresp.**	Voltage Test				Resistance Test			
							Normal		Reverse		Normal		Reverse	
2mm	4mm	2mm	4mm	Normal	Reverse		Feed End	Relay End	Feed End	Relay End	+Ve Leg	-Ve Leg	+Ve Leg	-Ve Leg

Comments	Meter Identity	Name	Signed	Company	Date

No.	Condition of Equipment & Track	Switch Opening (mm)		FPL Tests				Detection Test			
								Left Hand Switch*		Right Hand Switch*	
				Normal*		Reverse*		Detection Broken	Detection Made	Detection Broken	Detection Made
2		N	R	3.5mm	1.5mm	3.5mm	1.5mm	3.5mm	1.5mm	3.5mm	1.5mm

Supplementary Drive Detection]						Detection Loop (Only one entry required for this test on multiple point ends, note in comments)								
Normal*		Reverse*		Flangeway Clearance (mm)		Corresp.**	Voltage Test				Resistance Test			
							Normal		Reverse		Normal		Reverse	
2mm	4mm	2mm	4mm	Normal	Reverse		Feed End	Relay End	Feed End	Relay End	+Ve Leg	-Ve Leg	+Ve Leg	-Ve Leg

Comments	Meter Identity	Name	Signed	Company	Date

Complete sections as appropriate to system configuration *: Insert tick if correct **: Insert tick if all the point ends are in correspondence giving a N or R detection

NetworkRail	**Point System - Unistar** Maintenance Test	**Form: NR/SMS/PTS/RC06** **Date: 02/12/2023** **Issue: 01**

No.	Condition of Equipment & Track	Switch Opening (mm)		FPL Tests				Detection Test			
								Left Hand Switch*		Right Hand Switch*	
				Normal*		Reverse*		Detection Broken	Detection Made	Detection Broken	Detection Made
1		N	R	3.5mm	1.5mm	3.5mm	1.5mm	3.5mm	1.5mm	3.5mm	1.5mm

Supplementary Drive Detection						Detection Loop (Only one entry required for this test on multiple point ends, note in comments)								
Normal*		Reverse*		Flangeway Clearance (mm)		Corresp.**	Voltage Test				Resistance Test			
							Normal		Reverse		Normal		Reverse	
2mm	4mm	2mm	4mm	Normal	Reverse		Feed End	Relay End	Feed End	Relay End	+Ve Leg	-Ve Leg	+Ve Leg	-Ve Leg

Comments	Meter Identity	Name	Signed	Company	Date

No.	Condition of Equipment & Track	Switch Opening (mm)		FPL Tests				Detection Test			
								Left Hand Switch*		Right Hand Switch*	
				Normal*		Reverse*		Detection Broken	Detection Made	Detection Broken	Detection Made
2		N	R	3.5mm	1.5mm	3.5mm	1.5mm	3.5mm	1.5mm	3.5mm	1.5mm

Supplementary Drive Detection]						Detection Loop (Only one entry required for this test on multiple point ends, note in comments)								
Normal*		Reverse*		Flangeway Clearance (mm)		Corresp.**	Voltage Test				Resistance Test			
							Normal		Reverse		Normal		Reverse	
2mm	4mm	2mm	4mm	Normal	Reverse		Feed End	Relay End	Feed End	Relay End	+Ve Leg	-Ve Leg	+Ve Leg	-Ve Leg

Comments	Meter Identity	Name	Signed	Company	Date

Complete sections as appropriate to system configuration *: Insert tick if correct **: Insert tick if all the point ends are in correspondence giving a N or R detection

NetworkRail	**RC System: Type 'R' Reed FDM Test**	**Form: NR/SMS/RC01/RC01** **Date: 05/12/2020** **Issue: 01**

Power Signal Box:	End Function:	Location:	Line Amplifier Locations:

Number	System	Line Amplifier (1)			Line Amplifier (2)			Line Amplifier (3)			Line Amplifier (4)			Line Amplifier (5)			Line Amplifier Comments
		Feedback Setting	Voltages		Feedback Setting	Voltages		Feedback Setting	Voltages		Feedback Setting	Voltages		Feedback Setting	Voltages		
			T7/T8 (AC or DC)	Amp O/P (AC)		T7/T8 (AC or DC)	Amp O/P (AC)		T7/T8 (AC or DC)	Amp O/P (AC)		T7/T8 (AC or DC)	Amp O/P (AC)		T7/T8 (AC or DC)	Amp O/P (AC)	
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	

Number	Function	Transmitter End					Receiver End							Comments	Meter Identity	Signature	Name & Company	Date
		Power Supply			Transmitter		Power Supply			Receiver								
		Voltages			Voltages (AC)		Voltages			Voltages (DC)								
					Tx O/P					Rx O/P		Reed Follower						
		AC I/P	DC O/P	AC Ripple	Tx'ing	Not Tx'ing	AC I/P	DC O/P	AC Ripple	Rx'ing	Not Rx'ing	Rx'ing	Not Rx'ing					
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		

NetworkRail	**RC System: Type 'R' Reed FDM Test**	**Form: NR/SMS/RC01/RC01** **Date: 05/12/2020** **Issue: 01**

Number	System	Line Amplifier (1)			Line Amplifier (2)			Line Amplifier (3)			Line Amplifier (4)			Line Amplifier (5)			Line Amplifier Comments
		Feedback Setting	Voltages		Feedback Setting	Voltages		Feedback Setting	Voltages		Feedback Setting	Voltages		Feedback Setting	Voltages		
			T7/T8 (AC or DC)	Amp O/P (AC)		T7/T8 (AC or DC)	Amp O/P (AC)		T7/T8 (AC or DC)	Amp O/P (AC)		T7/T8 (AC or DC)	Amp O/P (AC)		T7/T8 (AC or DC)	Amp O/P (AC)	
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	

Number	Function	Transmitter End					Receiver End							Comments	Meter Identity	Signature	Name & Company	Date
		Power Supply			Transmitter		Power Supply			Receiver								
		Voltages			Voltages (AC)		Voltages			Voltages (DC)								
					Tx O/P					Rx O/P		Reed Follower						
		AC I/P	DC O/P	AC Ripple	Tx'ing	Not Tx'ing	AC I/P	DC O/P	AC Ripple	Rx'ing	Not Rx'ing	Rx'ing	Not Rx'ing					
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		

NetworkRail	**Reed Point Detection (Transmitter)**	**Form: NR/SMS/RC01/RC02** **Date: 05/12/2020** **Issue: 01**

Signal Box:	Point End Number:	Normal Channel Number:	Reverse Channel Number

	Power Supply		Transmitter End						Comments	Meter Identity	Signature	Name & Company	Date
	Local Supply I/P	PSU O/P	Points Normal Transmitter		Outp ut Links	Points Reverse Transmitter		Output Links					
			Input	Output		Input	Output						
Units	AC(V)	DC(V)	DC(V)	AC(mV)	AC(mV)	DC(V)	AC(mV)	AC(mV)					
Limits	99-121	11.5-	11.5-13.5	350-400	350-400	11.5-13.5	350-400	350-400					
Terms			D3(+) A3(-)	D2 A1		D3(+) A3(-)	D2 A1						
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													

	Reed Point Detection (Transmitter)	**Form: NR/SMS/RC01/RC02** **Date: 05/12/2020** **Issue: 01**

	Power Supply		Transmitter End						Comments	Meter Identity	Signature	Name & Company	Date
	Local Supply I/P	PSU O/P	Points Normal		Output Links	Points Reverse		Output Links					
			Transmitter			Transmitter							
			Input	Output		Input	Output						
Units	AC(V)	DC(V)	DC(V)	AC(mV)	AC(mV)	DC(V)	AC(mV)	AC(mV)					
Limits	99-121	11.5-13.5	11.5-13.5	350-400	350-400	11.5-13.5	350-400	350-400					
Terms			D3(+) A3(-)	D2 A1		D3(+) A3(-)	D2 A1						
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
32													
33													
34													
35													
36													
37													
38													
39													
40													
41													
42													
43													

NetworkRail	**Reed Point Detection (Receiver)**	**Form: NR/SMS/RC01/RC03** **Date: 05/12/2020** **Issue: 01**

Signal Box:	Point End Number:	Normal Channel Number:	Reverse Channel Number

	Power Supply		Receiver End						Comments	Meter Identity	Signature	Name & Company	Date
	Local Supply I/P	PSU O/P	Points Normal		Input Links	Points Reverse		Input Links					
			NKR Coil	RKR Coil		NKR Coil	RKR Coil						
Units	AC(V)	DC(V)	DC(V)	DC(mV)	AC(mV)	DC(mV)	DC(V)	AC(mV)					
Limits	99-121	11.5-13.5	11.5-16.5	<0.1	350-400	<0.1	11.5-16.5	350-400					
Terms			R1(+) R2(-)	R1(+) R2(-)		R1(+) R2(-)	R1(+) R2(-)						
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													

	Reed Point Detection (Receiver)	**Form: NR/SMS/RC01/RC03** **Date: 05/12/2020** **Issue: 01**

	Power Supply		Receiver End						Comments	Meter Identity	Technicians SSM Name	Company	Date
	Local Supply I/P	PSU O/P	Points Normal		Input Links	Points Reverse		Input Links					
			NKR Coil	RKR Coil		NKR Coil	RKR Coil						
Units	AC(V)	DC(V)	DC(V)	DC(mV)	AC(mV)	DC(mV)	DC(V)	AC(mV)					
Limits	99-121	11.5-13.5	11.5-16.5	<0.1	350-400	<0.1	11.5-16.5	350-400					
Terms			R1(+) R2(-)	R1(+) R2(-)		R1(+) R2(-)	R1(+) R2(-)						
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
32													
33													
34													
35													
36													
37													
38													
39													
40													
41													
42													
43													

NetworkRail	**RC System: GEC Type 'RR' Reed FDM Test**	**Form: NR/SMS/RC02/RC01** **Date: 05/12/2020** **Issue: 01**

Power Signal Box:	RR Reed Type:	End Function:	Location:	Line Amplifier Locations:

Service A Tests

Number	System	Line Amplifiers										Line Amplifier Comments
		Line Amplifier (1)		Line Amplifier (2)		Line Amplifier (3)		Line Amplifier (4)		Line Amplifier (5)		
		Voltages		Voltages		Voltages		Voltages		Voltages		
		Amp I/P (AC)	T10/T11 (AC or DC)	Amp I/P (AC)	T10/T11 (AC or DC)	Amp I/P (AC)	T10/T11 (AC or DC)	Amp I/P (AC)	T10/T11 (AC or DC)	Amp I/P (AC)	T10/T11 (AC or DC)	
1												
2												
3												
4												
5												
6												
7												

Service A Tests

Number	Function	Transmitter End					Receiver End							Comments	Meter Identity	Signature	Name & Company	Date
		Power Supply			Transmitter		Power Supply			Receiver								
		Voltages			Voltages (AC)		Voltages			Voltages (DC)								
					Tx O/P					Rx O/P		Reed Follower*						
		AC I/P	DC I/P	DC O/P	Tx'ing	Not Tx'ing	AC I/P	DC I/P	DCO/P	Rx'ing	Not Rx'ing	Rx'ing	Not Rx'ing					
1																		
2																		
3																		
4																		
5																		
6																		
7																		

* Vital Systems Only

NetworkRail	**RC System: GEC Type 'RR' Reed FDM Test**	**Form: NR/SMS/RC02/RC01** **Date: 05/12/2020** **Issue: 01**

Number	System	Line Amplifiers										Line Amplifier Comments
		Line Amplifier (1)		Line Amplifier (2)		Line Amplifier (3)		Line Amplifier (4)		Line Amplifier (5)		
		Voltages		Voltages		Voltages		Voltages		Voltages		
		Amp I/P (AC)	T10/T11 (AC or DC)	Amp I/P (AC)	T10/T11 (AC or DC)	Amp I/P (AC)	T10/T11 (AC or DC)	Amp I/P (AC)	T10/T11 (AC or DC)	Amp I/P (AC)	T10/T11 (AC or DC)	
8												
9												
10												
11												
12												

Service A Tests

Number	Function	Transmitter End					Receiver End							Comments	Meter Identity	Signature	Name & Company	Date
		Power Supply			Transmitter		Power Supply			Receiver								
		Voltages			Voltages (AC)		Voltages			Voltages (DC)								
					Tx O/P					Rx O/P		Reed Follower*						
		AC I/P	DC I/P	DC O/P	Tx'ing	Not Tx'ing	AC I/P	DC I/P	DCO/P	Rx'ing	Not Rx'ing	Rx'ing	Not Rx'ing					
8																		
9																		
10																		
11																		
12																		

Service B Tests*

Line Levels (mV)				Comments	Test Equipment Identity	Signature	Name & Company	Date
High Frequency		Low Frequency						
Line	Dummy Amp/Rx	Line	Dummy Amp/Rx					

NetworkRail	**RC System: Westone Non-Vital FDM Test**	**Form: NR/SMS/RC03/RC01** **Date: 05/12/2020** **Issue: 01**

Power Signal Box:	Remote Interlocking:	System No:

Number	Service A Tests									
	Signal Box & Equipment Rooms (all)									
	Power Supplies						Line Levels		Functions	
	I/Ps (AC)*	Comments	O/Ps (DC)*	Comments	Ripple (AC)*	Comments	(mV)*	Comments	Correct Operation*	Comments
1										
2										
3										
4										
5										

Number	General Comments	Test Equipment Identity(s)	Signature	Name & Company	Date
1					
2					
3					
4					
5					

* Insert details of problems or tick if all correct

NetworkRail	**RC System: Westone Non-Vital FDM Test**	**Form: NR/SMS/RC03/RC01** **Date: 05/12/2020** **Issue: 01**

Number	Service A Tests									
	Signal Box & Equipment Rooms (all)									
	Power Supplies						Line Levels		Functions	
	I/Ps (AC)*	Comments	O/Ps (DC)*	Comments	Ripple (AC)*	Comments	(mV)*	Comments	Correct Operation*	Comments
6										
7										
8										
9										
10										
11										

Number	General Comments	Test Equipment Identity(s)	Signature	Name & Company	Date
6					
7					
8					
9					
10					
11					

* Insert details of problems or tick if all correct

NetworkRail	**RC System: FDM69-NV Test**	**Form: NR/SMS/RC04/RC01** **Date: 05/12/2020** **Issue: 01**

Power Signal Box:	Remote Interlocking:	System No:

Service A Tests							Comments	Test Equipment Identity	Signature	Name & Company	Date
Signal Box & Equipment Rooms											
Power Supplies			Transmitter Levels		Receiver Levels						
I/Ps (AC)	O/Ps (DC)	Ripple (AC)	Tx	Not Tx	Rx	Not Rx					

NetworkRail	**RC System: FDM69-NV Test**	**Form: NR/SMS/RC04/RC01** **Date: 05/12/2020** **Issue: 01**

Service A Tests							Comments	Test Equipment Identity	Signature	Name & Company	Date
Signal Box & Equipment Rooms											
Power Supplies			Transmitter Levels		Receiver Levels						
I/Ps (AC)	O/Ps (DC)	Ripple (AC)	Tx	Not Tx	Rx	Not Rx					

NetworkRail	**Siemens Westplex** Maintenance Test	**Form: NR/SMS/RC05/RC01** **Date: 05/12/2020** **Issue: 01**

Signal Box / Interlocking:	Locations:	System:	IP Addresses:

LED`s #	Line 1		Line 2		Signature	Name & Company	Date
	Signal / Noise (dB)	Loop Attenuation (dB)	Signal / Noise (dB)	Loop Attenuation (dB)			
	(Greater than 35) *	(Less than 10) *	(Greater than 35) *	(Less than 10) *			

* Record obtained value # Insert tick if correct

NetworkRail	**Siemens Westplex** Maintenance Test	**Form: NR/SMS/RC05/RC01** **Date: 05/12/2020** **Issue: 01**

LED's #	Line 1		Line 2		Signature	Name & Company	Date
	Signal / Noise (dB)	Loop Attenuation (dB)	Signal / Noise (dB)	Loop Attenuation (dB)			
	(Greater than 35) *	(Less than 10) *	(Greater than 35) *	(Less than 10) *			

* Record obtained value # Insert tick if correct

NetworkRail	RC System: GEC Type RM TDM Test	Form: NR/SMS/RC07/RC01 Date: 05/12/2020 Issue: 01

Power Signal Box:	Number of Remote Interlockings:	Remote Interlocking (1):	Remote Interlocking (2):
Remote Interlocking (3):	Remote Interlocking (4):	Remote Interlocking (5):	Remote Interlocking (6):

Number	Office Tests				Field Tests (All Interlockings)			
	Indications		Power Supplies		Indications		Power Supplies	
	Correct Functions*	Comments	Within Specification*	Adjustment Details	Correct Functions*	Comments	Within Specification*	Adjustment Details
1								
2								
3								
4								

No.	General Comments	Test Equipment Identity(s)	Signature	Name & Company	Date
1					
2					
3					
4					

	RC System: GEC Type RM TDM Test	**Form: NR/SMS/RC07/RC01** **Date: 05/12/2020** **Issue: 01**

Number	Service B Tests											
	Office Tests						Field Tests (All Interlockings)					
	Power Supplies		System Changeover**		Line Levels		Power Supplies		System Changeover**		Line Levels	
	Within Spec.*	Adjustment Details	Correct Functions*	Comments	Within Spec.*	Adjustment Details	Within Spec.*	Adjustment Details	Correct Functions*	Comments	Within Spec.*	Adjustment Details
1												
2												
3												
4												

No.	General Comments	Test Equipment Identity(s)	Signature	Name & Company	Date
1					
2					
3					
4					

* Insert details of supply/system requiring adjustment or tick if all correct **: Dual systems Only

NetworkRail	**RC System: WBS Type TDM 69 Test**	**Form: NR/SMS/RC08/RC01** **Date: 05/12/2020** **Issue: 01**

Power Signal Box:	Number of Remote Interlockings:	Remote Interlocking (1):	Remote Interlocking (2):
Remote Interlocking (3):	Remote Interlocking (4):	Remote Interlocking (5):	Remote Interlocking (6):

Number	Office Tests				Field Tests (All Interlockings)			
	Indications		High/Low Voltage Tests		Indications		High/Low Voltage Tests	
	All Correct*	Comments	Correct Functions*	Comments	All Correct*	Comments	Correct Functions*	Comments
1								
2								
3								
4								

No.	General Comments	Test Equipment Identity(s)	Signature	Name & Company	Date
1					
2					
3					
4					

* Insert details of indication/supply not to specification or tick if all correct

NetworkRail	**RC System: WBS Type TDM 69 Test**	**Form: NR/SMS/RC08/RC01** **Date: 05/12/2020** **Issue: 01**

Number	Service B Tests											
	Office Tests											
	Individual Bit Test		Line Connection Units		Received Signal Levels		Line Levels		Voltage Tests		Insulation / Noise Tests	
	All Correct*	Comments	All Correct*	Comments	All Correct*	Comments	All Correct*	Comments	All Correct*	Comments	All Correct*	Comments
1												
2												

Number	Service B Tests											
	Field Tests (all interlockings)											
	Individual Bit Test		Line Connection Units		Received Signal Levels		Line Levels		Voltage Tests		Insulation / Noise Tests	
	All Correct*	Comments	All Correct*	Comments	All Correct*	Comments	All Correct*	Comments	All Correct*	Comments	All Correct*	Comments
1												
2												

No.	General Comments	Test Equipment Identity(s)	Signature	Name & Company	Date
1					
2					

* Insert details of indication/supply not to specification or tick if all correct

	RC System: WBS Type S2 TDM Test	Form: NR/SMS/RC09/RC01 Date: 05/12/2020 Issue: 01

Power Signal Box:	Number of Remote Interlockings:	Remote Interlocking (1):	Remote Interlocking (2):
Remote Interlocking (3):	Remote Interlocking (4):	Remote Interlocking (5):	Remote Interlocking (6):

Number	Office Tests				Field Tests (All Interlockings)			
	Indications		Power Supplies		Indications		Power Supplies	
	Correct Functions*	Comments	Within Specification*	Adjustment Details	Correct Functions*	Comments	Within Specification*	Adjustment Details
1								
2								
3								
4								

No.	General Comments	Test Equipment Identity(s)	Signature	Name & Company	Date
1					
2					
3					
4					

* Insert details of supply/system requiring adjustment or tick if all correct

NetworkRail	RC System: WBS Type S2 TDM Test	Form: NR/SMS/RC09/RC01 Date: 05/12/2020 Issue: 01

Number	Service B Tests											
	Office Tests						Field Tests (All Interlockings)					
	Power Supplies		Line Levels		System Changeover**		Power Supplies		Line Levels		System Changeover**	
	Within Spec.*	Adjustment Details	Within Spec.*	Adjustment Details	Correct Functions*	Comments	Within Spec.*	Adjustment Details	Within Spec.*	Adjustment Details	Correct Functions*	Comments
1												
2												
3												
4												

No.	General Comments	Test Equipment Identity(s)	Signature	Name & Company	Date
1					
2					
3					
4					

* Insert details of supply/system requiring adjustment or tick if all correct
** Dual Systems Only

	RC System: Westronic F1 TDM Test	Form: NR/SMS/RC10/RC01 Date: 05/12/2020 Issue: 01

Power Signal Box:	Number of Remote Interlockings:	Remote Interlocking (1):	Remote Interlocking (2):
Remote Interlocking (3):	Remote Interlocking (4):	Remote Interlocking (5):	Remote Interlocking (6):

Number	Office Tests						Field Tests (All Interlockings)			
	Indications		Power Supplies		Line Changeover**		Indications		Power Supplies	
	Correct Functions*	Comments	Within Specification*	Adjustment Details	Correct Function*	Comments	Correct Functions*	Comments	Within Specification*	Adjustment Details
1										
2										
3										
4										

No.	General Comments	Test Equipment Identity(s)	Signature	Name & Company	Date
1					
2					
3					
4					

* Insert details of supply/system requiring adjustment or tick if all correct

** If provided

NetworkRail	**RC System: Westronic F1 TDM Test**	**Form: NR/SMS/RC10/RC01** **Date: 05/12/2020** **Issue: 01**

Number	Service B Tests											
	Office Tests								Field Tests (All Interlockings)			
	Alarms		Marginal Voltage		Line Proving (main)**		Line Proving (standby)**		Alarms		Marginal Voltage	
	Within Spec.*	Adjustment Details	Within Spec.*	Adjustment Details	Correct Functions*	Comments	Correct Functions*	Comments	Within Spec.*	Adjustment Details	Within Spec.*	Adjustment Details
1												
2												
3												
4												

No.	General Comments	Test Equipment Identity(s)	Signature	Name & Company	Date
1					
2					
3					
4					

* Insert details of supply/system requiring adjustment or tick if all correct

	RC System: Vaughan Harmon Type DM11 Test	**Form: NR/SMS/RC11/RC01** **Date: 05/12/2020** **Issue: 01**

Power Signal Box:	Number of Remote Interlockings:	Remote Interlocking (1):	Remote Interlocking (2):
Remote Interlocking (3):	Remote Interlocking (4):	Remote Interlocking (5):	Remote Interlocking (6):

Number	Office Tests				Field Tests (All Interlockings)			
	Indications		Power Supplies		Indications		Power Supplies	
	Correct Functions*	Comments	Within Specification*	Adjustment Details	Correct Functions*	Comments	Within Specification*	Adjustment Details
1								
2								
3								
4								

No.	General Comments	Test Equipment Identity(s)	Signature	Name & Company	Date
1					
2					
3					
4					

* Insert details of supply/system requiring adjustment or tick if all correct

NetworkRail	RC System: Vaughan Harmon Type DM11 Test	Form: NR/SMS/RC11/RC01 Date: 05/12/2020 Issue: 01

Number	Service B Tests											
	Office Tests						Field Tests (All Interlockings)					
	Power Supplies		System Changeover		Line Levels		Power Supplies		System Changeover		Line Levels	
	Within Spec.*	Adjustment Details	Correct Functions*	Adjustment Details	Within Spec.*	Comments	Within Spec.*	Adjustment Details	Correct Functions*	Adjustment Details	Within Spec.*	Comments
1												
2												
3												
4												

No.	General Comments	Test Equipment Identity(s)	Signature	Name & Company	Date
1					
2					
3					
4					

* Insert details of supply/system requiring adjustment or tick if all correct

NetworkRail	**RC System: Telecode 80 Test**	**Form: NR/SMS/RC12/RC01** **Date: 05/12/2020** **Issue: 01**

Power Signal Box:	Number of Remote Interlockings:	Remote Interlocking (1):	Remote Interlocking (2):
Remote Interlocking (3):	Remote Interlocking (4):	Remote Interlocking (5):	Remote Interlocking (6):

Number	Office Tests				Field Tests (All Interlockings)			
	Indications		Power Supplies		Indications		Power Supplies	
	Correct Functions*	Comments	Within Specification*	Adjustment Details	Correct Functions*	Comments	Within Specification*	Adjustment Details
1								
2								
3								
4								

No.	General Comments	Test Equipment Identity(s)	Signature	Name & Company	Date
1					
2					
3					
4					

NetworkRail	**RC System: Telecode 80 Test**	**Form: NR/SMS/RC12/RC01** **Date: 05/12/2020** **Issue: 01**

Number	Service B Tests											
	Office Tests											
	Power Supplies		Standby Battery Test #		Line Levels		Alarms		Transmission Test		System Changeover	
	Within Spec.*	Adjustment Details	Correct Functions*	Adjustment Details	Within Spec.*	Comments	Correct Functions*	Adjustment Details	Correct Functions*	Adjustment Details	Within Spec.*	Comments
1												
2												

Number	Service B Tests											
	Field Tests (all interlockings)											
	Power Supplies		Standby Battery Test #		Line Levels		Alarms		Transmission Test		System Changeover #	
	Within Spec.*	Adjustment Details	Correct Functions*	Adjustment Details	Within Spec.*	Comments	Correct Functions*	Adjustment Details	Correct Functions*	Adjustment Details	Within Spec.*	Comments
1												
2												

No.	General Comments	Test Equipment Identity(s)	Signature	Name & Company	Date
1					
2					

* Insert details of supply/system requiring adjustment or tick if all correct

Where fitted

NetworkRail	**RC System: AP Datalink TDM Test**	**Form: NR/SMS/RC13/RC01** **Date: 05/12/2020** **Issue: 01**

Power Signal Box:	Number of Remote Interlockings:	Remote Interlocking (1):	Remote Interlocking (2):
Remote Interlocking (3):	Remote Interlocking (4):	Remote Interlocking (5):	Remote Interlocking (6):

Number	Office Tests				Field Tests (All Interlockings)			
	Alarms		Power Supplies		Alarms		Power Supplies	
	Correct Functions*	Comments	Within Specification*	Adjustment Details	Correct Functions*	Comments	Within Specification*	Adjustment Details
1								
2								
3								
4								

No.	General Comments	Test Equipment Identity(s)	Signature	Name & Company	Date
1					
2					
3					
4					

* Insert details of supply/system requiring adjustment or tick if all correct

	RC System: AP Datalink TDM Test	Form: NR/SMS/RC13/RC01 Date: 05/12/2020 Issue: 01

Number	Service B Tests											
	Office Tests											
	Carrier Tx Levels		Carrier Rx Levels		Mark-Space Ratio		Line Change Over		Alarms		Battery Supply Units	
	Within Spec.*	Comments	Within Spec.*	Comments	Within Spec.*	Comments	Correct Functions*	Adjustment Details	Correct Functions*	Adjustment Details	Within Spec.*	Comments
1												
2												

Number	Service B Tests											
	Field Tests (all interlockings)											
	Carrier Tx Levels		Carrier Rx Levels		Mark-Space Ratio		Line Change Over		Alarms		Battery Supply Units	
	Within Spec.*	Adjustment Details	Within Spec.*	Adjustment Details	Within Spec.*	Comments	Correct Functions*	Adjustment Details	Correct Functions*	Adjustment Details	Within Spec.*	Comments
1												
2												

No.	General Comments	Test Equipment Identity(s)	Signature	Name & Company	Date
1					
2					

* Insert details of supply/system requiring adjustment or tick if all correct

<table>
<tr><td>NetworkRail</td><td>RC System: Westronic 1024 TDM Test</td><td>Form: NR/SMS/RC16/RC01
Date: 05/12/2020
Issue: 01</td></tr>
</table>

Power Signal Box (Office):	Remote Interlocking (Field):	Office / Field**

SERVICE B TESTS								
Tests*		Voltages		Comments	Meter Identity	Signature	Name & Company	Date
Indications Correct?	System Changeover Successful?	PSU 5V (DC)	Ripple (AC)					

*: Insert tick if all correct, enter problems in the comment's columns **: Delete as appropriate

NetworkRail	RC System: Westronic 1024 TDM Test	Form: NR/SMS/RC16/RC01 Date: 05/12/2020 Issue: 01

SERVICE B TESTS

Tests*		Voltages		Comments	Meter Identity	Signature	Name & Company	Date
Indications Correct?	System Changeover Successful?	PSU 5V (DC)	Ripple (AC)					

* Insert tick if all correct, enter problems in the comment's columns

** Delete as appropriate

GENERAL COMMENTS

Network Rail	**Severn Tunnel Pull Wire Record Card** **NR/SMS/SW20/Test 059**	**Form: NR/SMS/SW20/T059/RC01** **Date: April 2006** **Issue: 02**

Service B Tests*				Comments	Signature, Name & Company	Date
Key Identit	Correct Indications	Key Identit	Correct Indications			
1		33				
2		34				
3		35				
4		36				
5		37				
6		38				
7		39				
8		40				
9		41				
10		42				
11		43				
12		44				
13		45				
14		46				
15		47				
16		48				
17		49				
18		50				
19		51				
20		52				
21		53				
22		54				
23		55				
24		56				
25		57				
26		58				
27		59				
28		60				
29		61				
30		62				
31		63				
32						
*: Insert tick if correct						

Network Rail	Junction Indicator and Position Light Signal – All types Maintenance Test	Form: NR/SMS/T021/RC01 Date: 01/09/2018 Issue: 02

Signal Box / Interlocking / Equipment Room:	Location:	Signal Number:

					Lamp / SLM Voltage								
Date	Name	Company	Signature	Meter Identity	PLS Pivot	PLS Bottom LED	PLS Top	Jct Indicator Position 1	Jct Indicator Position 2	Jct Indicator Position 3	Jct Indicator Position 4	Jct Indicator Position 5	Jct Indicator Position 6

Network Rail

Route Indicator – non LED

Maintenance Test

Form: NR/SMS/T021/RC02
Date: 01/09/2018
Issue: 02

Signal Box / Interlocking / Equipment Room:	Location:	Signal Number:

Type of Signal: (Circle)				**Manufacturer:** (Circle)				
MARI	SARI	PRI	Other	Dorman	VMS	Signalhouse		

					Indication Displayed			Indication Displayed			Indication Displayed			Indication Displayed		
Date	Name	Company	Signature	Meter ID	Main (V)	Aux (V)	Lamp changed (#)	Main (V)	Aux (V)	Lamp changed (#)	Main (V)	Aux (V)	Lamp changed (#)	Main (V)	Aux (V)	Lamp changed (#)
							Y / N			Y / N			Y / N			Y / N
							Y / N			Y / N			Y / N			Y / N
							Y / N			Y / N			Y / N			Y / N
							Y / N			Y / N			Y / N			Y / N
							Y / N			Y / N			Y / N			Y / N
							Y / N			Y / N			Y / N			Y / N
							Y / N			Y / N			Y / N			Y / N
							Y / N			Y / N			Y / N			Y / N
							Y / N			Y / N			Y / N			Y / N
							Y / N			Y / N			Y / N			Y / N
							Y / N			Y / N			Y / N			Y / N
							Y / N			Y / N			Y / N			Y / N
							Y / N			Y / N			Y / N			Y / N
							Y / N			Y / N			Y / N			Y / N

(#) Circle as required

Network Rail	Route Indicator - LED Maintenance Test	Form: NR/SMS/T021/RC03 Date: 01/09/2018 Issue: 02

Signal Box / Interlocking / Equipment Room:	Location:	Signal Number:

Type of Signal: (Circle)				**Manufacturer:** (Circle)				
MARI	SARI	PRI	Other	Dorman	VMS	Signalhouse		

					Indication Displayed		Indication Displayed		Indication Displayed		Indication Displayed		Indication Displayed	
Date	Name	Company	Signature	Meter ID	SLM Voltage	Module changed (#)	SLM Voltage	Module changed (#)	SLM Voltage	Module changed (#)	SLM Voltage	Module changed (#)	SLM Voltage	Module changed (#)
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N

(#) Circle as required

Network Rail	**Signal - (Filament / Light Engine)** Maintenance Test	**Form: NR/SMS/T021/RC04** **Date: 01/06/2019** **Issue: 05**

Signal Box / Interlocking / Equipment Room:	**Location:**	**Signal Number:**

Type of Signal: (Circle)					**Illumination Type:** (Circle)		**Lens Type:** (Circle)		**Type of Lamp** (Circle)						**Other Type**
Multi-Aspect	Searchlight	Semaphore	Banner	SPAD	Approach Lit	Continuously Lit	Normal	Spreadlit/ Short Range	SL35 8000hr	Light Engine	SL18	10V Halogen	10V 6000hr Halogen	12V Halogen	

Aspect Details	Red	Yellow	Green	Top Yellow / Top Red (SPAD)	Searchlight
Lens Material : Glass = G Polycarbonate = P (Enter type codes into the appropriate boxes)					
Alignment of Centre Line of Hot Strip: (Enter the position using clock face indication method)					

				Red / Searchlight / Banner / Semaphore				**Yellow**				**Green**				**Top Yellow / Top Red (SPAD)**				**SMS Test Completed (tick)**	
				Filament (V)		Lamp Change	Lens Change	Filament (V)		Lamp Change	Lens Change	Filament (V)		Lamp Change	Lens Change	Filament (V)		Lamp Change	Lens Change		
Date	Name	Company	Meter ID	Main	Aux *			Main	Aux *			Main	Aux *			Main	Aux *			Test 21	Test 22
						Y / N	Y / N			Y / N	Y / N			Y / N	Y / N			Y / N	Y / N		
						Y / N	Y / N			Y / N	Y / N			Y / N	Y / N			Y / N	Y / N		
						Y / N	Y / N			Y / N	Y / N			Y / N	Y / N			Y / N	Y / N		
						Y / N	Y / N			Y / N	Y / N			Y / N	Y / N			Y / N	Y / N		
						Y / N	Y / N			Y / N	Y / N			Y / N	Y / N			Y / N	Y / N		
						Y / N	Y / N			Y / N	Y / N			Y / N	Y / N			Y / N	Y / N		
						Y / N	Y / N			Y / N	Y / N			Y / N	Y / N			Y / N	Y / N		
						Y / N	Y / N			Y / N	Y / N			Y / N	Y / N			Y / N	Y / N		
						Y / N	Y / N			Y / N	Y / N			Y / N	Y / N			Y / N	Y / N		
						Y / N	Y / N			Y / N	Y / N			Y / N	Y / N			Y / N	Y / N		
						Y / N	Y / N			Y / N	Y / N			Y / N	Y / N			Y / N	Y / N		
						Y / N	Y / N			Y / N	Y / N			Y / N	Y / N			Y / N	Y / N		
						Y / N	Y / N			Y / N	Y / N			Y / N	Y / N			Y / N	Y / N		
						Y / N	Y / N			Y / N	Y / N			Y / N	Y / N			Y / N	Y / N		
						Y / N	Y / N			Y / N	Y / N			Y / N	Y / N			Y / N	Y / N		
						Y / N	Y / N			Y / N	Y / N			Y / N	Y / N			Y / N	Y / N		
						Y / N	Y / N			Y / N	Y / N			Y / N	Y / N			Y / N	Y / N		
						Y / N	Y / N			Y / N	Y / N			Y / N	Y / N			Y / N	Y / N		

* For Double Filament Lamps Only

Network Rail	**Signal - LED** Maintenance Test	**Form: NR/SMS/T021/RC05** **Date: 01/06/2019** **Issue: 03**

Signal Box / Interlocking / Equipment Room:	**Location:**	**Signal Number:**

Type of Signal: (Circle)			**Manufacturer:** (Circle)					**Illumination Type:** (Circle)		**Lens Type:** (Circle)	
Multi-Aspect	Searchlight	Semaphore	Dorman	VMS	Signalhouse			Approach Lit	Continuously Lit	Normal	Spreadlit/ Short Range

					Red / White (Semaphore)		**Yellow**		**Double Yellow**		**Green**		**Double Red (SPAD)**	
Date	Name	Company	Signature	Meter ID	SLM Voltage	Module changed (#)	SLM Voltage	Module changed (#)	SLM Voltage	Module changed (#)	SLM Voltage	Module changed (#)	SLM Voltage	Module changed (#)
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N
						Y / N		Y / N		Y / N		Y / N		Y / N

(#) Circle as required

Network Rail	**Signal - SIMIS-W Interlocking Areas Only** Maintenance Test	**Form: NR/SMS/T021/RC06** **Date: 01/09/2018** **Issue: 02**

Signal Box / Interlocking / Equipment Room:	**Location:**	**Signal Number:**

Type of Signal: (Circle)			**Illumination Type:** (Circle)		**Lens Type:** (Circle)		**Type of Lamp** (Circle)							**Other Type** (Specify Type and Voltage)
Multi-Aspect	Searchlight	Semaphore	Approach Lit	Continuously Lit	Normal	Spreadlit/ Short Range	SL35	SL35 8000hr	Light Engine	SL18	10V Halogen	10V 6000hr Halogen	12V Halogen	

Aspect Details	Red	Yellow	Green	Top Yellow	Searchlight
Lens Material : Glass = G Polycarbonate = P (Enter type codes into the appropriate boxes)					
Alignment of Centre Line of Hot Strip: (Enter the position using clock face indication method)					

			Red						**Yellow**						**Green**						**Top Yellow**					
			Filament (V)		TX I/P Current (mA)	Transformer Settings		SSC Code	Filament (V)		TX I/P Current (mA)	Transformer Settings		SSC Code	Filament (V)		TX I/P Current (mA)	Transformer Settings		SSC Code	Filament (V)		TX I/P Current (mA)	Transformer Settings		SSC Code
Date	Name	Meter ID	Main	Aux *		I/P	O/P		Main	Aux*		I/P	O/P		Main	Aux*		I/P	O/P		Main	Aux*		I/P	O/P	

* For Double Filament Lamps Only

			Red						Yellow						Green						Top Yellow					
			Filament (V)		TX I/P Current (mA)	Transformer Settings		SSC Code	Filament (V)		TX I/P Current (mA)	Transformer Settings		SSC Code	Filament (V)		TX I/P Current (mA)	Transformer Settings		SSC Code	Filament (V)		TX I/P Current (mA)	Transformer Settings		SSC Code
Date	Name	Meter ID	Main	Aux *		I/P	O/P		Main	Aux*		I/P	O/P		Main	Aux*		I/P	O/P		Main	Aux*		I/P	O/P	

* For Double Filament Lamps Only

Network Rail	**Trainstop (Electro-Hydraulic) Calibration Test Record Card (Front)** **NR/SMS/Test/026**	**Form: NR/SMS/T026/RC/01** **Date: August 2004** **Issue: 01**

Signal Box:	Location:	Train Stop Number:	Train Stop Type:

Stop Arm & Motor Cut Out Settings (mm)					Comments	Signature	Name & Company	Date
Arm Fully Raised	On Detection Lost	Off Detection Made	Arm Fully Lowered	Motor Cut Out				

Network Rail	**Trainstop (Electro-Hydraulic) Calibration Test Record Card (Rear)** **NR/SMS/Test/026**	**Form: NR/SMS/T026/RC/01** **Date: August 2004** **Issue: 01**

Stop Arm & Motor Cut Out Settings (mm)					Comments	Signature	Name & Company	Date
Arm Fully Raised	On Detection Lost	Off Detection Made	Arm Fully Lowered	Motor Cut Out				

Network Rail	**ATP (Chilterns)** Maintenance Test	**Form: NR/SMS/T029/RC01** **Date: June 2019** **Issue: 03**

Signal Number:	Loop ID:	Loop Length (M):	Line Speed:	Gradient:	Distance to Loop (M)

Date	Name & Company	Signed	Meter Identity	Current Probe Identity	Power Supply Voltage	Loop Cable Current (μA)	Comments *Adjustments etc*

*: Insert tick if correct **: Insert tick if fitted and details in the comments column

Network Rail	**Insulated Rail Joint (IRJ) - DC & BR-WR Quick Release TC's** Maintenance Test	**Form: NR/SMS/T041/RC01** **Date: 01/09/2018** **Issue: 02**

Signal Box / Interlocking:	Adjacent Track Circuits:	Line: Up / Down Rail: Six Foot / Cess *Delete as Appropriate*

Voltages (V)					Meter Identity	220 Ohm Shunt Identity	Comments *Joint Condition, Pway Condition etc*	Signature	Name & Company	Date
Rail to Rail	Inner Plate to Rail		Outer Plate to Rail							
V1	V2	V3	V2	V3						

Network Rail	**Insulated Rail Joint (IRJ) - DC & BR-WR Quick Release TC's** Maintenance Test	**Form: NR/SMS/T041/RC01** **Date: 01/09/2018** **Issue: 02**

Signal Box / Interlocking:	Adjacent Track Circuits:	Line: Up / Down Rail: Six Foot / Cess *Delete as Appropriate*

Voltages (V)					Meter Identity	220 Ohm Shunt Identity	Comments *Joint Condition, Pway Condition etc*	Signature	Name & Company	Date
Rail to Rail	Inner Plate to Rail		Outer Plate to Rail							
V1	V2	V3	V2	V3						

Network Rail

Insulated Rail Joint Test (IRJ) - 50Hz AC TC's

Maintenance Test

Form: NR/SMS/T041/RC/02
Date: 01/09/2018
Issue: 02

Signal Box / Interlocking:	Adjacent Track Circuits:	Line: Up / Down Rail: Six Foot / Cess *Delete as Appropriate*

Resistance (Ohms)																Meter Identity	Comments *Joint Condition, Pway Condition etc*	Signature	Name & Company	Date
Rails to Inner Plate		Rail to Inner Plate Bolts						Rails to Outer Plate		Rail to Outer Plate Bolts										
1	2	1	2	3	4	5	6	1	2	1	2	3	4	5	6					

Network Rail	**Insulated Rail Joint Test (IRJ) - DC & 50Hz AC TC's** Maintenance Test	**Form: NR/SMS/T041/RC/02** **Date: 01/09/2018** **Issue: 02**

Signal Box / Interlocking:	Adjacent Track Circuits:	Line: Up / Down Rail: Six Foot / Cess *Delete as Appropriate*

Resistance (Ohms)																Meter Identity	Comments *Joint Condition, Pway Condition etc*	Signature	Name & Company	Date
Rails to Inner Plate		Rail to Inner Plate Bolts						Rails to Outer Plate		Rail to Outer Plate Bolts										
1	2	1	2	3	4	5	6	1	2	1	2	3	4	5	6					

Network Rail	**Axle Counter - AzL70** Evaluator & Single Rail Contacts Record Card	**Form: NR/SMS//T042/01** **Date: March 2018** **Issue: 02**

Signal Box / Interlocking:		Location:	Axle Counter Section:
Count In Letter/Number:	Count Out (1) Letter/Number:	Count Out (2) Letter/Number:	Rail Contact Type:

Number	**Evaluator**																		**Lineside Junction Box (EAK)**				
	Voltages (V)								Wavefor	System Tests*									Voltages (V & mV)				
	DC Supply	DC Stabilised Supply	BUPL Jacks						Square Wave * (optional)	Eval uato					LED's/Relay Indications/Positions		Power Supply		DC Supply	DC Stabilised	Signal Generator	Channel 1 SK1	Channel 1 SK2
			1a	1b	2a	2b	3a	3b		Count In	Count Out	System Reset	Count Indication	SVA Card Removal	Section Clear	Section Occupied	Charger Current	Standby Functional					
1																							
2																							
3																							
4																							
5																							
6																							
7																							

Number	**Rail Contacts**												**General Information**				
	Voltage (mV) at AL4/3-4 For SK1 & AL4/1-2 for SK2																
	Without Dummy Wheel						With Dummy Wheel										
	Count In		Count Out (1)		Count Out (2)		Count In		Count Out (1)		Count Out (2)						
	SK1	SK2	SK1	SK2	SK1	SK2	SK1	SK2	SK1	SK2	SK1	SK2	Comments	Date	Meter ID	Name & Company	Signature
1																	
2																	
3																	
4																	
5																	
6																	
7																	

*: Insert tick if functions/indications/tests are correct to RT/SMS steps

Axle Counter - AzL70

Evaluator & Double Rail Contacts Record Card (Front)

Form: NR/SMS/T042/02
Date: March 2018
Issue: 01

Signal Box / Interlocking:	Location:	Axle Counter Section:

Count In Letter/Number:	Count Out (1) Letter/Number:	Count Out (2) Letter/Number:	Rail Contact Type:

Number	Evaluator																	
	Voltages (V)								Waveforms	System Tests*								
	DC Supply	DC Stabilised Supply	BUPL Jacks						Square Wave * (Optional)	Evaluator Functions					LED's/Relay Indications/Positions		Power Supply	
			1a	1b	2a	2b	3a	3b		Count In	Count Out	System Reset	Count Indication	SVA Card Removal	Section Clear	Section Occupied	Charger Current	Standby Functional
1																		
2																		
3																		
4																		

Number	Rail Contacts Tests																							
	Voltage (mV)														Output Voltage & Frequency Checks									
	Phase Reversal Tests [MESSAB 1 (10) for SK1 & MESSAB 2 (12) for SK2]												PEGUE 1 (11)	PEGUE 2 (13)	No Dummy Wheel		Dummy Wheel over SK1			Dummy Wheel over SK2			Dummy Wheel over SK1 & SK2	
	Without Dummy Wheel						With Dummy Wheel																	
	Count In		Count Out 1		Count Out 2		Count In		Count Out 1		Count Out 2				LED's *	LTG1 (mV)	LED's *	LTG1 (mV)	Freq (kHz)	LED's *	LTG1 (mV)	Freq (kHz)	LED's *	LTG1 (mV)
	SK1	SK2	SK1	SK2	SK1	SK2	SK1	SK2	SK1	SK2	SK1	SK2												
1																								
2																								
3																								
4																								

Number	Lineside Junction Box (EAK) Tests											Comments *Adjustments etc*	Meter Identity	Signature	Name & Company	Date
	Voltages (mV & V)							Tx Outputs								
	Incoming Supply	Stabilised Supply 1 (3)	Stabilised Supply 2 (4)	MESSAB 1 (10)	MESSAB 2 (12)	PEGUE 1 (11)	PEGUE 2 (13)	SK1		SK2						
								Volts (AC)	Freq (kHz)	Volts (AC)	Freq (kHz)					
1																
2																
3																
4																

*: Insert tick if LED indications are correct to RT/SMS steps Note: Numbers in brackets refer to the test box switch positions

Network Rail

Axle Counter - AzL70 (Thales)

Evaluator & Double Rail Contacts Record Card

(Back)

Form: NR/SMS//T042/AzL 70 Double
Date: March 2018
Issue: 02

Number	Evaluator																	
	Voltages (V)								Waveforms	System Tests*								
	DC Supply	DC Stabilised Supply	BUPL Jacks						Square Wave * (Optional)	Evaluator Functions					LED's/Relay Indications/Positions		Power Supply	
			1a	1b	2a	2b	3a	3b		Count In	Count Out	System Reset	Count Indication	SVA Card Removal	Section Clear	Section Occupied	Charger Current	Standby Functional
5																		
6																		
7																		
8																		
9																		

Number	Rail Contacts Tests																							
	Voltage (mV)														Output Voltage & Frequency Checks									
	Phase Reversal Tests [MESSAB 1 (10) for SK1 & MESSAB 2 (12) for SK2]												PEGUE 1 (11)	PEGUE 2 (13)	No Dummy Wheel		Dummy Wheel over SK1			Dummy Wheel over SK2			Dummy Wheel over SK1 & SK2	
	Without Dummy Wheel						With Dummy Wheel								LED's *	LTG1 (mV)	LED's *	LTG1 (mV)	Freq (kHz)	LED's *	LTG1 (mV)	Freq (kHz)	LED's *	LTG1 (mV)
	Count In		Count Out 1		Count Out 2		Count In		Count Out 1		Count Out 2													
	SK1	SK2	SK1	SK2	SK1	SK2	SK1	SK2	SK1	SK2	SK1	SK2												
5																								
6																								
7																								
8																								
9																								

Number	Lineside Junction Box (EAK) Tests											Comments : *Adjustments etc*	Meter Identity	Signature	Name & Company	Date
	Voltages (mV & V)							Tx Outputs								
	Incoming Supply	Stabilised Supply 1 (3)	Stabilised Supply 2 (4)	MESSAB 1 (10)	MESSAB 2 (12)	PEGUE 1 (11)	PEGUE 2 (13)	SK1		SK2						
								Volts (AC)	Freq (kHz)	Volts (AC)	Freq (kHz)					
5																
6																
7																
8																
9																

*: Insert tick if LED indications are correct to RT/SMS steps   Note: Numbers in brackets refer to the test box switch positions

Network Rail	**Axle Counter - AzL70/30 & AzL70/30s** Evaluator & Rail Contacts Record Card (Front)	**Form: NR/SMS//T042/03** **Date: March 2018** **Issue: 01**

Signal Box / Interlocking:	Location:	Axle Counter Section:	System Type: 70/30 70/30S (Circle)
Count In Letter/Number:	Count Out (1) Letter/Number:	Count Out (2) Letter/Number:	Rail Contact Type:

Number	Evaluator																					
	Voltages (V)												Waveform	System Tests*								
	DC Supply	DC Stabilised Supply	BUPL Terminals				BUPL Jacks						Square Wave * (Optional)	Evaluator Functions					LED's/Relay Indications/Positions		Power Supply	
			2nd	4th	5th	6th	1a	1b	2a	2b	3a	3b		Count In	Count Out	System Reset	Count Indication	SVA Card Removal	Section Clear	Section Occupied	Charger Current	Standby Functional
1																						
2																						
3																						
4																						

Number	Rail Contacts Tests																							
	Voltage (mV)														Output Voltage & Frequency Checks									
	Phase Reversal Tests [MESSAB 1 (10) for SK1 & MESSAB 2 (12) for SK2]												PEGUE 1 (11)	PEGUE 2 (13)	No Dummy Wheel		Dummy Wheel over SK1			Dummy Wheel over SK2			Dummy Wheel over SK1 & SK2	
	Without Dummy Wheel						With Dummy Wheel								LED's *	LTG1 (mV)	LED's *	LTG1 (mV)	Freq (kHz)	LED's *	LTG1 (mV)	Freq (kHz)	LED's *	LTG1 (mV)
	Count In		Count Out 1		Count Out 2		Count In		Count Out 1		Count Out 2													
	SK1	SK2	SK1	SK2	SK1	SK2	SK1	SK2	SK1	SK2	SK1	SK2												
1																								
2																								
3																								
4																								

Number	Lineside Junction Box (EAK) Tests											Comments *Adjustments etc*	Meter Identity	Signature	Name & Company	Date
	Voltages (mV & V)							Tx Outputs								
	Incoming Supply	Stabilised Supply 1 (3)	Stabilised Supply 2 (4)	MESSAB 1 (10)	MESSAB 2 (12)	PEGUE 1 (11)	PEGUE 2 (13)	SK1		SK2						
								Volts (AC)	Freq (kHz)	Volts (AC)	Freq (kHz)					
1																
2																
3																
4																

*: Insert tick if LED indications are correct to RT/SMS steps   Note: Numbers in brackets refer to the test box switch positions

Axle Counter - AzL70 (Thales)

Evaluator & Double Rail Contacts Record Card (Back)

Form: NR/SMS//T042/AzL70 /30
Date: March 2018
Issue: 02

Number	Evaluator																					
	Voltages (V)												Waveform	System Tests*								
	DC Supply	DC Stabilised Supply	BUPL Terminals				BUPL Jacks						Square Wave * (Optional)	Evaluator Functions					LED's/Relay Indications/Positions		Power Supply	
			2nd	4th	5th	6th	1a	1b	2a	2b	3a	3b		Count In	Count Out	System Reset	Count Indication	SVA Card Removal	Section Clear	Section Occupied	Charger Current	Standby Functional
5																						
6																						
7																						
8																						
9																						

Number	Rail Contacts Tests																							
	Voltage (mV)														Output Voltage & Frequency Checks									
	Phase Reversal Tests [MESSAB 1 (10) for SK1 & MESSAB 2 (12) for SK2]												PEGUE 1 (11)	PEGUE 2 (13)										
	Without Dummy Wheel						With Dummy Wheel								No Dummy Wheel		Dummy Wheel over SK1			Dummy Wheel over SK2			Dummy Wheel over SK1 & SK2	
	Count In		Count Out 1		Count Out 2		Count In		Count Out 1		Count Out 2				LED's *	LTG1 (mV)	LED's *	LTG1 (mV)	Freq (kHz)	LED's *	LTG1 (mV)	Freq (kHz)	LED's *	LTG1 (mV)
	SK1	SK2	SK1	SK2	SK1	SK2	SK1	SK2	SK1	SK2	SK1	SK2												
5																								
6																								
7																								
8																								
9																								

Number	Lineside Junction Box (EAK) Tests											Comments : *Adjustments etc*	Meter Identity	Signature	Name & Company	Date
	Voltages (mV & V)							Tx Outputs								
	Incoming Supply	Stabilised Supply 1 (3)	Stabilised Supply 2 (4)	MESSAB 1 (10)	MESSAB 2 (12)	PEGUE 1 (11)	PEGUE 2 (13)	SK1		SK2						
								Volts (AC)	Freq (kHz)	Volts (AC)	Freq (kHz)					
5																
6																
7																
8																
9																

*: Insert tick if LED indications are correct to RT/SMS steps Note: Numbers in brackets refer to the test box switch positions

Network Rail	**Track Circuit Aid (TCAID) Test Record Card (Front)** **NR/SMS/Test/043**	**Form: NR/SMS/T043/RC/01** **Date: August 2004** **Issue: 01**

Signal Box / Interlocking:	Location:	TC Number / Letter:

TC Start (Miles/Yds):	TC Finish (Miles/Yds):	Number of TCAIDS on TC:	Usage: Continuous / Seasonal *Delete as appropriate*

No.	TCAID								
	Serial No.	Position (Miles/Yds)	Type (& direction if D)	Installed Date	Commissioned Date	De-Commissioned Date	Comments	Signature	Name & Company
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

Network Rail	**Track Circuit Aid (TCAID) Test Record Card (Rear)** **NR/SMS/Test/043**	**Form: NR/SMS/T043/RC/01** **Date: August 2004** **Issue: 01**

Number	Tests															
	Test 1				Test 2				Test 3				Test 4			
	Test OK*	Battery Renewed	Signature Date	Company	Test OK*	Battery Renewed	Signature Date	Company	Test OK*	Battery Renewed	Signature Date	Company	Test OK*	Battery Renewe	Signature Date	Company
1		Yes/No				Yes/No				Yes/No				Yes/No		
2		Yes/No				Yes/No				Yes/No				Yes/No		
3		Yes/No				Yes/No				Yes/No				Yes/No		
4		Yes/No				Yes/No				Yes/No				Yes/No		
5		Yes/No				Yes/No				Yes/No				Yes/No		
6		Yes/No				Yes/No				Yes/No				Yes/No		
7		Yes/No				Yes/No				Yes/No				Yes/No		
8		Yes/No				Yes/No				Yes/No				Yes/No		
9		Yes/No				Yes/No				Yes/No				Yes/No		
10		Yes/No				Yes/No				Yes/No				Yes/No		
11		Yes/No				Yes/No				Yes/No				Yes/No		
12		Yes/No				Yes/No				Yes/No				Yes/No		
13		Yes/No				Yes/No				Yes/No				Yes/No		
14		Yes/No				Yes/No				Yes/No				Yes/No		
15		Yes/No				Yes/No				Yes/No				Yes/No		
16		Yes/No				Yes/No				Yes/No				Yes/No		
17		Yes/No				Yes/No				Yes/No				Yes/No		
18		Yes/No				Yes/No				Yes/No				Yes/No		
19		Yes/No				Yes/No				Yes/No				Yes/No		
20		Yes/No				Yes/No				Yes/No				Yes/No		

* Insert tick if activate and de-activate voltages are correct

Network Rail	**Treadle Timing and Adjustment** Maintenance Test	**Form: NR/SMS/T44/Treadle Timing** **Date: June 2019** **Issue: 04**

Signal Box / Equipment Room:	Location:	Treadle Number:	Treadle Type: 59 / 69 Treadle Arm: Single / Double

Actuating Arm Gauge				Arm Return Timing		Meter Identity	Gauge Type Plump Weight & Step Gauge Reading in (mm) / Treadle Gauge Insert Pass / Fail	Comments *Adjustments, Fluid top up etc*	Signature & Initials	Date
Single Arm		2nd Arm (*)		Single Arm	2nd Arm (*)					
Rail to Arm gap (mm) Pass / Fail	Height below rail level (mm) Pass / Fail	Rail to Arm gap (mm) Pass / Fail	Height below rail level (mm) Pass / Fail	Time (Sec)	Time (Sec)					

(*) Style 69 double arm treadles only

Network Rail

Axle Counter - AzLM & AzLE

Detection Points Record Card

Form: NR/SMS /T045/01
Date: September 2018
Issue: 05

Signal Box / Interlocking:	Location:	Detection Point Name:	EAK Type	H	K
			Contact Type	H	K

Detection point Shared between ACEs?	Yes	No	ACE(s) Identity/Location	Power by: ACE: ………………….. OR LOCAL POWER: Location …………………….

Power Channel		MASSAB 1 (10) mVDC			MASSAB 2 (12) mVDC			SK1		SK2						
CH 1 (3) VDC	CH 2 (4) VDC	Without Dummy Wheel (+)	With Dummy Wheel (-)	PEGUE 1 (11) mVDC	Without Dummy Wheel (+)	With Dummy Wheel (-)	PEGUE 2 (13) mVDC	Voltage VAC	Freq KHz	Voltage VAC	Freq KHz	Comments	Meter Identity	Signature	Name & Company	Date

Thales AzLM & AzLE Axle Counter

Detection Points Record Card

Form: NR/SMS /T045/01
Date: September 2018
Issue: 05

Power Channel		MASSAB 1 (10) mVDC			MASSAB 2 (12) mVDC			SK1		SK2						
CH 1 (3) VDC	CH 2 (4) VDC	Without Dummy Wheel (+)	With Dummy Wheel (-)	PEGUE 1 (11) mVDC	Without Dummy Wheel (+)	With Dummy Wheel (-)	PEGUE 2 (13) mVDC	Voltage VAC	Freq KHz	Voltage VAC	Freq KHz	Comments	Meter Identity	Signature	Name & Company	Date

Network Rail	**Level Crossing CCTV Camera Test Record Card (Front)** **NR/SMS/Test/046**	**Form: NR/SMS/T046/RC/01** **Date: August 2004** **Issue: 01**

Monitoring Signal Box:	Level Crossing:	Camera Types:

Fisheye Lenses Fitted?:	CCU Fitted?:	VRTU Fitted?:	Location of VRTU:

Number	Camera 1												
	Operation & Settings*				Picture Resolution*		Picture Content*				Waveforms & Voltages (V)		
	In Use Ind'tion	Shutter	Iris	Wiper	Centre of Picture	Edges of Picture	Complete & No Skyline	Un-obstructed	Stop Lines Visible	No Streaking/ Flaring etc	Composite Video (Pk-Pk)	Black Level	Video Content Adjustment Comments
1													
2													
3													
4													

Number	Camera 2												
	Operation & Settings*				Picture Resolution*		Picture Content*				Waveforms & Voltages (V)		
	In Use Ind'tion	Shutter	Iris	Wiper	Centre of Picture	Edges of Picture	Complete & No Skyline	Un-obstructed	Stop Lines Visible	No Streaking/ Flaring etc	Composite Video (Pk-Pk)	Black Level	Video Content Adjustment Comments
1													
2													
3													
4													

Number	General Comments	Test Equipment Identity	Signature	Name & Company	Date
1					
2					
3					
4					

*: Insert tick if correct to NR/SMS steps

Network Rail	**Level Crossing CCTV Camera Test Record Card (Rear)** **NR/SMS/Test/046**	**Form: NR/SMS/T046/RC/01** **Date: August 2004** **Issue: 01**

Number	Camera 1												
	Operation & Settings*				Picture Resolution*		Picture Content*				Waveforms & Voltages (V)		
	In Use Ind'tion	Shutter	Iris	Wiper	Centre of Picture	Edges of Picture	Complete & No Skyline	Un-obstructed	Stop Lines Visible	No Streaking/ Flaring etc	Composite Video (Pk-Pk)	Black Level	Video Content Adjustment Comments
5													
6													
7													
8													
9													
10													

Number	Camera 2												
	Operation & Settings*				Picture Resolution*		Picture Content*				Waveforms & Voltages (V)		
	In Use Ind'tion	Shutter	Iris	Wiper	Centre of Picture	Edges of Picture	Complete & No Skyline	Un-obstructed	Stop Lines Visible	No Streaking/ Flaring etc	Composite Video (Pk-Pk)	Black Level	Video Content Adjustment Comments
5													
6													
7													
8													
9													
10													

Number	General Comments	Test Equipment Identity	Signature	Name & Company	Date
5					
6					
7					
8					
9					
10					

*: Insert tick if correct to NR/SMS steps

CCTV Tx Systems (Marconi/GEC 14.5MHz AM) Tests

Maintenance Test

Form: NR/SMS/T047/RC/01
Date: 01/09/2018
Issue: 2

Monitoring Signal Box:	Level Crossing:	Number of Repeaters:

Number	Transmission End							Repeater (1)						Repeater (2)					
	Power Supply O/P (V)					Waveforms**		Power Supply O/P (V)				Waveforms**		Power Supply O/P				Waveforms**	
	To Modulator			To Launch Amp*		O/P from Modulator	O/P from Launch Amp*	To Line Amp		To Launch Amp*		O/P from Modulator	O/P from Launch Amp*	To Line Amp		To Launch Amp*		O/P from Modulator	O/P from Launch Amp*
	DC +ve	DC -ve	AC Ripple	DC +ve	AC Ripple			DC +ve	AC Ripple	DC +ve	AC Ripple			DC +ve	AC Ripple	DC +ve	AC Ripple		
1																			
2																			
3																			
4																			

Number	Repeater (3)						Repeater (4)						Receiver End				
	Power Supply O/P (V)				Waveforms**		Power Supply O/P				Waveforms**		Power Supply O/P		Waveforms**	Received Picture**	
	To Line Amp		To Launch Amp*		O/P from Modulator	O/P from Launch Amp*	To Line Amp		To Launch Amp*		O/P from Modulator	O/P from Launch Amp*	To Demodulator		O/P from Demodulator	Satisfactory Resolution	Satisfactory Content
	DC +ve	AC Ripple	DC +ve	AC Ripple			DC +ve	AC Ripple	DC +ve	AC Ripple			DC +ve	AC Ripple			
1																	
2																	
3																	
4																	

Number	Comments	Test Equipment Identity	Signature	Name & Company	Date
1					
2					
3					
4					

*: If fitted to the system **: Insert tick if correct

CCTV Tx Systems (Marconi/GEC 14.5MHz AM) Tests

Maintenance Test

Form: NR/SMS/T047/RC/01
Date: 01/09/2018
Issue: 2

Number	Transmission End							Repeater (1)						Repeater (2)					
	Power Supply O/P (V)					Waveforms**		Power Supply O/P (V)				Waveforms**		Power Supply O/P				Waveforms**	
	To Modulator			To Launch Amp*		O/P from Modulator	O/P from Launch Amp*	To Line Amp		To Launch Amp*		O/P from Modulator	O/P from Launch Amp*	To Line Amp		To Launch Amp*		O/P from Modulator	O/P from Launch Amp*
	DC +ve	DC -ve	AC Ripple	DC +ve	AC Ripple			DC +ve	AC Ripple	DC +ve	AC Ripple			DC +ve	AC Ripple	DC +ve	AC Ripple		
5																			
6																			
7																			
8																			
9																			

Number	Repeater (3)						Repeater (4)						Receiver End				
	Power Supply O/P (V)				Waveforms**		Power Supply O/P				Waveforms**		Power Supply O/P		Waveforms**	Received Picture**	
	To Line Amp		To Launch Amp*		O/P from Modulator	O/P from Launch Amp*	To Line Amp		To Launch Amp*		O/P from Modulator	O/P from Launch Amp*	To Demodulator		O/P from Demodulator	Satisfactory Resolution	Satisfactory Content
	DC +ve	AC Ripple	DC +ve	AC Ripple			DC +ve	AC Ripple	DC +ve	AC Ripple			DC +ve	AC Ripple			
5																	
6																	
7																	
8																	
9																	

Number	Comments	Test Equipment Identity	Signature	Name & Company	Date
5					
6					
7					
8					
9					

CCTV Tx Systems (Philips FM System) Tests

Maintenance Test

Form: NR/SMS/T047/RC/02
Date: 01/09/2018
Issue: 02

Monitoring Signal Box:	Level Crossing:	Number of Repeaters:

Number	Transmission End				Repeater (1)					Repeater (2)				
	Power Supply		Waveforms**		Coaxial Cable		Waveforms		Video	Coaxial Cable		Waveforms		Video
	DC Voltage	AC Ripple	Modulator O/P (carrier Only)	Launch Amp O/P (Multiburst)*	Loop Resistance (Ohms)	Insulation Resistance (Ohms)	Video O/P (Multiburst)	FM signal O/P Level (Modulated)	Picture Quality	Loop Resistance (Ohms)	Insulation Resistance (Ohms)	Video O/P (Multiburst)	FM signal O/P Level (Modulated)	Picture Quality
1														
2														
3														
4														

Number	Repeater (3)					Repeater (4)					Receiver End			
	Coaxial Cable		Waveforms		Video	Coaxial Cable		Waveforms		Video	Power Supply		Waveforms	Video
	Loop Resistance (Ohms)	Insulation Resistance (Ohms)	Video O/P (Multiburst)	FM signal O/P Level (Modulated)	Picture Quality	Loop Resistance (Ohms)	Insulation Resistance (Ohms)	Video O/P (Multiburst)	FM signal O/P Level (Modulated)	Picture Quality	DC Voltage	AC Ripple	Modulated Carrier I/P	Picture Quality (Processed Video O/P)
1														
2														
3														
4														

Number	Comments	Test Equipment Identity	Signature	Name & Company	Date
1					
2					
3					
4					

CCTV Tx Systems (Philips FM System) Tests

Maintenance Test

Form: NR/SMS/T047/RC/02
Date: 01/09/2018
Issue: 02

Number	Transmission End				Repeater (1)					Repeater (2)				
	Power Supply		Waveforms**		Coaxial Cable		Waveforms		Video	Coaxial Cable		Waveforms		Video
	DC Voltage	AC Ripple	Modulator O/P (carrier Only)	Launch Amp O/P (Multiburst)*	Loop Resistance (Ohms)	Insulation Resistance (Ohms)	Video O/P (Multiburst)	FM signal O/P Level (Modulated)	Picture Quality	Loop Resistance (Ohms)	Insulation Resistance (Ohms)	Video O/P (Multiburst)	FM signal O/P Level (Modulated)	Picture Quality
5														
6														
7														
8														
9														

Number	Repeater (3)					Repeater (4)					Receiver End			
	Coaxial Cable		Waveforms		Video	Coaxial Cable		Waveforms		Video	Power Supply		Waveforms	Video
	Loop Resistance (Ohms)	Insulation Resistance (Ohms)	Video O/P (Multiburst)	FM signal O/P Level (Modulated)	Picture Quality	Loop Resistance (Ohms)	Insulation Resistance (Ohms)	Video O/P (Multiburst)	FM signal O/P Level (Modulated)	Picture Quality	DC Voltage	AC Ripple	Modulated Carrier I/P	Picture Quality (Processed Video O/P)
5														
6														
7														
8														
9														

Number	Comments	Test Equipment Identity	Technicians SSM Name	Company	Date
5					
6					
7					
8					
9					

*: If fitted to the system **: Insert tick if correct

Network Rail	**AC Busbar & Earth Test** Maintenance Test	**Form: NR/SMS/T051/RC01** **Date: 01/09/2018** **Issue: 02**

Signal Box / Interlocking:	Location / Equipment Room

Busbar:				Busbar:				Busbar:				Meter Identity	AC Busbar Earth Test Adapter Identity	Signature	Name & Company	Date
Busbar Voltage	V1	V2	Vb	Busbar Voltage	V1	V2	Vb	Busbar Voltage	V1	V2	Vb					

Network Rail	**AC Busbar & Earth Test** Maintenance Test	**Form: NR/SMS/T051/RC01** **Date: 01/09/2018** **Issue: 02**

Busbar:				Busbar:				Busbar:				Meter Identity	AC Busbar Earth Test Adapter Identity	Signature	Name & Company	Date
Busbar Voltage	V1	V2	Vb	Busbar Voltage	V1	V2	Vb	Busbar Voltage	V1	V2	Vb					

Network Rail	**DC Busbar & Earth Test** Maintenance Test	**Form: NR/SMS/T051/RC02** **Date: 01/09/2018** **Issue: 02**

Signal Box / Interlocking:	Location / Equipment Room

Busbar:			Busbar:			Busbar:			Busbar:			Meter Identity	Meter Shunt Identity	Signature	Name & Company	Date
Busbar Voltage	V1 B - E	V2 N - E	Busbar Voltage	V1 B - E	V2 N - E	Busbar Voltage	V1 B - E	V2 N - E	Busbar Voltage	V1 B - E	V2 N - E					

Network Rail

DC Busbar & Earth Test

Maintenance Test

Form: NR/SMS/T051/RC02
Date: 01/09/2018
Issue: 02

Busbar:			Busbar:			Busbar:			Busbar:			Meter Identity	Meter Shunt Identity	Signature	Name & Company	Date
Busbar Voltage	V1 B - E	V2 N - E	Busbar Voltage	V1 B - E	V2 N - E	Busbar Voltage	V1 B - E	V2 N - E	Busbar Voltage	V1 B - E	V2 N - E					

Network Rail	**Dynamic Earth Test (Power Worked Points)** Maintenance Test	**Form: NR/SMS/T052/RC01** **Date: 01/09/2018** **Issue: 02**

Signal Box / Interlocking:	Location / Equipment Room	Point Number:	Number of Ends:

Maximum Drive Voltage B to Earth		Maximum Drive Voltage N to Earth		Detection Voltage Across Busbar	Detection Voltage B to Earth		Detection Voltage N to Earth		Meter Identity	Comments	Signature	Name & Company	Date
N-R	R-N	N-R	R-N		N	R	N	R					

Network Rail

Dynamic Earth Test (Power Worked Points)

Maintenance Test

Form: NR/SMS/T052/RC01
Date: 01/09/2018
Issue: 02

Maximum Drive Voltage B to Earth		Maximum Drive Voltage N to Earth		Detection Voltage Across Busbar	Detection Voltage B to Earth		Detection Voltage N to Earth		Meter Identity	Comments	Signature	Name & Company	Date
N-R	R-N	N-R	R-N		N	R	N	R					

Network Rail	**Dynamic Earth Test (Level Crossing Barriers)** Maintenance Test	**Form: NR/SMS/T052/RC/02** **Date: 01/09/2018** **Issue: 02**

Signal Box / Interlocking:	Level Crossing Type:	Level Crossing Name:

B24 (Barr) Voltage Across Busbar	Maximum B24 (Barr) Voltage During Xing Cycle		Meter Identity	Comments	Signature	Name & Company	Date
	Positive to Earth	Negative to Earth					

Network Rail

Dynamic Earth Test (Level Crossing Barriers)

Maintenance Test

Form: NR/SMS/T052/RC/02
Date: 01/09/2018
Issue: 02

B24 (Barr) Voltage Across Busbar	Maximum B24 (Barr) Voltage During Xing Cycle		Meter Identity	Comments	Signature	Name & Company	Date
	Positive to Earth	Negative to Earth					

Network Rail	**Earth Leakage Detector – 930 / P and IR145** Function Test	**Form: NR/SMS/T053/RC01** **Date: June 2019** **Issue: 02**

Signal Box:	Interlocking:	Location:	ELD Name:

Function Test

Date	Name	Signature	Meter ID	Weather 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded	Busbar 1: Name / ID				Busbar 2: Name / ID				Busbar 3: Name / ID			
					Busbar Voltage	Indication on ELD*	If Fault Cleared OK**	ELD Test OK**	Busbar Voltage	Indication on ELD*	If Fault Cleared OK**	ELD Test OK**	Busbar Voltage	Indication on ELD*	If Fault Cleared OK**	ELD Test OK**
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N
						C / F	Y / N	Y / N		C / F	Y / N	Y / N		C / F	Y / N	Y / N

*: Clear/Fault, Circle as Appropriate **: Yes/No, Circle as Appropriate

Network Rail	**Earth Leakage Detector – 930 / P / and IR145** Calibration Test	**Form: NR/SMS/T220/RC/01** **Date: June 2019** **Issue: 02**

Calibration Test

Date	Name	Signature	Meter ID	Weather 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded	22Ω Resistor Value	Busbar 1: Name / ID			Busbar 2: Name / ID			Busbar 3: Name / ID		
						Busbar Voltage	B or BX* Correct	N or NX* Correct	Busbar Voltage	B or BX* Correct	N or NX* Correct	Busbar Voltage	B or BX* Correct	N or NX* Correct
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N
							Y / N	Y / N		Y / N	Y / N		Y / N	Y / N

*: Yes/No, Circle as Appropriate

Network Rail	**Earth Leakage Detector – IR425** Function Test	**Form: NR/SMS/T053/RC02** **Date: March 2020** **Issue: 01**

Signal Box:	Interlocking:	Location:	ELD Name:

Function Test

Date	Name	Company	Signature	Meter ID	Weather 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded	Alarm Status on arrival		Manual Test		Comments
						Alarm 1	Alarm 2	ELD Test OK**	If "NO" Error Code	
						CLR/LIT	CLR/LIT	Y / N		
						CLR/LIT	CLR/LIT	Y / N		
						CLR/LIT	CLR/LIT	Y / N		
						CLR/LIT	CLR/LIT	Y / N		
						CLR/LIT	CLR/LIT	Y / N		
						CLR/LIT	CLR/LIT	Y / N		
						CLR/LIT	CLR/LIT	Y / N		
						CLR/LIT	CLR/LIT	Y / N		
						CLR/LIT	CLR/LIT	Y / N		
						CLR/LIT	CLR/LIT	Y / N		
						CLR/LIT	CLR/LIT	Y / N		
						CLR/LIT	CLR/LIT	Y / N		
						CLR/LIT	CLR/LIT	Y / N		
						CLR/LIT	CLR/LIT	Y / N		
						CLR/LIT	CLR/LIT	Y / N		
						CLR/LIT	CLR/LIT	Y / N		
						CLR/LIT	CLR/LIT	Y / N		
						CLR/LIT	CLR/LIT	Y / N		
						CLR/LIT	CLR/LIT	Y / N		

*: Yes/No, Circle as Appropriate

Network Rail	**Earth Leakage Detector – IR425** Calibration Test	**Form: NR/SMS/T053/RC/02** **Date: March 2020** **Issue: 01**

	Calibration Test											
			Status on Arrival			Busbar 1: Name / ID		Busbar 2: Name / ID		Busbar 3: Name / ID		
Date	Name & Company	Signature	Alarm Indications Clear	Displayed Resistance	22Ω Resistor Value	Alarm 1 Lit	Alarm 2 Lit	Alarm 1 Lit	Alarm 2 Lit	Alarm 1 Lit	Alarm 2 Lit	Comments
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N		Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Ω	Ω	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	

*: Yes/No, Circle as Appropriate

Network Rail	**Cable Insulation** Maintenance Record	**Form: NR/SMS/T054/Cable Insulation** **Date: March 2018** **Issue: 03**

Signal Box / Interlocking:	Cable Name/Number:	Cable From:	Cable To:
Cable Length:	Cable Type*: Lineside / Tail	Test Type*: Maintenance / Full	Cable Installation/Commissioning Date(s):
Cable Core Size:	Number of Cores:	Number of Joints:	Type/Condition of Cable Route:
Cable Carrying Reed FDM Transmissions*: Yes / No	Weather Conditions:	Meter Identity:	Voltage Tested To:
Megger Identity#1:	Reed Cable Adaptor Identity#1:	Reed Earth Leakage Tester Identity#1:	Cable Running Parallel to FS2600 TC's or Routes Carrying Class 92 or 373 Trains*#2: Yes/No
Tested By:	Testers Signature:	Company:	Date:

#1: Fill in details as applicable to type of cable test #2: Applicable to cables carrying Reed FDM Transmissions only *: Delete as applicable

1st Reference Core Number:	2nd Reference Core Number:	Polarity Correct: Yes / No / NA

Insulation Resistance				Loop Resistance		
Core to Earth		Core to Core		Core to Core		
Core No.	M Ohms	Core No's.	M Ohms	Core No's.	Ohms	Cable Core Function

Insulation Resistance				Loop Resistance		
Core to Earth		Core to Core		Core to Core		
Core No.		Core No's.	M Ohms	Core No's.	Ohms	Cable Core Function

Network Rail

Cable Insulation

Maintenance Record

Form: NR/SMS/T054/Cable Insulation
Date: March 2018
Issue: 03

Insulation Resistance				Loop Resistance		Cable Core Function
Core to Earth		Core to Core		Core to Core		
Core No.	M Ohms	Core No's.	M Ohms	Core No's.	Ohms	

Insulation Resistance				Loop Resistance		Cable Core Function
Core to Earth		Core to Core		Core to Core		
Core No.	M Ohms	Core No's.	M Ohms	Core No's.	Ohms	

General Comments or Remarks:

Network Rail	**Non-Intrusive Earth Leakage for FDM Systems Test (Method A)** Maintenance Record Card	**Form: NR/SMS/T054/RC02** **Date: 01/09/2018** **Issue: 03**

Earth Leakage			Line Resistance	Weather Conditions	Comments	Adaptor Identity	Meter Identity	Signature	Name & Company	Date
V1 Voltage	V2 Voltage*	Resistance to Earth								

*: Record reading when V2 is lower than V1

Network Rail	**Non-Intrusive Earth Leakage for FDM Systems Test (Method A)** Maintenance Record Card	**Form: NR/SMS/T054/RC02** **Date: 01/09/2018** **Issue: 03**

Earth Leakage			Line Resistance	Weather Conditions	Comments	Adaptor Identity	Meter Identity	Signature	Name & Company	Date
V1 Voltage	V2 Voltage*	Resistance to Earth								

*: Record reading when V2 is lower than V1

Network Rail	**Non-Intrusive Earth Leakage for FDM Systems (Method B)** Maintenance Record Card	**Form: NR/SMS/T054/RC03** **Date: 01/09/2018** **Issue: 02**

Power Signal Box:	System:	Location From:	Location To:

Meter Reading (0-Red)	Resistance to Earth (Ohms)	Weather Conditions	Comments	Meter Identity	Signature	Name & Company	Date

Network Rail	**Non-Intrusive Earth Leakage for FDM Systems (Method B)** Maintenance Record Card	**Form: NR/SMS/T054/FDM (B)** **Date: March 2018** **Issue: 02**

Meter Reading (0-Red)	Resistance to Earth (Ohms)	Weather Conditions	Comments	Meter Identity	Signature	Name & Company	Date

Network Rail	**Secondary Cell Test - ALCAD - Vantage** Maintenance Record Card	**Form: NR/SMS/T055/RC01** **Date: 1st September 2018** **Issue: 02**

Signal Box / Interlocking:			Location:
Battery Name:	Capacity:	Number of Cells:	Date Installed:

Date	Name & Company	Signature	Meter Number	Charger On		Charger Off		Adjustments, Topping up Etc
				Full Battery Voltage	Average Cell Voltage*	Full Battery Voltage	Time on load (mins)	

Average cell voltage = lowest reading plus highest reading divided by the number of cells

Network Rail	**Secondary Cell Test - ALCAD - Vantage** Maintenance Record Card	**Form: NR/SMS/T055/RC01** **Date: 1st September 2018** **Issue: 02**

Date	Name & Company	Signature	Meter Number	Charger On		Charger Off		Adjustments, Topping up Etc
				Full Battery Voltage	Average Cell Voltage*	Full Battery Voltage	Time on load (mins)	

Average cell voltage = lowest reading plus highest reading divided by the number of cells

	Secondary Cell Test (Cyclon) Maintenance Record Card	**Form: NR/SMS/T055/RC/Cyclon** **Date: 1st September 2018** **Issue: 03**

Signal Box / Interlocking:	Location:

Battery Name:	Capacity:	Number of Cells:	Date Installed:

				Charger On	Charger Off	Charger On	
Date	Name & Company	Signature	Meter Number	Full Battery Voltage	Full Battery Voltage	Voltage rise when charger	Comments

*: Insert tick if correct, record any deficiencies in the comments column Note: Full battery voltage = 2.35x number of cells)

Network Rail	**Secondary Cell Test (Cyclon)** Maintenance Record Card	**Form: NR/SMS/T055/RC/Cyclon** **Date: 1st September 2018** **Issue: 03**

				Charger On	Charger Off	Charger On	
Date	Name & Company	Signature	Meter Number	Full Battery Voltage	Full Battery Voltage	Voltage rise when charger	Comments

*: Insert tick if correct, record any deficiencies in the comments column Note: Full battery voltage = 2.35x number of cells)

Network Rail	**Secondary Cell Test - Lead Acid / Alkaline** Maintenance Record Card	**Form: NR/SMS/T055/RC03** **Date: 1st September 2018** **Issue: 03**

Signal Box / Interlocking:		Location:
Battery Name:	Battery Type:	Manufacturer:
Capacity:	Number of Cells:	Date Installed:

Date	Name & Company	Signature	Meter Identity	Charger Off / Battery on Load				Charger On	Comments
				Lowest Obtained Reading			Full Battery Voltage	Cell voltage increase when charger switched on? Tick if correct	*Adjustments, Gassing, Sediment, Topping up, Etc*
				Cell No.	Volts	Specific Gravity*			

*: Lead Acid Cells Only (see NR/SMS/Test/055, task 1.4)

Network Rail

Secondary Cell Test - Lead Acid / Alkaline

Maintenance Record Card

Form: NR/SMS/T055/RC03
Date: 1st September 2018
Issue: 03

				Charger Off / Battery on Load				Charger On	Comments
				Lowest Obtained Reading			Full Battery Voltage	Cell voltage increase when charger switched on? Tick if correct	*Adjustments, Gassing, Sediment, Topping up, Etc*
Date	Name & Company	Signature	Meter Identity	Cell No.	Volts	Specific Gravity*			

*: Lead Acid Cells Only (see NR/SMS/Test/055, task 1.4)

Network Rail	**Secondary Cell Test - Power Box - Modular** Maintenance Record Card	**Form: NR/SMS/T055/RC04** **Date: 1st September 2018** **Issue: 01**

Signal Box / Interlocking:			Location:
Battery Name:	Capacity:	Number of Cells:	Date Installed:

Date	Name & Company	Signature	Meter Number	Charger On	Charger Off	Charger On		Comments
				Full Battery Voltage Red 1 – Black 5	Full Battery Voltage Red 1 – Black 5	Time on Load	Voltage rise when charger on?	

Network Rail	**Secondary Cell Test - Power Box - Modular** Maintenance Record Card	**Form: NR/SMS/T055/RC04** **Date: 1st September 2018** **Issue: 01**

Date	Name & Company	Signature	Meter Number	Charger On Full Battery Voltage Red 1 – Black 5	Charger Off Full Battery Voltage Red 1 – Black 5	Charger On Time on Load	Charger On Voltage rise when charger on?	Comments

Network Rail	**Avel-Lindberg Static Invertor Tests** **Record Card (Front)** **NR/SMS/Test/056**	**Form: NR/SMS/T56/RC/01** **Date: August 2004** **Issue: 01**

Signal Box / Interlocking:	Location:	Inverter Identity:

Number	Battery Tests				Invertor Tests							
	Charger Off			Charger On	Off Load	On Load						
	Cell Average Readings		Total Battery Voltage	Trickle Charge Current	Indications (Insert tick if correct)	Indications (Insert tick if correct)	Voltages (On Load Take-Up)			Voltages (After 1hr on Load)		
	Voltage	Specific Gravity					I/P to Switch Cab. (DC)	O/P to Equip. (AC)	BX110 Busbar	I/P to Switch Cab. (DC)	O/P to Equip. (AC)	BX110 Busbar
1												
2												
3												
4												
5												
6												
7												
8												

Number	Generator Tests			Comments	Meter Identity	Signature	Name & Company	Date
	On Load							
	Indications (Insert tick if correct)	Voltages						
		O/P to Equip. (AC)	BX110 Busbar					
1								
2								
3								
4								
5								
6								
7								
8								

Network Rail	**Avel-Lindberg Static Invertor Tests** **Record Card (Rear)** **NR/SMS/Test/056**	**Form: NR/SMS/T056/RC/01** **Date: August 2004** **Issue: 01**

Number	Battery Tests				Invertor Tests							
	Charger Off			Charger On	Off Load	On Load						
	Cell Average Readings		Total Battery Voltage	Trickle Charge Current	Indications (Insert tick if correct)	Indications (Insert tick if correct)	Voltages (On Load Take-Up)			Voltages (After 1hr on Load)		
	Voltage	Specific Gravity					I/P to Switch Cab. (DC)	O/P to Equip. (AC)	BX110 Busbar	I/P to Switch Cab. (DC)	O/P to Equip. (AC)	BX110 Busbar
9												
10												
11												
12												
13												
14												
15												
16												
17												

Number	Generator Tests			Comments	Meter Identity	Signature	Name & Company	Date
	On Load							
	Indications (Insert tick if correct)	Voltages						
		O/P to Equip. (AC)	BX110 Busbar					
9								
10								
11								
12								
13								
14								
15								
16								
17								

Network Rail	**Uninterruptible Power Supply - Not TPWS UPS** Maintenance Test	**Form: NR/SMS/T057/RC01** **Date: 01/09/2018** **Issue: 02**

Signal Box / Interlocking:	Location:	Minimum UPS O/P Voltage at end of expected load period:

UPS Off Load	UPS On Load					UPS Off Load		Comments	Meter Identity	Signature	Name & Company	Date
			O/P Voltages (V)				Batteries**					
Indications *	Indications *	Time on Load (min/secs)	Start of Load Period	Middle of Load Period	End of Load Period	Indications *	Charging					

*: Insert tick if correct **: Were batteries are external to the UPS

Network Rail	**Uninterruptible Power Supply - Not TPWS UPS** Maintenance Test	**Form: NR/SMS/T057/RC01** **Date: 01/09/2018** **Issue: 02**

UPS Off Load	UPS On Load					UPS Off Load		Comments	Meter Identity	Signature	Name & Company	Date
			O/P Voltages (V)				Batteries**					
Indications *	Indications *	Time on Load (min/secs)	Start of Load Period	Middle of Load Period	End of Load Period	Indications *	Charging					

*: Insert tick if correct **: Were batteries are external to the UPS

Network Rail

Uninterruptible Power Supply - (for TPWS only)

Maintenance Test

Form: NR/SMS/T057/RC02
Date: 01/09/2018
Issue: 02

Signal Box / Interlocking:	Location:	TPWS / Signal Name / Number:

Heaters		UPS Off Load	UPS On Load							Comments	PowerView Control Unit Identity	Signature	Name & Company	Date
Working *	Thermostat setting (°C)	Indications *	Indications *	Voltages (V)		Currents (A)		Freq (Hz)	TPWS Working correctly *					
				I/P	O/P	I/P	O/P	O/P						

*: Insert tick if correct

Network Rail	# Uninterruptible Power Supply - (for TPWS only) Maintenance Test	**Form: NR/SMS/T057/RC02** **Date: 01/09/2018** **Issue: 02**

Heaters		UPS Off Load	UPS On Load							Comments	PowerView Control Unit Identity	Signature	Name & Company	Date
Working *	Thermostat setting (°C)	Indications *	Indications *	Voltages (V)		Currents (A)		Freq (Hz)	TPWS Working correctly *					
				I/P	O/P	I/P	O/P	O/P						

*: Insert tick if correct

Network Rail	**Primary Cell Test Record Card (Front)** **NR/SMS/Test/058**	**Form: NR/SMS/T058/RC/01** **Date: August 2004** **Issue: 01**

Signal Box:		Location:
Battery Name:	Battery Type:	Number of Cells:

Voltages (V)		Cells Renewed	Comments	Meter Identity	1 Ohm Shunt Identity	Signature	Name & Company	Date
With 1 Ohm Shunt	Without 1 Ohm Shunt							
Average Cell Reading	Total Battery Voltage							
		Yes / No						
		Yes / No						
		Yes / No						
		Yes / No						
		Yes / No						
		Yes / No						
		Yes / No						
		Yes / No						
		Yes / No						
		Yes / No						
		Yes / No						
		Yes / No						
		Yes / No						
		Yes / No						
		Yes / No						
		Yes / No						
		Yes / No						
		Yes / No						
		Yes / No						

Average cell voltage = lowest reading plus highest reading divided by the number of cells

Network Rail	**Primary Cell Test Record Card (Rear) NR/SMS/Test/058**	**Form: NR/SMS/T058/RC/01** **Date: August 2004** **Issue: 01**

<table>
<tr><td colspan="2">Voltages (V)</td><td rowspan="3">Cells Renewed</td><td rowspan="3">Comments</td><td rowspan="3">Meter Identity</td><td rowspan="3">1 Ohm Shunt Identity</td><td rowspan="3">Signature</td><td rowspan="3">Name & Company</td><td rowspan="3">Date</td></tr>
<tr><td>With 1 Ohm Shunt</td><td>Without 1 Ohm Shunt</td></tr>
<tr><td>Average Cell Reading</td><td>Total Battery Voltage</td></tr>
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</table>

Average cell voltage = lowest reading plus highest reading divided by the number of cells

Network Rail	**Emergency Signals on Control (ESOC) Test Record Card (Front)** **NR/SMS/Test/060**	**Form: NR/SMS/T060/RC/01** **Date: August 2004** **Issue: 01**

Signal Box:

ESOC Test			Comments	Signature	Name & Company	Date
Interlocking	LED Indications Correct	Relay Energisation Time (secs)				
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					

Network Rail	**Emergency Signals on Control (ESOC) Test Record Card (Rear) NR/SMS/Test/060**	**Form: NR/SMS/T060/RC/01** **Date: August 2004** **Issue: 01**

ESOC Test			Comments	Signature	Name & Company	Date
Interlocking	LED Indications Correct	Relay Energisation Time (secs)				
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					
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	Yes / No					
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	Yes / No					
	Yes / No					
	Yes / No					
	Yes / No					

Network Rail	**Relay Timer Test Record Card** Maintenance Test	**Form: NR/SMS/T061/RC01** **Date: 01/09/2018** **Issue: 02**

Signal Box / Interlocking:		Location:		Relay Function:
Relay Type:	Relay Serial No:	Pin Code:	Last Service Date:	Design Time (sec):

Relay Function	Function Test				Comments	Signature	Name & Company	Date
	Actual Time (sec)	Adjustment Made	Time After Adjustment (sec)	Adjustment Aperture Sealed				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
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		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				

Network Rail	**Relay Timer Test Record Card** Maintenance Test	**Form: NR/SMS/T061/RC01** **Date: 01/09/2018** **Issue: 02**

Relay Function	Function Test				Comments	Signature	Name & Company	Date
	Actual Time (sec)	Adjustment Made	Time After Adjustment (sec)	Adjustment Aperture Sealed				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				
		Yes / No		Yes / No				

Network Rail	**Line Protection Units Record Card (Front) NR/SMS/Test/062**	**Form: NR/SMS/T062/RC/01** **Date: August 2004** **Issue: 01**

Signal Box:	Start of Line Equipment Room / Trackside Apparatus Case *:	End of Line Equipment Room / Trackside Apparatus Case *:
Equipment at Start of Line:	Equipment at End of Line:	Line Protection Equipment Type:

Unit Identity	Line Protection Unit Tests**			Comments	Test Equipment Identity	Signature	Name & Company	Date
	LED Indications #	Ohms Reading						
		Low Voltage	High Voltage					

*: Enter details appropriate to location **: Use columns appropriate to equipment type #: Tick if indications are correct, cross if not and enter details in comments column

Line Protection Units **Record Card (Rear)** **NR/SMS/Test/062**	**Form: NR/SMS/T62/RC/01** **Date: August 2004** **Issue: 01**

Unit Identity	Line Protection Unit Tests**			Comments	Test Equipment Identity	Signature	Name & Company	Date
	LED Indications #	Ohms Reading						
		Low Voltage	High Voltage					

*: Enter details appropriate to location **: Use columns appropriate to equipment type #: Tick if indications are correct, cross if not and enter details in comments column

Network Rail	**RETB Radio Systems** Regular Tasks	Form: NR/SMS/T063/RC/01 Date: 03/03/18 Issue: 02

Signal Box / System	

Test 1 Signallers Control Console – Observations. (Inc any changes made)	**NAME**	**INITIAL**	**DATE**

Test 2 2Wire Dial-up Interfaces – Observations. (Inc any changes made. Confirm all 2&4 wire connections))	**NAME**	**INITIAL**	**DATE**

Test 5 System Current Issues Checks – Observations. (Inc any action taken and changes made)	**NAME**	**INITIAL**	**DATE**

Network Rail	**RETB Radio Systems – Service A** Maintenance Tests	Form: NR/SMS/T063/RC/02 Date: 03/03/18 Issue: 02

Signal Box / System	

Test 3&4 Basic and Extended Radio Rack Checks – Observations. (Inc any changes made)	**NAME**	**INITIAL**	**DATE**

Network Rail	**RETB Radio Systems – Service A** Maintenance Tests	Form: NR/SMS/T063/RC/02 Date: 03/03/18 Issue: 02

Signal Box / System	

Test 6 Network Data Integrity tests					**NAME**	**INITIAL**	**DATE**
Source ID	**Sink ID**	**Bits sent**	**Errors**	**Observations. (Inc any repeats or further investigations)**			

Network Rail	**RETB System (Six Monthly) Tests** **Record Card (Front)** **NR/SMS/Test/063**	**Form: NR/SMS/T063/RC/03** **Date: August 2004** **Issue: 01**

Signal Box:

Token Data Levels Test							
Site / Location	Token Data Level		Comments	Test Equipment Identity	Signature	Name & Company	Date
	1200Hz	1800Hz					

Network Rail	**RETB System (Six Monthly) Tests** **Record Card (Rear)** **NR/SMS/Test/063**	**Form: NR/SMS/T063/RC/03** **Date: August 2004** **Issue: 01**

Signal Box:

Validity of Data Telegrams

Site / Location	Validity Tests		Comments	Signature	Name & Company	Date
	Telegram Bits	Handshakes				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				
	Pass / Fail	Pass / Fail				

Network Rail	RETB Fixed Site Power Supply Test – Service A Record Card (Sheet 1) NR/SMS/Test/064	Form: NR/SMS/T064/RC/01 Date: 03/03/18 Issue: 02

Signal Box / System		Site	

Test 2 & 3 PSU Checks								NAME / INITIAL	DATE
2.1 - 2.3 Visual OK?	2.4 Site I/F Volt (V)	3.2 Mains Alarm Rec'd?	3.3 / 3.4 LEDs correct?	3.5 Site I/F Voltage (V)	3.2 Mains Clear Rec'd?	3.8 / 3.9 LEDs correct?	Observations. (Inc any repeats or further investigations)		

Network Rail	RETB Fixed Site Power Supply Test – Service B Record Card (Sheet 1) NR/SMS/Test/064	Form: NR/SMS/T064/RC/02 Date: 03/03/18 Issue: 02

Signal Box / System		Site	

Test 4,5 & 6 Battery and Charger Tests								NAME / INITIAL	DATE
4.3 / 5.3 Batt 1 Volts (V)	4.5 / 5.5 Batt 1 Int Res (mΩ)	4.5 / 5.5 Batt 1 Int Res OK?	5.3 Batt 2 Volts (V)	5.5 Batt 2 Int Res (mΩ)	5.5 Batt 2 Int Res OK?	6.2 DRU1 Volts (V)	6.2 DRU2 Volts (V)		
Observations									
Observations									
Observations									
Observations									
Observations									

Network Rail	RETB Fixed Site Antenna Systems – Service A Record Card (Sheet 1) NR/SMS/Test/065	Form: NR/SMS/T065/RC/01 Date: 03/03/18 Issue: 02

Signal Box / System	

Test 1 Antenna System Inspection – Observations. (Inc Fixtures, Fittings, Mast Feeder and Antenna.)	NAME	INITIAL	DATE

Network Rail	RETB Fixed Site Antenna – Service B Record Card (Sheet 1) NR/SMS/Test/065	Form: NR/SMS/T065/RC/02 Date: 03/03/18 Issue: 02

Signal Box / System		Site	

Test 2 Antenna VSWR Measurements									NAME / INITIAL	DATE
Antenna 1. ID (Cell, Link 1, etc..)			Antenna 2 ID (Cell, Link 1, etc..)			Antenna 3 ID (Cell, Link 1, etc..)				
Fwd Power (W)	Rev Power (W)	VSWR Ratio	Fwd Power (W)	Rev Power (W)	VSWR Ratio	Fwd Power (W)	Rev Power (W)	VSWR Ratio		
Observations.										
Observations										
Observations										
Observations										
Observations										
Observations										

Network Rail	RETB Fixed Site Radio and Interface Equipment (Pre-Site Visit) Record Card (Sheet 1) NR/SMS/Test/066	Form: NR/SMS/T066/RC/01 Date: 03/03/18 Issue: 02

Signal Box / System	

Test 1 & 2 Pre-Visit 4 and 2 wire line level checks.						NAME / INITIAL	DATE
Site Name	1.3 4Wire Rack Rx Level.	1.3 4Wire FSI RX Level	2.3 2Wire Rack Rx Level.	2.3 2Wire FSI RX Level	Observations. (Inc any repeats or adjustments required.)		

Network Rail	RETB Fixed Site Radio and Interface Equipment (Pre-Site Visit) Record Card (Sheet 2) NR/SMS/Test/066	Form: NR/SMS/T066/RC/01 Date: Aug 2017 Issue: 02

Signal Box / System	

Test 3&4 Pre-Visit	Site Interface and Radio Parameter Checks	NAME	INITIAL	DATE
Site Name	Observations. (Inc. any changes made or required)			

Network Rail	RETB Fixed Site Radio and Interface Equipment– Service A (On-Site Checks) Record Card (Sheet 1) NR/SMS/Test/066	Form: NR/SMS/T066/RC/02 Date: 03/03/18 Issue: 02

Signal Box / System		Site	

Test 5 & 6 Installation & FSI LED Checks – Observations. (Inc. any changes made or required)	NAME	INITIAL	DATE

Signal Box / System		Site	

Test 7 FSI Line Level Adjustment			NAME / INITIAL	DATE
7.3 Rx Power	7.3 Reported Tx Power	Observations. (Inc any repeats or adjustments required.)		

Signal Box / System		Site	

Test 8 Reported Parameter (checking for Normal Operation) – Observations. (Inc. any changes made or required)	NAME	INITIAL	DATE

Network Rail	RETB Fixed Site Radio and Interface Equipment – Service B Record Card (Sheet 1) NR/SMS/Test/066	Form: NR/SMS/T066/RC/03 Date: 03/03/18 Issue: 02

Signal Box / System		Site	
Transceiver Type (delete)	CELL / LINK1 / LINK 2 / LINK 3	Transceiver ID#	

Test 8 Reported Parameters										NAME	INITIAL	DATE
Supply (V)		Supply (A)		VSWR	Temp (^{0}C)		Indicators (ON / OFF)					
Idle	Key	Idle	Key	(1:?)	Int.	PA	Tx Dis	Poor VSWR	Tx Protect			

Signal Box / System		Site	

Test 9 Tx Output Power									NAME / INITIAL	DATE
Antenna 1 (*delete) (CELL / LINK1 / LINK 2 / LINK 3*)			Antenna 2 (*delete) (CELL / LINK1 / LINK 2 / LINK 3*)			Antenna 3 (*delete) (CELL / LINK1 / LINK 2 / LINK 3*)				
Fwd Power (W)	Fwd Power (dBm)	Rev Power (W)	Fwd Power (W)	Fwd Power (dBm)	Rev Power (W)	Fwd Power (W)	Fwd Power (dBm)	Rev Power (W)		
Observations.										
Observations										
Observations										
Observations										
Observations										

W	5	6	8	10	13	16	20	25	32	40	50
dBm	37	38	39	40	41	42	43	44	45	46	47

Signal Box / System		Site	
Radio Path Under Test: *(This Site – Neighbouring Site)* *(eg Banavie Cell – Locheilside Link 1 or Dingwall Link 1 – Garve Cell)*		This Site Transceiver ID#	
		Neighbouring Site Transceiver ID#	

Test 10 Received Signal Strength (dBm)	Test 11 Received Signal Strength @ Neighbour (dBm)	Observations.	NAME	INITIAL	DATE

Network Rail	**SSI Datalinks: Health Check Tests** **Record Card (Front)** **NR/SMS/Test/089**	**Form: NR/SMS/T089/RC/01** **Date: August 2004** **Issue: 01**

Signal Box:	Interlocking:	Identity:	Datalink:

Blip Detection Blips per Hour	Comments	Test Equipment Identity	Signature	Name & Company	Date

Network Rail	**SSI Datalinks: Health Check Tests** **Record Card (Rear)** **NR/SMS/Test/089**	**Form: NR/SMS/T089/RC/01** **Date: August 2004** **Issue: 01**

Telegram Error Detection		Comments	Test Equipment Identity	Signature	Name & Company	Date
Telegram Errors per Hour	Telegram Errors per 24 Hours					

Network Rail	**SSI Datalinks: Baseband / LDT Tests Record Card (Front) NR/SMS/Test/089**	**Form: NR/SMS/T089/RC/02** **Date: August 2004** **Issue: 01**

Signal Box:	Interlocking:	Identity:	Datalink:

Baseband Tests						Comments	Test Equipment Identity	Signature	Name & Company	Date
DLM Identity	Telegram Tx Amplitude (V)	Telegram Tx Asymmetry (mV)	Telegram Tx Overshoot (mV)	Noise Level Between Telegrams (mV)	Telegram Amplitude Variation (%)					

Network Rail	**SSI Datalinks: Baseband / LDT Tests** **Record Card (Rear)** **NR/SMS/Test/089**	**Form: NR/SMS/T089/RC/02** **Date: August 2004** **Issue: 01**

Signal Box:	Interlocking:	Identity:	Datalink:

LDT Tests						Comments	Test Equipment Identity	Signature	Name & Company	Date
LDT Identity	Telegram Tx Amplitude (V)	Telegram Tx Asymmetry (mV)	Telegram Tx Overshoot (mV)	Noise Level Between Telegrams (mV)	Telegram Amplitude Variation (%)					

Network Rail

Track Circuit Test - DC Track

Maintenance Test Record Card

Form: NR/SMS/T251/RC01
Date: 01/09/2018
Issue: 04

Signal Box / Interlocking / Equipment Room:	Location:	TC Number / Letter:

Feed End				Relay End			Ballast 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded	Meter Identity	Train Shunt Identity	Comments *If a full test has been undertaken, the relevant details shall also be recorded*	Signature	Name & Company	Date
Voltages (V)		Train Shunt on Links (Ohms)		Voltage (V)	Train Shunt on Links (Ohms)								
Rail to Rail	TFR Coil*	Drop Shunt*	Pick Up Shunt*	TR Coil	Drop Shunt	Pick Up Shunt							

* Installations Fitted **With** Track Feed Relays Only

Network Rail	**Track Circuit Test - DC Track** Full Test	**Form: NR/SMS/T251/RC01** **Date: 01/09/2018** **Issue: 04**

Signal Box / Interlocking / Equipment Room:	Location:	TC Number / Letter:

No.	Feed End									Relay End				Track Circuit Extremities **	Ballast 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded
	Settings		Voltages (V)					Train Shunt Across Rails (Ohms)		Voltages (V)		Train Shunt Across Rails (Ohms)		T/Shunt Across Rails set at 0.5 Ohms	
	Feed Unit#	Resistor #	PSU I/P#	PSU O/P#	Battery #	Rail to Rail	TFR Coil*	Drop Shunt*	Pick Up Shunt*	Rail to Rail	TR Coil	Drop Shunt	Pick Up Shunt	All Extremities (tick if correct)	
1															
2															
3															
4															
5															
6															
7															

No.	Residual Voltage Tests**			Meter Identity	Train Shunt Identity	Comments *Transfer of the relevant details to the maintenance test columns shall also be undertaken*	Signature	Name & Company	Date
	D/Away (V)	P/Up (V)	Res Voltage after 120s (V)						
1									
2									
3									
4									
5									
6									
7									

* Installations Fitted **With** Track Feed Relays Only ** Installations **Without** Track Feed Relays

* # Complete Details Appropriate to the Installation

NetworkRail	**Track Circuit Test – EBI Track 200** **Maintenance Test**	**Form: NRSMS/T253/RC01** **Date: 01/09/18** **Issue: 06**

Signal Box / Interlocking:			**Track Circuit ID:**
Equipment Room/Location:	TC length (Tx to Rx) m		TC Frequency:
Tx Serial No.		Rx Serial No.	
Normal Power / Low Power / Low Power Plus / Single Rail (delete as appropriate)			

				1	2	3	4	5
Relay (Rx) End	Voltages (V) & Current (A)	Rail Connections (Rail to Rail Volts) #1	X (Pole)					
			Y (Tx / Rx : Zero)					
			TZ Ratio #2					
		Rail Current measured in the rail with Rocoil (mA)						
		1Ω Resistor Voltage Drop OR Inow AV (Ave. Current) ☒						
	Train Shunt on Rails (Ω)	Drop Shunt						
		Pick Up Shunt						
Side Band Ratio								
Ballast: 1. Wet, 2. Damp, 3. Dry, 4 .Frozen, 5. Flooded								
Comments: Transfer of the relevant details to the maintenance test columns shall also be undertaken.								
Meter Identities								
Train Shunt Identity								
Name								
Company								
Date								

Note : ☒ Readings to be taken from Tx/Rx display.

* Where Fitted, fill in details appropriate to the position and number of bonds
#1: X: EBI Track 200 under test Y: Adjacent EBI Track 200 TC (Additionally note whether this is the Tx or Rx end)
#2: Calculate TZ Ratio (Pole/Zero) and Record whether at Commissioning.

NetworkRail	# Track Circuit Test – EBI Track 200 **Full Test**	**Form: NRSMS/T253/RC02** **Date: 01/09/18** **Issue: 06**

Signal Box / Interlocking:			**Track Circuit ID:**
Equipment Room/Location:	TC length (Tx to Rx) m		TC Frequency:
Tx Serial No.		Rx Serial No.	

Normal Power / Low Power / Low Power Plus / Single Rail (delete as appropriate)

				1	2	3	4	5
DETERMINING RECEIVER SET-UP SHUNT VALUE								
Irail (Max at Tx end)								
Irail (Min at Rx end)								
Irail ratio as % (Min at RX End ÷ Max Tx end)				%	%	%	%	%
Ballast Impedance Ωkm				Ω	Ω	Ω	Ω	Ω
Commissioning Drop Shunt Value Used to set Ith (1Ω, 1.5Ω etc.)				Ω	Ω	Ω	Ω	Ω
Feed (Tx) End Voltages (V) & Current (A)	Power Supply	IP V (AC)						
		OP V (DC)						
		O/P A (DC)						
		O/P A (AC+DC)						
	TX	TX O/P						
	Rail Connections (Rail to Rail Volts) #1	X (Pole)						
		Y (Tx / Rx : Zero)						
		TZ Ratio #2						
	Rail Current measured in the rail with Rocoil (mA)							
Impedance Bond(s) *	Voltages (V)	Rail To Rail	1					
			2					
			3					
		Across Aux or Tuning Coil*	1					
			2					
			3					
	Impedance (Ω)		1					
			2					
			3					
Relay (Rx) End	Voltages (V) & Current (A)	Power Supply	I/P V (AC)					
			O/P V (DC) (Vpsu)					
			O/P A (DC)					
			O/P A (AC+DC)					
		Rail Connections (Rail to Rail Volts) #1	X (Pole)					
			Y (Tx / Rx : Zero)					
			TZ Ratio #2					
		Rail Current measured in the rail with Rocoil (mA)						

* Where Fitted, fill in details appropriate to the position and number of bonds
#1: X: EBI Track 200 under test Y: Adjacent EBI Track 200 TC (Additionally note whether this is the Tx or Rx end)
#2: Calculate TZ Ratio (Pole/Zero) and Record whether at Commissioning.

Relay (Rx) End	1Ω Resistor Voltage Drop OR Inow AV (Ave. Current) ☒							
	Track Relay	Coils V (DC) ☒						
	Train Shunt on Rails (Ω)	Drop Shunt						
		Pick Up Shunt						
	Settings	Rx gain / Ith Threshold ☒						
	Straps (SMS Table D1)	1						
		2						
		I/P 1						
		I/P 2						
	Side Band Ratio							
Drop Shunt of Extremities (No RX) Tested (Yes/No)								
Ballast: 1. Wet, 2. Damp, 3. Dry, 4 .Frozen, 5. Flooded								
Interference Test (mV)								
Comments: Transfer of the relevant details to the maintenance test columns shall also be undertaken.								
Meter Identities								
Train Shunt Identity								
Name								
Company								
Date								

Note : ☒ Readings to be taken from Tx/Rx display.

* Where Fitted, fill in details appropriate to the position and number of bonds
#1: X: EBI Track 200 under test Y: Adjacent EBI Track 200 TC (Additionally note whether this is the Tx or Rx end)
#2: Calculate TZ Ratio (Pole/Zero) and Record whether at Commissioning.

Network Rail	**Track Circuit Test - SF15 / Aster U** Maintenance Test	**Form: NR/SMS/T254/RC01** **Date: 07/03/2020** **Issue: 05**

Signal Box / Interlocking / Equipment Room:	Location:	TC Number / Letter:	Frequency (Hz):

Date	Name & Company	Signature	Relay (Rx) End				Meter Identity	Drop Shunt (Ω)	Pick-Up Shunt (Ω)	Train Shunt Identity	Ballast 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded	Comments
			Voltages (V)									
			Power Supply		Receiver Unit T1-T2 (AC)	Relay Coils (DC)						
			Input (AC)	Output (DC)								

Network Rail	**SF15 / Aster U Track Circuit** Full Test	**Form: NR/SMS/T254/RC01** **Date: 07/03/2020** **Issue: 05**

General Information						**Transmitter (Tx) End**				
						Power Supply (V)		Voltages (V)		
								Tx Unit		Tuning Unit
Date	Name & Company	Signature	Meter Identity	Train Shunt Identity	Comments	Input (AC)	Output (DC)	1-2/3 (AC)	T1-T2 (AC)	T1-T2 (AC)

Receiver (Rx) End															Ballast 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded
Power Supply (V)		Receiver Taps & Strapping			Voltages (V)				Train Shunt Rails		Train Shunt TU T1-T2		Track Circuit Extremities Checked (Tick)	Interference Test Completed (Tick)	
					Rx Unit	Tuning Unit		Relay Coils							
Input (AC)	Output (DC)	Rec.1	Rec.2	Strap/s	T1-T2 (AC)	T1-T2 (AC)	I/P T1- T2 (AC)	R1/2 (DC)	Drop	Pick Up	Drop	Pick Up			

Network Rail	**Track Circuit Test - HVI** Maintenance Test	**Form: NR/SMS/T255/RC01** **Date: 01/09/2018** **Issue: 04**

Signal Box / Interlocking / Equipment Room:	Location:	TC Number / Letter:	Traction Supply (Delete as appropriate): 3rd Rail DC / AC OHL / DC OHL / Dual / None

Relay End						Ballast 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded	Meter Identity	Train Shunt Identity	Comments *If a full test has been undertaken, the relevant details shall also be recorded*	Signature	Name & Company	Date
Train Shunt Across Track Transformer Track Terminals	Voltages (V)											
T1	T3		T4		T5							
Drop Shunt (Ohms)	Track Relay Coils (DC)		Track Transformer		Load Test (DC)							
	V1	V2	+Ve	-Ve								

Network Rail	**Track Circuit Test - HVI** Maintenance Test	**Form: NR/SMS/T255/RC01** **Date: 01/09/2018** **Issue: 04**

Signal Box / Interlocking / Equipment Room:	Location:	TC Number / Letter:	Traction Supply (Delete as appropriate): 3rd Rail DC / AC OHL / DC OHL / Dual / None

Number	Relay End							Feed End						Relay/Feed Ends	
	Train Shunt Across Track Transformer Track Terminals	Train Shunt Across Relay End Rails	Voltages (V)					Voltages (V)					Pulse Rate	External Interference Voltages (V)	
	T1	T2	T3		T4		T5	T6		T7	T8		T9	T10	T11
	Drop Shunt (Ohms)	Drop Shunt (Ohms)	Track Relay Coils (DC)		Track Transformer		Load Test (DC)	Power Supply		Transmitter Power (DC)	Track Transformer		No. of Pulses in Seven Seconds	Un-shunted Interference Test (DC)	Shunted Interference Test (DC)
			V1	V2	+Ve	-Ve		Volts (AC)	Current (AC)		+Ve	-Ve			
1															
2															
3															
4															
5															
6															

Number	Ballast 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded	Meter Identity	Train Shunt Identity	Comments *Transfer of the relevant details to the maintenance test columns shall also be undertaken*	Signature	Name & Company	Date
1							
2							
3							
4							
5							
6							

Track Circuit Test - BR-WR Quick Release

Maintenance Test

Form: NR/SMS/T256/RC01
Date: 01/09/2018
Issue: 04

Signal Box / Interlocking / Equipment Room:	Location:	Length of Track Circuit (Meters):	TC Number / Letter:

Relay End				Ballast 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded	Last Full Test Number	Meter Identity	Train Shunt Identity	Comments *If a full test has been undertaken, the relevant details shall also be recorded*	Signature	Name & Company	Date
Train Shunt Across Rails*	Train Shunt Across Relay End Links (Remote TR)*		Voltages (V)								
Drop Shunt (Ohms)	Drop Shunt (Ohms)	Drop Away Voltage Across Relay Coils (DC)	Relay Coil (DC)								

* Use Appropriate Column for Method of Test Used

Network Rail	**Track Circuit Test - BR-WR Quick Release** Full Test	**Form: NR/SMS/T256/RC01** **Date: 01/09/2018** **Issue: 04**

Signal Box / Interlocking / Equipment Room:	Location:	Length of Track Circuit (Meters):	TC Number / Letter:

Number	Feed End				Relay End				Track Circuit Extremities	Ballast 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded
	Voltages (V)			Feed Unit O/P Strapping	Voltages (V)		Train Shunt Across Rails (Ohms)		T/Shunt Across Rails set at 0.5 Ohms	
	Power Supply		Rail to Rail (AC)							
	I/P (AC)	O/P (AC)			Rail to Rail (AC)	Track Relay Coil (DC)	Drop Shunt	Pick Up Shunt	All Extremities (tick if correct)	
1										
2										
3										
4										
5										
6										
7										
8										

Number	Meter Identity	Train Shunt Identity	Comments *Transfer of the relevant details to the maintenance test columns shall also be undertaken*	Signature	Name & Company	Date
1						
2						
3						
4						
5						
6						
7						
8						

Network Rail	**Track Circuit Test - Reed Type RT** Maintenance Test	**Form: NR/SMS/T257/RC01** **Date: 01/09/2018** **Issue: 04**

Signal Box / Interlocking / Equipment Room:	Location:		TC Number / Letter:
Jointed / Jointless #	Single Rail / Double Rail #	Centre Feed#? Yes / No	Number of Intermediate Receivers*:
Number of Impedance Bonds*:	Impedance Bond Type*:	Channel/Frequency:	Intermediate RX / End RX#

Relay (Rx) End				Ballast 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded	Meter Identity	Train Shunt Identity	Comments *If a full test has been undertaken, the relevant details shall also be recorded*	Signature	Name & Company	Date
Train Shunt Across Incoming TC Terminations	Voltages (V)									
Drop Shunt (Ohms)	RT7202 / RT7212 (AC)	Dummy Amp. (AC)*	Track Relay Coils (DC)							

*: If Fitted #: Delete as Applicable

Network Rail	**Track Circuit Test - Reed Type RT** Full Test	**Form: NR/SMS/T257/RC01** **Date: 01/09/2018** **Issue: 04**

Signal Box / Interlocking / Equipment Room:		Location:	TC Number / Letter:
Jointed / Jointless #	Single Rail / Double Rail #	Centre Feed#? Yes / No	Number of Intermediate Receivers*:
Number of Impedance Bonds*:	Impedance Bond Type*:	Channel/Frequency:	Intermediate RX / End RX#

Number	Impedance Bonds* Voltages (V) Rail to Rail			Torque (Nm)			Voltage Fall/Rise as resonating Cct disconnected /Connected (tick if correct)			Feed (Tx) End Voltages (V) & Currents (A)					Intermediate / End Relay (Rx) Voltages (V)				
	1	2	3	1	2	3	1	2	3	NT1202 I/P (AC)	PA I/P (DC)	RT5001 I/P (DC)	Current at TF Links (AC) SC	OC	RR9121 I/P (AC)	RR2002 I/P (DC)	RT7202 RT7212 (AC)*	Dummy Amp (AC)*	Track Relay Coils (DC)
1																			
2																			
3																			
4																			
5																			

Number	Intermediate / End Relay (Rx) Train Shunt Across Rails (Ohms) Drop Shunt	Pick Up Shunt	Track Circuit Extremities T/Shunt Across Rails All Extremities (tick if correct)**	Ballast 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded	Meter Identity	Train Shunt Identity	Comments *Transfer of the relevant details to the maintenance test columns shall also be undertaken*	Signature	Name & Company	Date
1										
2										
3										
4										
5										

* if Fitted ** 0.5 Ohms Without Impedance Bond / 0.3 Ohms With Impedance Bond #: Delete as Appropriate

Network Rail	**Track Circuit Test - Rectified AC (Diode)** Maintenance Test	**Form: NR/SMS/T258/RC01** **Date: 01/09/2018** **Issue: 04**

Signal Box / Equipment Room:	TC Number / Letter:

Feed/Relay (Near) End										Ballast 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded	Meter Identity	Train Shunt Identity	Signature	Name & Company	Date
Feed Resister Strapping			Voltages (V)					Train Shunt Across TC Links							
I/P	O/P	Straps	Across Feed Resister (AC)	Relay Coils		Rail to Rail		Drop Shunt	Pick Up Shunt						
				AC	DC	AC	DC								

Network Rail	# Track Circuit Test - Rectified AC (Diode) Full Test	**Form: NR/SMS/T258/RC01** **Date: 01/09/2018** **Issue: 04**

Signal Box / Equipment Room:	TC Number / Letter:

Number	Feed/Relay (Near) End										Diode (Remote) End						Ballast 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded
	Feed Resister Strapping			Voltages (V)					Train Shunt Across Rails (Ohms)		Voltages (V)		Currents (A)		Train Shunt Across Rails (Ohms)		
	I/P	O/P	Straps	Across Feed Resister (AC)	Relay Coils		Rail to Rail		Drop Shunt	Pick Up Shunt	Rail to Rail		Dis'ed Diode to Term.		Drop Shunt	Pick Up Shunt	
					AC	DC	AC	DC			AC	DC	AC	DC			
1																	
2																	
3																	
4																	
5																	
6																	
7																	

Number	Meter Identity	Train Shunt Identity	Comments *Transfer of the relevant details to the maintenance test columns shall also be undertaken*	Signature	Name & Company	Date
1						
2						
3						
4						
5						
6						
7						
8						

Network Rail	**Track Circuit Test - FS2600** Maintenance Test	**Form: NR/SMS/T259/RC01** **Date: 01/09/2018** **Issue: 04**

Signal Box / Interlocking / Equipment Room:	Location:	TC Number / Letter:

Date	Name & Company	Signature	Train shunt Identity	Meter Identity	Feed (Tx) End		Intermediate Impedance Bond*		Relay (Rx) End						Ballast 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded
					Torques (Nm)		Torques (Nm)		Torques (Nm)		LED indications (tick if correct)		Voltages (V) at Monitor Point		
					Rail Leads	Bonds #	Rail Leads	Bonds	Rail Leads	Bonds #	Track Clear	Track Shunted $	Track Clear	Track Shunted $	

Where Fitted $ Train shunt set to 0.6 ohms

Network Rail

Track Circuit Test - FS2600

Maintenance Test

Form: NR/SMS/T259/RC01
Date: 01/09/2018
Issue: 04

Signal Box / Interlocking / Equipment Room:	Location:	TC Number / Letter:
Length of Track Circuit (Tx to Rx):	**Channel Number**	**Number & Type of Impedance Bonds:**

No.	Feed (TX) End										Intermediate Impedance Bond*					Relay (RX) End	
	Torque (Nm)		Power Supply		Transmitter Outputs				Impedance Bond		Torque (Nm)		Voltages (V)		Rail to Rail voltage falls when S/C or O/C applied to tuning Capacitor tick if correct	Torque (Nm)	
							Voltages (V)		Voltages (V)								
	Rail Leads	Bonds*	I/P V (AC)	Tapping T11 to	Term Settings		TX O/P (AC)	Rail to Rail (AC)	Rail to Rail		Rail Leads	Bonds	Rail to Rail	Across Aux Coil		Rail Leads	Bonds*
									#1	#2							
1																	
2																	
3																	
4																	

No.	Relay (Rx) End																	
	LED indications (tick if correct)		Receiver Unit						Rx Impedance Bond*			Rx Unit Set Up						Ballast 1. Wet 2. Damp 3. Dry 4.Frozen 5.Flooded
			Supply	Monitor Point Voltages		Train Shunt (Ohms) #3		Track Circuit Extremities	Voltages (V)		Rail to Rail voltage falls when S/C applied to tuning capacitor tick if correct	Ratio (V)	Monitor Point (V) #4	Rx Input Settings (Links)				
	Track Clear	Track Shunted	I/P V (AC)	Track Clear	Track Shunted	Drop Shunt	Pick Up Shunt	T/Shunt Across Rails tick if correct #4	Rail to Rail	Across Aux coil				A	B	C	D	
1																		
2																		
3																		
4																		

No	Phase Stagger Details	Meter Identity	Train Shunt Identity	Set Up Box Identity	Comments *Transfer of the relevant details to the maintenance test columns shall also be undertaken*	Signature	Name & Company	Date
1								
2								
3								
4								

* Where Fitted #1: With S/C across tuning capacitor #2: Without S/C across tuning capacitor #3: Across rails with impedance bond / At Rx unit if no bond #4: Train Shunt set to 0.6 Ohms

Network Rail	**Track Circuit Test - 50Hz AC** Maintenance Test	**Form: NR/SMS/T260/RC01** **Date: 04/06/2022** **Issue: 05**

Signal Box / Interlocking / Equipment Room:	Location:	TC Number / Letter:	Single Rail / Double Rail #

Relay End								Ballast 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded	Meter Identity	Train Shunt Identity	Phase Angle Meter Identity	Comments *If a full test has been undertaken, the relevant details shall also be recorded*	Signature	Name & Company	Date
Control Voltage / Phase Angle / Stagger					Train Shunt Across Rails (Ohms)		VT1(SP) Relays only								
TR Control Coil (V)	Phase Angle (°)	Lead or Lag	Stagger		Relay End	Stub Ends **	Time Delay (seconds)								
			Needle Position	2x Lights #2											

* * Single rail configurations only with the shunt set to 0.5ohm, tick if correct   # : Delete as Appropriate   #2: Insert tick if correct

Track Circuit Test - 50Hz AC

Full Test

Form: NR/SMS/T260/RC01
Date: 03/09/2022
Issue: 05

Signal Box / Interlocking / Equipment Room:	Location:	TC Number / Letter:	Single Rail / Double Rail #
Length of Track Circuit:	Number of Impedance Bonds:	Type of Impedance Bonds:	

No.	Feed End						Feed End Impedance Bonds				Intermediate Impedance Bond No.1				Intermediate Impedance Bond No.2			
	Voltages (V)			Current (A)	Capacitor		Voltage (V)	Torque (Nm)	Voltage Ratio #2	Phasing #2	Capacitor		Voltage Ratio #2	Torque (Nm)	Capacitor		Voltage Ratio #2	Torque (Nm)
	Supply I/P	Across Links/S Arrester	Rail to Rail	To Track	Voltage Across	Value	Across Aux Coil				Voltage Across	Value			Voltage Across	Value		
1																		
2																		
3																		
4																		

No.	Relay End Impedance Bond*							Relay End													
	Voltages (V)	Capacitor			Torque (Nm)	Voltage Ratio#2	Phasing #2	Voltages (V)				Current (A)	Control Resistor Setting (% of max)	Phase Angle / Stagger				Train Shunt Across Rails (Ohms)		
																Stagger				
	Across Aux Coil	Voltage Across	Value	Stability Check				Rail to Rail	Across Links/S Arrester	TR Local Coil	TR Control	From Track		Phase Angle (°)	Lead or Lag	Needle Position	2x Lights #2	Drop Shunt	Pick Up Shunt	Stub Ends #1
1																				
2																				
3																				
4																				

No	Ballast 1. Wet 2. Damp 3. Dry 4. Frozen 5. Flooded	Meter Identity	Train Shunt Identity	Phase Angle Meter Identity	Details of Stagger of other Block Joints within the Track circuit	Comments *Transfer of the relevant details to the maintenance test columns shall also be undertaken*	Signature	Name & Company	Date
1									
2									
3									
4									

Where Fitted #: Delete as Appropriate #1: Single rail configurations only with the shunt set to 0.5ohm, tick if correct #2: Insert tick if correct

Network Rail	# Track Circuit Test - Rail Circuit Maintenance Test	Form: NR/SMS/T261/RC01 Date: 01/09/2018 Issue: 04

Location/Equipment	TC Number / Letter:

General Information					**Run In End**				**Run Off End**				
Date	Name & Company	Signature	Meter ID	Shunt ID	Relay Energised (Tick)	Relay Voltage (V)	Relay De-energies (Ω)	Relay Voltage (V)	Relay Energised (Tick)	Relay Voltage (V)	Relay De-energies (Ω)	Relay Voltage (V)	Comments

Network Rail	**Track Circuit Test - DC Coded** Maintenance Test	Form: NR/SMS/T262/RC01 Date: 01/09/2018 Issue: 03

Signal Box / Interlocking / Equipment Room:	Location:	TC Number / Letter:

				Feed End		Relay End						Ballast 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded	
				Voltages (V)		Voltages (V)				Train Shunt on Links			
				Rail to Rail		Rail to Rail		CFR Coil					
Date	Name	Meter ID	Train Shunt ID	Min	Max	Min	Max	Max	Min	Drop Away (Ω)	Pick-up (Ω)		Comments

Network Rail	# Track Circuit Test - DC Coded Full Test	Form: NR/SMS/T262/RC01 Date: 01/09/2018 Issue: 03

				Feed End							Relay End						Ballast 1.Wet 2.Damp 3.Dry 4.Frozen 5.Flooded	Track Extremities Checked (Tick)	
				Resister Settings		Voltages (V)					Voltages (V)				Shunt Across				
						PSU		Battery (DC)	Rail To Rail		Rail to Rail		CFR						
Date	Name	Meter ID	Train Shunt ID	TZO	TO	Input (AC)	Output (DC)		Min	Max	Min	Max	Min	Max	Drop Away	Pick Up			Comments

Track Circuit Test - EBI Track 400

Maintenance Test

Form: T263/RC01
Date: 01/09/2018
Issue: 06

Signal Box / Interlocking:		**Track Circuit ID:**	
Equipment Room/Location:	TC length (Tx to Rx) m		TC Frequency:
Tx Serial No.	Rx Serial No.		
Open Line / Station Area (delete as appropriate)	Double Rail / Single Rail (delete as appropriate)		

				1	**2**	**3**	**4**	**5**
Receiver 1 (Rx1 End)	Voltages (V) & Current (A)	Rail Connections (Rail to Rail Volts) #1	X (Pole)					
			Y (Tx / Rx : Zero)					
			TZ Ratio #2					
		Rail Current measured in the rail with a Rocoil (mA)						
		Ith (mA) Threshold Current ☒						
		Inow AV (mA) (Average Current) ☒						
	Train Shunt on Rails (Ω)	Drop Shunt						
		Pick Up Shunt						
Receiver 2 (Rx2 End)	Voltages (V) & Current (A)	Rail Connections (Rail to Rail Volts) #1	X (Pole)					
			Y (Tx / Rx : Zero)					
			TZ Ratio #2					
		Rail Current measured in the rail with a Rocoil (mA)						
		Ith (mA) Threshold Current ☒						
		Inow AV (mA) (Average Current) ☒						
	Train Shunt on Rails (Ω)	Drop Shunt						
		Pick Up Shunt						
Ballast: 1. Wet, 2. Damp, 3. Dry, 4 .Frozen, 5. Flooded								
Comments: Transfer of the relevant details to the maintenance test columns shall also be undertaken.								
Meter Identities								
Train Shunt Identity								
Name								
Company								
Date								

Note : ☒ Readings to be taken from Tx/Rx display.

* Where Fitted, fill in details appropriate to the position and number of bonds
#1: X: ET400 under test (Pole), Y: Adjacent ET400 TC (Zero) (Additionally note whether this is the Tx or Rx end)
#2: Calculate TZ Ratio (Pole/Zero) and Record whether at Commissioning.

Track Circuit Test - EBI Track 400

Full Test **Open Line**

Form: T263/RC02
Date: 01/09/20182018
Issue: 06

Track Circuit ID			Frequency / Code		/
Equipment location					
TC length	m	Tx to TU/ETU distance	m	Ambient Temp.	C
Tx Serial No.			Rx Serial No.		

		1		**2**		**3**	
	Date :						
	Set up / measurements signature :						
	Checked signature :						
DETERMINING RECEIVER SET-UP SHUNT VALUE		**1st Rx**	**2nd Rx**	**1st Rx**	**2nd Rx**	**1st Rx**	**2nd Rx**
Irail (Max at Tx end)							
Irail (Min at Rx end)							
Irail ratio as % (Min at RX End ÷ Max Tx end)		%	%	%	%	%	%
Ballast Impedance Ωkm		Ω	Ω	Ω	Ω	Ω	Ω
Commissioning Drop Shunt Value Used to set Ith (1Ω, 1.5Ω etc.)		Ω	Ω	Ω	Ω	Ω	Ω

	Test Ref.	**Measurement**	**Units**			
PSU (TX)	2.5	AC signalling power supply voltage	V			
	2.6 (B)	Tx power supply voltage (Vpsu) ☒	V			
	2.7 (A)	Tx power supply current	A			
TRANSMITTER	2.8 (C)	Tx output voltage across TM1/TM2	V RMS			
	2.9	OM setting (Step Setting Set to 0R)	Y/N			
	2.10 (D)	OM O/P voltage (Vout) ☒	V			
	2.11 (E1)	LMU(TU) I/P Voltage (Meter)	V			
	2.12 (E3)	Tx TU/ETU I/P voltage (Meter)	V			
	2.13 (G)	Tx TU/ETU Pole (X) track (rail to rail) voltage (Meter)	V			
	2.14	Rail Current measured in the rail with a Rocoil	mA			
	2.15 (H)	Tx Companion TU Zero (Y) (rail to rail) voltage (Meter)	V			
	2.15 (H)	Tuned Zone Ratio – Pole/Zero (X/Y) #2	Ratio			

				1st Rx	**2nd Rx**	**1st Rx**	**2nd Rx**	**1st Rx**	**2nd Rx**
PSU (RX)	2.28	AC signalling power supply voltage	V						
	2.29 (B)	Rx power supply voltage	V						
	2.30 (A)	Rx power supply current (Relay Up)	A						

#1: X: ET400 under test (Pole), Y: Adjacent ET400 TC (Zero) (Additionally note whether this is the Tx or Rx end)
#2: Calculate TZ Ratio (Pole/Zero) and Record whether at Commissioning.

NetworkRail	# Track Circuit Test - EBI Track 400 **Full Test Open Line**	**Form:** T263/RC02 **Date:** 01/09/20182018 **Issue:** 06

				1st Rx	2nd Rx	1st Rx	2nd Rx	1st Rx	2nd Rx
RECEIVER(S)	2.32 (K)	Rx TU/ETU O/P voltage (Meter)	V						
	2.33(G)	Rx TU Pole (X) track (rail to rail) voltage (Meter)	V						
	2.34	Rail Current measured in the rail with a Rocoil	mA						
	2.35 (H)	Rx Companion TU Zero (Y) (rail to rail) voltage (Meter)	V						
	2.35 (H)	Tuned Zone Ratio – Pole/Zero (X/Y) #2	V						
	2.36 (N)	Rx I/P current - clear current (Inow AV) ⊠	mA						
	2.37	Rx threshold setting (Ith) ⊠	mA						
	2.38 (S)	ITOT measured at the Rx ⊠	mA						
	2.39	Rx Quality Factor (QUAL) ⊠	-						
	2.40 (L)	Rx Output voltage (relay voltage) ⊠	V						
	2.41 (M)	Track Drop Shunt on the rails	Ω						
	2.41 (M)	Track Pick Up Shunt on the rails	Ω						
	2.44 (P)	Cross Talk and Feed through (Interference)	P/F						
EXTREMITIES	2.45	Shunt at Tx extremity (Pole)	P/F						
	2.45	Shunt at Rx extremity (Pole)	P/F						
	2.45	Shunt at non Rx extremity (Non detected spur)	P/F						

Test Ref.	Measurement	Units			
	IRJ Insulation	P/F			
Q	Earth Continuity Tests	P/F			
R	Surge Arrestor Integrity	P/F			
	IRJ Inspection / Test	P/F			

IMPEDANCE BOND(S) ⌘	2.18	Voltages (V)	Rail To Rail	1	V			
				2	V			
				3	V			
	2.19	Voltages (V)	Across Aux or Tuning Coil	1	V			
				2	V			
				3	V			
	2.21 to 2.25	Impedance (Ω)		1	Ω			
				2	Ω			
				3	Ω			

Ballast: 1. Wet, 2. Damp, 3. Dry, 4 .Frozen, 5. Flooded			
Remarks At Commissioning?			
Meter Identities			
Train Shunt Identity			
Name			
Company			
Date			

Note: ⊠ Readings to be taken from Tx/Rx display.

⌘ Where Fitted, fill in details appropriate to the position and number of bonds

#1: X: ET400 under test (Pole), Y: Adjacent ET400 TC (Zero) (Additionally note whether this is the Tx or Rx end)
#2: Calculate TZ Ratio (Pole/Zero) and Record whether at Commissioning.

NetworkRail	**Track Circuit Test - EBI Track 400** Full Test - Station Area	**Form: T263/RC03** **Date: 10/09/2018** **Issue: 06**

Track Circuit ID		Frequency / Code /	
Equipment location			
TC length m	Tx to SATU/CU distance m		Ambient Temp. C
Tx Serial No.		Rx Serial No.	
Set-Up Drop Shunt Value Used (1.5 ohm etc.) Ω (Ohms)			

				1		**2**		**3**	
			Date :						
			Set up / measurements signature :						
			Checked signature :						
Test Ref.		**Measurement**	**Units**						
PSU (TX)	2.5	AC signalling power supply voltage	V						
PSU (TX)	2.6 (B)	Tx power supply voltage (Vpsu) ☒	V						
PSU (TX)	2.7 (A)	Tx power supply current	A						
TRANSMITTER	2.8 (C)	Tx output voltage across TM1/TM2	V RMS						
TRANSMITTER	2.9	OM setting (Step Setting, 48R/0R) 48R for TC feed<750m, 0R for TC feed>750m to 2km	Y/N						
TRANSMITTER	2.10 (D)	OM O/P voltage (Vout) ☒	V						
TRANSMITTER	2.12 (E)	Tx SATU/CU I/P voltage (Meter)	V						
TRANSMITTER	2.13 (G)	Tx SATU/CU Pole (X) track (rail to rail) voltage (Meter)	V						
TRANSMITTER	2.14	Rail Current measured in the rail with a Rocoil	mA						
TRANSMITTER	2.15 (H)	Tx Companion SATU Zero (Y) (rail to rail) voltage (Meter)	V						
TRANSMITTER	2.15 (H)	Tuned Zone Ratio – Pole/Zero (X/Y) #2	Ratio						
				1st Rx	**2nd Rx**	**1st Rx**	**2nd Rx**	**1st Rx**	**2nd Rx**
PSU (RX)	2.28	AC signalling power supply voltage	V						
PSU (RX)	2.29 (B)	Rx power supply voltage	V						
PSU (RX)	2.30 (A)	Rx power supply current (Relay Up)	A						
RECEIVER(S)	2.32 (K)	Rx SATU/CU O/P voltage (Meter)	V						
RECEIVER(S)	2.33(G)	Rx SATU/CU Pole (X) track (rail to rail) voltage (Meter)	V						
RECEIVER(S)	2.34	Rail Current measured in the rail with a Rocoil	mA						
RECEIVER(S)	2.35 (H)	Rx Companion TU Zero (Y) (rail to rail) voltage (Meter)	V						
RECEIVER(S)	2.35 (H)	Tuned Zone Ratio – Pole/Zero (X/Y) #2	V						
RECEIVER(S)	2.36 (N)	Rx I/P current - clear current (Inow AV) ☒	mA						
RECEIVER(S)	2.37	Rx threshold setting (Ith) ☒	mA						
RECEIVER(S)	2.38 (V)	ITOT measured at the Rx ☒	mA						
RECEIVER(S)	2.39	Rx Quality Factor (QUAL) ☒	-						
RECEIVER(S)	2.40 (L)	Rx Output voltage (relay voltage) ☒	V						
RECEIVER(S)	2.41 (M)	Track Drop Shunt on the rails	Ω						
RECEIVER(S)	2.41 (M)	Track Pick Up Shunt on the rails	Ω						

#1: X: ET400 under test (Pole), Y: Adjacent ET400 TC (Zero) (Additionally note whether this is the Tx or Rx end)
#2: Calculate TZ Ratio (Pole/Zero) and Record whether at Commissioning.

NetworkRail	**Track Circuit Test - EBI Track 400** Full Test - Station Area

Form: T263/RC03
Date: 10/09/2018
Issue: 06

				1st Rx	2nd Rx	1st Rx	2nd Rx	1st Rx	2nd Rx
	2.44 (P)	Cross Talk and Feed through (Interference)	P/F						
EXTREMITIES	2.45 (S)	RX I/P (Inow AV) with 0.2Ω Shunt at Tx extremity (Pole) ☒	mA						
	2.45 (S)	RX I/P (Inow AV) with 0.2Ω Shunt at centre point ☒	mA						
	2.45 (S)	RX I/P (Inow AV) with 0.2Ω Shunt at Rx extremity (Pole) ☒	mA						
	2.45 (S)	RX I/P (Inow AV) with 0.2Ω Shunt at non Rx extremity (Non detected spur) ☒	mA						
	2.46 (T)	TX Tuned Zone Impedance ☒	Ω		(TX end)		(TX end)		(TX end)
	2.46 (U)	RX Tuned Zone Impedance ☒	Ω						

Test Ref.	Measurement	Units			
	IRJ Insulation	P/F			
Q	Earth Continuity Tests	P/F			
R	Surge Arrestor Integrity	P/F			
	IRJ Inspection / Test	P/F			

IMPEDANCE BOND(S) ⌘	2.18	Voltages (V)	Rail To Rail	1	V			
				2	V			
				3	V			
	2.19	Voltages (V)	Across Aux or Tuning Coil	1	V			
				2	V			
				3	V			
	2.21 to 2.25	Impedance (Ω)		1	Ω			
				2	Ω			
				3	Ω			

Ballast: 1. Wet, 2. Damp, 3. Dry, 4 .Frozen, 5. Flooded			
Remarks At Commissioning?			
Meter Identities			
Train Shunt Identity			
Name			
Company			
Date			

Note: ☒ Readings to be taken from Tx/Rx display.
⌘ Where Fitted, fill in details appropriate to the position and number of bonds

#1: X: ET400 under test (Pole), Y: Adjacent ET400 TC (Zero) (Additionally note whether this is the Tx or Rx end)
#2: Calculate TZ Ratio (Pole/Zero) and Record whether at Commissioning.

Network Rail	**Signal Visibility** Routine Maintenance	**Form: NR/SMS/T302/Signal Visibility** **Date: September 2018** **Issue: 02**

Signal Box / Interlocking / Equipment Room:	Location:	Signal Number:

Date	Name	Company	Signature	Method Used to Check Visibility (#)				Un-Obscured	Partially Obscured	Totally Obscured	Actions Taken
				1	2	3	4				

(#) for Method used refer to SMS Test 302 content.

Network Rail	**Train Describer Electro Mechanical Record Card (Front)** **NR/SMS/TD11**	**Form: NR/SMS/TD11/RC/01** **Date: August 2004** **Issue: 01**

Signal Box (Main / Fringe*): **Delete as Appropriate*	If Fringe, Main Signal Box Name:

Service A Tasks						Comments	Meter Identity	Signature	Name & Company	Date
Power Supplies										
50V DC		18V DC		12V AC	6V AC					
DC Voltage	AC Ripple	DC Voltage	AC Ripple	Voltage	Voltage					

Train Describer Electro Mechanical Record Card (Rear)
NR/SMS/TD11

Form: NR/SMS/TD11/RC/01
Date: August 2004
Issue: 01

Service A Tasks						Comments	Meter Identity	Signature	Name & Company	Date
Power Supplies										
50V DC		18V DC		12V AC	6V AC					
DC Voltage	AC Ripple	DC Voltage	AC Ripple	Voltage	Voltage					

Network Rail	**Train Describer Hewlett Packard 21MX (2100 series)** **Record Card (Front)** **NR/SMS/TD21**	**Form: NR/SMS/TD21/RC/01** **Date: August 2004** **Issue: 01**

Signal Box (Main / Fringe*): **Delete as Appropriate*	If Fringe, Main Signal Box Name:

Service A Tasks														Comments	Test Equipment Identity	Signature	Name & Company	Date
Power Supplies (C4 & C8 Cubicle)										Modem 1								
5.5V		-24V		-24V		-24V		-24V		Stab 1	Stab 2	Stab 3	Stab 4					
DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple									

Network Rail	Train Describer Hewlett Packard 21MX (2100 series) Record Card (Rear) NR/SMS/TD21	Form: NR/SMS/TD21/RC/01 Date: August 2004 Issue: 01

Number	Service B Tasks																
	Computer Voltages														Standb y	Modem Other Types Enter Details as Appropriate	
	+30V		+20V		+12V		+4.5V		-2V		-12V		-20V				
	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	Voltages	Indications*
1																	
2																	
3																	
4																	
5																	
6																	
7																	

Number	Service B Tasks													
	Modems Pye D200E (Enter amount & readings in the appropriate columns)								Common Service Modules					
	-24V		+12V		-6V		+6V		Switch Position					
									100V		180V		2kV	
	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple	Voltage	Ripple	Voltage	Ripple	Voltage	Ripple
1														
2														
3														
4														
5														
6														
7														

No	Comments	Test Equipment Identity	Signature	Name & Company	Date
1					
2					
3					
4					
5					
6					
7					

Network Rail	**Train Describer Hewlett Packard 21MX (2108 series)** **Record Card (Front)** **NR/SMS/TD21**	**Form: NR/SMS/TD21/RC/02** **Date: August 2004** **Issue: 01**

Signal Box (Main / Fringe*): **Delete as Appropriate*	If Fringe, Main Signal Box Name:

Number	Service A Tasks																	
	Power Supplies																	
	C1 Cubicle								C4 to C8 Cubicle								C5 to C7 Cubicle	
	Advance +5vL		Advance+5vR		WBS +24vL		WBS+24vR		WBS+6V		WBS+9.5V		WBS+18V		WBS+24V		Advance+5V	
	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		

Number	Service A Tasks														Comments	Test Equipment Identity	Signature	Name & Company	Date
	Power Supplies										AVS								
	C5 to C7 Cubicle						C6 Cubicle				Stab 1	Stab 2	Stab 3	Stab 4					
	Advance +12V		Advance –12V		WBS+5VReg		WBS+5VReg		WBS+12VReg										
	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Voltage	AC Ripple									
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			

Network Rail	**Train Describer Hewlett Packard 21MX (2108 series)** **Record Card (Rear)** **NR/SMS/TD21**	**Form: NR/SMS/TD21/RC/02** **Date: August 2004** **Issue: 01**

Number	Service B Tasks													
	Computer Voltages												Standby Battery Module	
	TP1 –12V		TP3 +12V		TP4 –2.3V		TP6 +5V(m)		TP9 +12V(m)		TP10 –12V(m)		Charge Voltage	Discharge Voltage
	DC Voltage	AC Ripple	DC Voltage	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple		
1														
2														
3														
4														
5														
6														

Number	Service B Tasks								Test Equipment Identity	Signature	Name & Company	Date
	HP Battery Module C5/C7		Common Service Modules									
			Switch Position									
	Charge Voltage	Battery Voltage	100V		180V		2kV					
			Voltage	Ripple	Voltage	Ripple	Voltage	Ripple				
1												
2												
3												
4												
5												
6												

No	Comments
1	
2	
3	
4	
5	
6	

Network Rail	**Train Describer Vaughan Type 4M** **Record Card (Front)** **NR/SMS/TD31**	**Form: NR/SMS/TD31/RC/01** **Date: August 2004** **Issue: 01**

Signal Box (Main / Fringe*): **Delete as Appropriate*	If Fringe, Main Signal Box Name:

Number	Service A Tasks																		
	Power Supplies									Line Levels									
	I/P	+5V		+12V		+12V I/F		-12V I/F		Link 1		Link 2		Link 3		Link 4		Link 5	
	AC Volts	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			

No	Comments	Test Equipment Identity	Signature	Name & Company	Date
1					
2					
3					
4					
5					
6					
7					
8					
9					

Network Rail	**Train Describer Vaughan Type 4M** **Record Card (Rear)** **NR/SMS/TD31**	**Form: NR/SMS/TD31/RC/01** **Date: August 2004** **Issue: 01**

Number	Service A Tasks																		
	Power Supplies									Line Levels									
	I/P	+5V		+12V		+12V I/F		-12V I/F		Link 1		Link 2		Link 3		Link 4		Link 5	
	AC Volts	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			

No	Comments	Test Equipment Identity	Signature	Name & Company	Date
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

Network Rail	**Train Describer Vaughan Type Small (Ex BR-WR)** **Record Card (Front)** **NR/SMS/TD32**	**Form: NR/SMS/TD32/RC/01** **Date: August 2004** **Issue: 01**

Signal Box (Main / Fringe*): **Delete as Appropriate*	If Fringe, Main Signal Box Name:

Number	Service A Tasks																		
	Power Supplies									Line Levels									
	I/P	+5V		+12V		+12V I/F		-12V I/F		Link 1		Link 2		Link 3		Link 4		Link 5	
	AC Volts	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			

No	Comments	Test Equipment Identity	Signature	Name & Company	Date
1					
2					
3					
4					
5					
6					
7					
8					
9					

Network Rail	**Train Describer Vaughan Type Small (Ex BR-WR)** **Record Card (Rear)** **NR/SMS/TD32**	**Form: NR/SMS/TD32/RC/01** **Date: August 2004** **Issue: 01**

Number	Service A Tasks																		
	Power Supplies									Line Levels									
	I/P	+5V		+12V		+12V I/F		-12V I/F		Link 1		Link 2		Link 3		Link 4		Link 5	
	AC Volts	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			

No	Comments	Test Equipment Identity	Signature	Name & Company	Date
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

Network Rail	**Train Describer GEC/GE Micro Processor Based Record Card (Front)** **NR/SMS/TD37**	**Form: NR/SMS/TD37/RC/01** **Date: August 2004** **Issue: 01**

Signal Box (Main / Fringe*): **Delete as Appropriate*	If Fringe, Main Signal Box Name:

Number	Service A Tasks																
	Equipment Room & CIS																
	Power Supplies (+5V)								Power Supplies (Other)								Voltage drop across PSU diodes Tick if all correct
	+5V (1)		+5V (2)		+5V (3)		+5V (4)		+12V		-12V		+24V		+50V		
	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	
1																	
2																	
3																	
4																	

Number	Service A Tasks																	
	SB Operating Floor																	
	Power Supplies (1)						Power Supplies (2)						Power Supplies (3)					
	+5V		+12V		-12V		+5V		+12V		-12V		+5V		+12V		-12V	
	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC volts	AC Ripple	DC Volts	AC Ripple
1																		
2																		
3																		
4																		

Number	Service A Tasks						Comments	Test Equipment Identity	Signature	Name & Company	Date
	SB Operating Floor										
	Power Supplies (4)										
	+5V		+12V		-12V						
	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple					
1											
2											
3											
4											

Network Rail	Train Describer GEC/GE Micro Processor Based Record Card (Rear) NR/SMS/TD37	Form: NR/SMS/TD37/RC/01 Date: August 2004 Issue: 01

Number	Service A Tasks																
	Equipment Room & CIS																
	Power Supplies (+5V)								Power Supplies (Other)								Voltage drop across PSU diodes Tick if all correct
	+5V (1)		+5V (2)		+5V (3)		+5V (4)		+12V		-12V		+24V		+50V		
	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	
5																	
6																	
7																	

Number	Service A Tasks																	
	SB Operating Floor																	
	Power Supplies (1)						Power Supplies (2)						Power Supplies (3)					
	+5V		+12V		-12V		+5V		+12V		-12V		+5V		+12V		-12V	
	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC volts	AC Ripple	DC Volts	AC Ripple
5																		
6																		
7																		

Number	Service A Tasks						Comments	Test Equipment Identity	Technicians SSM Name	Company	Date
	SB Operating Floor										
	Power Supplies (4)										
	+5V		+12V		-12V						
	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple					
5											
6											
7											

Service B Tasks							Comments	Test Equipment Identity	Signature	Name & Company	Date
PSU Fringe Boxes Only	Earth Continuity Checks (Ohms): *Enter details of earthing in the appropriate columns*										
AC I/P Volts	One:	Two:	Three:	Four:	Five:	Six:					

Network Rail	**Train Describer GETS Dual Record Card (Front) NR/SMS/TD40**	**Form: NR/SMS/TD40/RC/01** **Date: August 2004** **Issue: 01**

Signal Box (Main / Fringe*): **Delete as Appropriate*	If Fringe, Main Signal Box Name:

Number	Service A Tasks																			
	Power Supplies																			
	3AC-AP/SP Modules												6PP-B Modules							
	A						B						A						B	
	12V Logic		+12V Interface		-12V Interface		12V Logic		+12V Interface		-12V Interface		12V Logic		+12V Interface		-12V Interface		12V Logic	
	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple
1																				
2																				
3																				
4																				

Number	Service A Tasks																		Test Equipment Identity
	Power Supplies																		
	6PP-B Modules				6PP-C Modules												AP-H Module		
	B				A						B								
	+12V Interface		-12V Interface		5V logic		7V Logic		12V Interface		5V Logic		7V Logic		12V Interface				
	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	
1																			
2																			
3																			
4																			

No	Comments	Signature	Name & Company	Date
1				
2				
3				
4				

Network Rail	**Train Describer GETS Dual Record Card (Rear) NR/SMS/TD40**	**Form: NR/SMS/TD40/RC/01** **Date: August 2004** **Issue: 01**

Number	Service A Tasks															
	Power Supplies															
	3AC-AP/SP Modules												6PP-B Modules			
	A						B						A						B	
	12V Logic		+12V Interface		-12V Interface		12V Logic		+12V Interface		-12V Interface		12V Logic		+12V Interface		-12V Interface		12V Logic	
	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple
5																				
6																				
7																				
8																				
9																				

Number	Service A Tasks																		Test Equipment Identity
	Power Supplies																		
	6PP-B Modules				6PP-C Modules												AP-H Module		
	B				A						B								
	+12V Interface		-12V Interface		5V logic		7V Logic		12V Interface		5V Logic		7V Logic		12V Interface				
	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	DC Volts	AC Ripple	
5																			
6																			
7																			
8																			
9																			

No	Comments	Signature	Name & Company	Date
5				
6				
7				
8				
9				

TPWS Test: Equipment Associated with Signals Record Card (Front) **NR/SMS/TP11 –Test/025**		**Form: NR/SMS/TP11/T25/RC/01** **Date: December 2009** **Issue: 02**

Signal Box / Interlocking:	Signal Number	Normal / Opposite Direction *Delete as appropriate*

Transmitter Loops and Module Indications

Number	TSS: Centre Point to Signal (± 0.1m) #	TSS: Loop Centre Line in Spec #: Arm	TSS: Loop Centre Line in Spec #: Trig	TSS: Loop Height #: Arming	TSS: Loop Height #: Trigger	TSS: Main Signal Off Sub Signal On**: LED' s #	TSS: Main Signal Off Sub Signal On**: Arming Loop O/P(mV)*: CJ	TSS: Main Signal Off Sub Signal On**: Arming Loop O/P(mV)*: MJ	TSS: Main Signal Off Sub Signal On**: Trigger Loop O/P(mV)*: CJ	TSS: Main Signal Off Sub Signal On**: Trigger Loop O/P(mV)*: MJ	TSS: Main Signal On Sub Signal On**: LED' s #	TSS: Main Signal On Sub Signal On**: Arming Loop f. (kHz)	TSS: Main Signal On Sub Signal On**: Arming Loop O/P(mV)*: CJ	TSS: Main Signal On Sub Signal On**: Arming Loop O/P(mV)*: MJ	TSS: Main Signal On Sub Signal On**: Trigger Loop f. (kHz)	TSS: Main Signal On Sub Signal On**: Trigger Loop O/P(mV)*: CJ	TSS: Main Signal On Sub Signal On**: Trigger Loop O/P(mV)*: MJ	OSS: Arming to Trigger loop(± 0.5m) #	OSS: Trigger Loop to Signal (± 25m)	OSS: Loop Centre Line in Spec #: Arm	OSS: Loop Centre Line in Spec #: Trig	OSS: Loop Height #: Arming	OSS: Loop Height #: Trigger	OSS: Main Signal Off Sub Signal On**: LED' s #	OSS: Main Signal Off Sub Signal On**: Arming Loop O/P (mV): CJ	OSS: Main Signal Off Sub Signal On**: Arming Loop O/P (mV): MJ	OSS: Main Signal Off Sub Signal On**: Trigger Loop O/P (mV): CJ	OSS: Main Signal Off Sub Signal On**: Trigger Loop O/P (mV): MJ
1																												
2																												
3																												
4																												
5																												

Number	OSS: Main Signal On Sub Signal On**: LED' s #	OSS: Main Signal On Sub Signal On**: Arming Loop f. (kHz)	OSS: Main Signal On Sub Signal On**: Arming Loop O/P(mV): CJ	OSS: Main Signal On Sub Signal On**: Arming Loop O/P(mV): MJ	OSS: Main Signal On Sub Signal On**: Trigger Loop f. (kHz)	OSS: Main Signal On Sub Signal On**: Trigger Loop O/P(mV): CJ	OSS: Main Signal On Sub Signal On**: Trigger Loop O/P(mV): MJ	Location Equipment: Modules Voltage Inputs (V): SIM	Location Equipment: Modules Voltage Inputs (V): Main Sig	Location Equipment: Modules Voltage Inputs (V): Sub Sig Supp **	Location Equipment: Module Voltage Outputs (V): TSS Arming Loop (V)	Location Equipment: Module Voltage Outputs (V): TSS Trigger Loop (V)	Location Equipment: Module Voltage Outputs (V): OSS Arming Loop (V)	Location Equipment: Module Voltage Outputs (V): OSS Trigger Loop (V)	S/Box Equipment** Module Voltage Outputs (V): LED' s #	S/Box Equipment** Module Voltage Outputs (V): BN12 (V)	Meter Identity	Test Aerial Identity	Technicians / Supervisors Name	Company	Date
1																					
2																					
3																					
4																					
5																					

* CJ: Commissioning Jig used / MJ: Maintenance Jig Used (Fill in voltages in the appropriate column for the type of jig used) ** If fitted to the installation # Insert tick if correct
Frequencies to be entered to five digit resolution. All voltages to one tenth of a volt / millivolt as applicable. Trigger loops always 65.x50 kHz. Loop frequencies max deviation + or - 0.010kHz.

Network Rail	**TPWS Test: Equipment Associated with Signals** **Record Card (Rear)** **NR/SMS/TP11-Test/025**	**Form: NR/SMS/TP11/T25/RC/01** **Date: December 2009** **Issue: 02**

Transmitter Loops and Module Indications

Number	TSS: Centre Point to Signal (± 0.1m) #	TSS: Loop Centre Line in Spec # – Arm	TSS: Loop Centre Line in Spec # – Trig	TSS: Loop Height # – Arming	TSS: Loop Height # – Trigger	TSS: Main Signal Off Sub Signal On** – LED' s #	TSS: Main Signal Off Sub Signal On** – Arming Loop O/P(mV)* CJ	TSS: Main Signal Off Sub Signal On** – Arming Loop O/P(mV)* MJ	TSS: Main Signal Off Sub Signal On** – Trigger Loop O/P(mV)* CJ	TSS: Main Signal Off Sub Signal On** – Trigger Loop O/P(mV)* MJ	TSS: Main Signal On Sub Signal On** – LED' s #	TSS: Main Signal On Sub Signal On** – Arming Loop f. (kHz)	TSS: Main Signal On Sub Signal On** – Arming Loop O/P(mV)* CJ	TSS: Main Signal On Sub Signal On** – Arming Loop O/P(mV)* MJ	TSS: Main Signal On Sub Signal On** – Trigger Loop f. (kHz)	TSS: Main Signal On Sub Signal On** – Trigger Loop O/P(mV)* CJ	TSS: Main Signal On Sub Signal On** – Trigger Loop O/P(mV)* MJ	OSS: Arming to Trigger loop(± 0.5m) #	OSS: Trigger Loop to Signal (± 25m)	OSS: Loop Centre Line in Spec # – Arm	OSS: Loop Centre Line in Spec # – Trig	OSS: Loop Height # – Arming	OSS: Loop Height # – Trigger	OSS: Main Signal Off Sub Signal On** – LED' s #	OSS: Main Signal Off Sub Signal On** – Arming Loop O/P (mV) CJ	OSS: Main Signal Off Sub Signal On** – Arming Loop O/P (mV) MJ	OSS: Main Signal Off Sub Signal On** – Trigger Loop O/P (mV) CJ	OSS: Main Signal Off Sub Signal On** – Trigger Loop O/P (mV) MJ
6																												
7																												
8																												
9																												
10																												
11																												

Number	Over Speed Sensor (OSS) Main Signal On Sub Signal On** – LED' s #	OSS – Arming Loop f. (kHz)	OSS – Arming Loop O/P(mV) CJ	OSS – Arming Loop O/P(mV) MJ	OSS – Trigger Loop f. (kHz)	OSS – Trigger Loop O/P(mV) CJ	OSS – Trigger Loop O/P(mV) MJ	Location Equipment – Modules Voltage Inputs (V) – SIM	Modules Voltage Inputs (V) – Main Sig	Modules Voltage Inputs (V) – Sub Sig Supp **	Module Voltage Outputs (V) – TSS Arming Loop (V)	Module Voltage Outputs (V) – TSS Trigger Loop (V)	Module Voltage Outputs (V) – OSS Arming Loop (V)	Module Voltage Outputs (V) – OSS Trigger Loop (V)	S/Box Equipment** Failure Indication Unit (FIU) – LED' s #	S/Box Equipment** Failure Indication Unit (FIU) – BN12 (V)	Meter Identity	Test Aerial Identity	Technicians/ Supervisors Name	Company	Date
6																					
7																					
8																					
9																					
10																					
11																					

* CJ: Commissioning Jig used / MJ: Maintenance Jig Used (Fill in voltages in the appropriate column for the type of jig used) ** If fitted to the installation # Insert tick if correct

Frequencies to be entered to five digit resolution. All voltages to one tenth of a volt / millivolt as applicable. Trigger loops always 65.x50 kHz. Loop frequencies max deviation + or - 0.010kHz.

Network Rail	TPWS Test: Equipment Associated with PSR's & Buffer Stops Record Card (Front) **NR/SMS/TP11-Test/025**	**Form: NR/SMS/TP11/T025/RC/02** **Date: August 2004** **Issue: 01**

Signal Box / Interlocking:	TPWS Identity	Normal / Opposite Direction *Delete as appropriate*

Transmitter Loops and Module Indications													Location Equipment			S/Box Equipment**		Meter Identity	Test Aerial Identity	Technicians SSM Name	Company	Date
Over Speed Sensor (OSS)													Module Voltage Inputs	Module Voltage Outputs (V)		Failure Indication Unit (FIU)*						
Arming to Trigger loop(± 0.5m) #	Trigger Loop to Board/Buffers (±0.5m) #	Loop Centre Line in Spec #		Loop Height #		Loops Energised																
							Arming Loop			Trigger Loop												
		Arming	Trigger	Arming	Trigger	LED's #	f.3 (kHz)	O/P(mV)*		f.2 (kHz)	O/P(mV)*		To SIM	To Arming Loop	To Trigger Loop	LED's #	BN12 (V)					
								CJ	MJ		CJ	MJ										

* CJ: Commissioning Jig Used / MJ: Maintenance Jig Used (Fill in voltages in the appropriate column for the type of jig used) ** If fitted to the installation # Insert 4if correct

Network Rail

TPWS Test: Equipment Associated with PSR's & Buffer Stops
Record Card (Rear)
NR/SMS/TP11-Test/025

Form: NR/SMS/TP11/T025/RC/02
Date: August 2004
Issue: 01

Transmitter Loops and Module Indications														Location Equipment			S/Box Equipment**		Meter Identity	Test Aerial Identity	Technicians SSM Name	Company	Date
Over Speed Sensor (OSS)														Module Voltage Inputs	Module Voltage Outputs (V)		Failure Indication Unit (FIU)*						
Arming to Trigger loop(±0.5m) #	Trigger Loop to Board/Buffers (±25m) #	Loop Centre Line in Spec #		Loop Height #		Loops Energised																	
						LED's #	Arming Loop			Trigger Loop													
							f.3 (kHz)	O/P(mV)*		f.2 (kHz)	O/P(mV)*												
		Arming	Trigger	Arming	Trigger			CJ	MJ		CJ	MJ		To SIM	To Arming Loop	To Trigger Loop	LED's #	BN12 (V)					

* CJ: Commissioning Jig Used / MJ: Maintenance Jig Used (Fill in voltages in the appropriate column for the type of jig used) ** If fitted to the installation # Insert tick if correct

Network Rail	**TPWS Test: Self Powered OSS (SPOSS)** **Record Card (Front)** **NR/SMS/TP11-Test/025**	**Form: NR/SMS/TP11/T025/RC03** **Date: August 2004** **Issue: 01**

Signal Box / Interlocking:		TPWS Identity / PSR Identity-Name:
Distance from Treadle Arm to Arming Loop (± 0.5m):	Distance from Arming to Trigger Loop (± 0.5m):	Distance from Trigger Loop to PSR (± 25m):
Height of Arming Loop Below Rail Level (60-100mm):		Height of Trigger Loop Below Rail Level (60-100mm):

Transmitter Loops												Location Equipment							Technicians SSM Name	Company	Date
Over Speed Sensor (OSS)																					
Arming to Trigger loop(± 0.5m) #	Trigger Loop to Board l(±25m) #	Loop Centre Line in Spec #		Loop Height #		Loops Energised						Indication Fault	Arming Loop Fault	Trigger Loop Fault	Battery Fault (Batt 1)	Battery Fault (Batt 2)	Treadle Checked	Battery Changed			
						Arming Loop			Trigger Loop												
		Arming	Trigger	Arming	Trigger	f.3(kHz)	O/P(mV)*		f.2(kHz)	O/P(mV)*											
							CJ	MJ		CJ	MJ										
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			

* CJ: Commissioning Jig Used / MJ: Maintenance Jig Used (Fill in voltages in the appropriate column for the type of jig used) # Insert tick if correct

Network Rail	**TPWS Test: Self Powered OSS (SPOSS)** **Record Card (Rear)** **NR/SMS/TP11-Test/025**	**Form: NR/SMS/TP11/T025/RC/03** **Date: August 2004** **Issue: 01**

Transmitter Loops												Location Equipment							Technicians SSM Name	Company	Date
Over Speed Sensor (OSS)												Indication Fault	Arming Loop Fault	Trigger Loop Fault	Battery Fault (Batt 1)	Battery Fault (Batt 2)	Treadle Checked	Battery Changed			
Arming to Trigger loop(± 0.5m) #	Trigger Loop to Board (±25m) #	Loop Centre Line in Spec #		Loop Height #		Loops Energised															
						Arming Loop			Trigger Loop												
		Arming	Trigger	Arming	Trigger	f.3(kHz)	O/P(mV)*		f.2(kHz)	O/P(mV)*											
							CJ	MJ		CJ	MJ										
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			
												Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N			

* CJ: Commissioning Jig Used / MJ: Maintenance Jig Used (Fill in voltages in the appropriate column for the type of jig used) ** If fitted to the installation # Insert tick if correct

Network Rail	**TPWS Test: OSS+ Loops at TPWS+ Installations** **Record Card (Front)** **NR/SMS/TP11/Test 025**	**Form: NR/SMS/TP11/T025/RC04** **Date: 07/03/2020** **Issue: 02**

Signal Box / Interlocking:	TPWS Identity	Normal / Opposite Direction *Delete as appropriate*

Transmitter Loops and Module Indications													Location Equipment			S/Box Equipment**		Meter Identity	Test Aerial Identity	Technicians SSM Name	Company	Date
Over Speed Sensor (OSS+)													Module Voltage Inputs	Module Voltage Outputs (V)		Failure Indication Unit (FIU)*						
Arming to Trigger loop(± 0.5m) #	Trigger Loop to Board/Buffers (±0.25m) #	Loop Centre Line in Spec #		Loop Height #		Loops Energised																
						LED's #	Arming Loop			Trigger Loop												
							f.3 (kHz)	O/P(mV)*		f.2 (kHz)	O/P(mV)*											
		Arming	Trigger	Arming	Trigger			CJ	MJ		CJ	MJ	To SIM	To Arming Loop	To Trigger Loop	LED's #	BN12 (V)					

* CJ: Commissioning Jig Used / MJ: Maintenance Jig Used (Fill in voltages in the appropriate column for the type of jig used) ** If fitted to the installation # Insert tick if correct

Network Rail	**TPWS Test: OSS+ Loops at TPWS+ Installations** **Record Card (Rear)** **NR/SMS/TP11/Test 025**	**Form: NR/SMS/TP11/T025/RC/04** **Date: 07/03/2020** **Issue: 02**

Transmitter Loops and Module Indications													Location Equipment			S/Box Equipment**		Meter Identity	Test Aerial Identity	Technicians SSM Name	Company	Date
Over Speed Sensor (OSS+)													Module Voltage Inputs	Module Voltage Outputs (V)		Failure Indication Unit (FIU)*						
Arming to Trigger loop(± 0.5m) #	Trigger Loop to Board/Buffers (±25m) #	Loop Centre Line in Spec #		Loop Height #		Loops Energised																
							Arming Loop			Trigger Loop												
							f.3 (kHz)	O/P(mV)*		f.2 (kHz)	O/P(mV)*											
		Arming	Trigger	Arming	Trigger	LED's #		CJ	MJ		CJ	MJ	To SIM	To Arming Loop	To Trigger Loop	LED's #	BN12 (V)					

* CJ: Commissioning Jig Used / MJ: Maintenance Jig Used (Fill in voltages in the appropriate column for the type of jig used)   ** If fitted to the installation   # Insert tick if correct

Network Rail	**Indusi Trainstops: Magnetic Trainstop (Associated with Stop Signals) Record Card (Front)** **NR/SMS/TS20**	**Form: NR/SMS/TS20/RC/01** **Date: December 2009** **Issue: 01**

Signal / Indusi Magnet Name / Number:

Magnet Position (mm)		Magnet Current (Strom) Readings (mA)				Comments	Trainstop Magnet Tester Identity	Signature	Name & Company	Date
Rail edge to centre of magnet	Top of Magnet to Crest of Rail	Signal at Stop (2000Hz)		Signal at Proceed (1000Hz)						
		1000Hz	2000Hz	2000Hz	1000Hz					

Network Rail	**Indusi Trainstops: Magnetic Trainstop (Associated with Stop Signals)** **Record Card (Rear)** **NR/SMS/TS20**	**Form: NR/SMS/TS20/RC/01** **Date: December 2009** **Issue: 01**

Magnet Position (mm)		Magnet Current (Strom) Readings (mA)				Comments	Trainstop Magnet Tester Identity	Signature	Name & Company	Date
Rail edge to centre of magnet	Top of Magnet to Crest of Rail	Signal at Stop (2000Hz)		Signal at Proceed (1000Hz)						
		1000Hz	2000Hz	2000Hz	1000Hz					

	Indusi Trainstops: Magnetic Trainstop (Associated with Speed Control) Record Card (Front) **NR/SMS/TS20**	**Form: NR/SMS/TS20/RC/02** **Date: December 2009** **Issue: 01**

Indusi Magnet Name / Number:	Indusi Speed Control Time (secs):

Magnet Position (mm)		Time (secs)	Magnet Current (Strom) Readings (mA)				Comments	Trainstop Magnet Tester Identity	Signature	Name & Company	Date
Rail edge to centre of magnet	Top of Magnet to Crest of Rail	Treadle Operation to Magnet Change of State	Speed Control Active (2000Hz)		Speed Control Inactive (1000Hz)						
			1000Hz	2000Hz	2000Hz	1000Hz					

Network Rail

Indusi Trainstops: Magnetic Trainstop (Associated with Speed Control) Record Card (Rear)
NR/SMS/TS20

Form: NR/SMS/TS20/RC/02
Date: December 2009
Issue: 01

Magnet Position (mm)		Time (secs)	Magnet Current (Strom) Readings (mA)				Comments	Trainstop Magnet Tester Identity	Signature	Name & Company	Date
Rail edge to centre of magnet	Top of Magnet to Crest of Rail	Treadle Operation to Magnet Change of State	Speed Control Active (2000Hz)		Speed Control Inactive (1000Hz)						
			1000Hz	2000Hz	2000Hz	1000Hz					

NetworkRail	**Train Stop – Manchester Metro** Maintenance Record Card	**Form: NR/SMS/TS22/Trainstop MM** **Date: March 2018** **Issue: 01**

Location Case:	Beacon Number:	Beacon Serial Number:

Date	Name	Company	Signature	Meter Identity	Beacon Secure (Tick)	Beacon Volts (DC)	Beacon Current (DC mA)	Comments

INDEX

END

Includes:	Signalling cables carried on telegraph wires
Excludes:	All other types of signalling cable

GENERAL

Refer to NR/L3/MTC/RSC0216/GH04 – Working at Height and NR/GI/U002 (inspection and Safety of Tools, Plant and Protective Equipment).

Do not climb a telegraph pole without first confirming that it will not break away at a decayed section. Soundness test is outlined in SERVICE A.

Defective poles, arms, steps, stays, braces and combiners might be the cause of serious accidents. Report any safety defects to your SM(S) Immediately.

Carefully maintained safety belts and hard hats shall be used whenever overhead pole work is undertaken. They are to be stored away from edge tools and acid. Do not store items in excessively hot or damp conditions.

SERVICE A

1.1 Record time and date of survey

1.2 Check Pole identification plate. Remove or report any encroaching vegetation (Enter S - scrub, T - trees, O - outside fence, R - danger to the overhead line)

1.3 Check the number of Stays is correct and record the condition (D - Defective, G - Sound, S - Slack, T- Tight). The stay wire where it is taken round the pole and the stay adjuster and screw may be served with bituminous compound to prevent corrosion.

1.4 Check all four stay wires in good condition are present on poles designated to have them. Generally present in 1 in every 10 poles etc.

1.5 Strike the pole with a hammer near the ground to make sure of its soundness (Ringing sound desired as opposed to a dull thud). Insert a sharp object at just below ground level to check there is no obvious decay. Poles are to be listed for renewal only after probing has shown that more than 25% of cross-section is rotten (at any point throughout its length).

1.6 Check and record the condition of the insulators/ cups (S – Satisfactory; U – Unsatisfactory and require replacement).

1.7 Check and record the condition of the stay rods (S – Satisfactory; U – Unsatisfactory and require replacement).

1.8 Check and record the condition of the binders (S – Satisfactory; U – unsatisfactory and require replacement).

1.9 Check and record the number and condition of arms (S – Satisfactory; U – unsatisfactory and require replacement). Pole arms to be wedged level as necessary.

1.10 Check and record the condition of the regulation (S – Satisfactory; U – unsatisfactory i.e.1 or more wires slack).

1.11 Check and record the condition of the loops (T- Transposition, J – Tap, E – Termination, RW – Redundant Wires, L – Defective, D – Dry Joint).

1.12 Record the estimated height of line wires when crossing the rail (minimum 6.1m) and public roads (minimum 6.7m). Record overall classification: (1 – Good, 2 – Fair, minimum non-critical defects only, 3 – Poor, significant defects requiring prompt attention, 4 – Major defect, broken pole, wire down etc).

APPENDIX A - Record Card

Location:		Date & time of inspection:	
Pole Identification :		Estimated height of wire:	
Component	**Condition**	**Component**	**Condition/ Number**
Cups		Regulation	
Binders		Loops	
Rods		Vegetation	
Arms		Arms Number	
Stays		Stays Number	
Pole Classification And comments:			
Inspectors Name:		Inspectors Signature:	

Figure 1 – Record Card

APPENDIX B - Pole Diagram

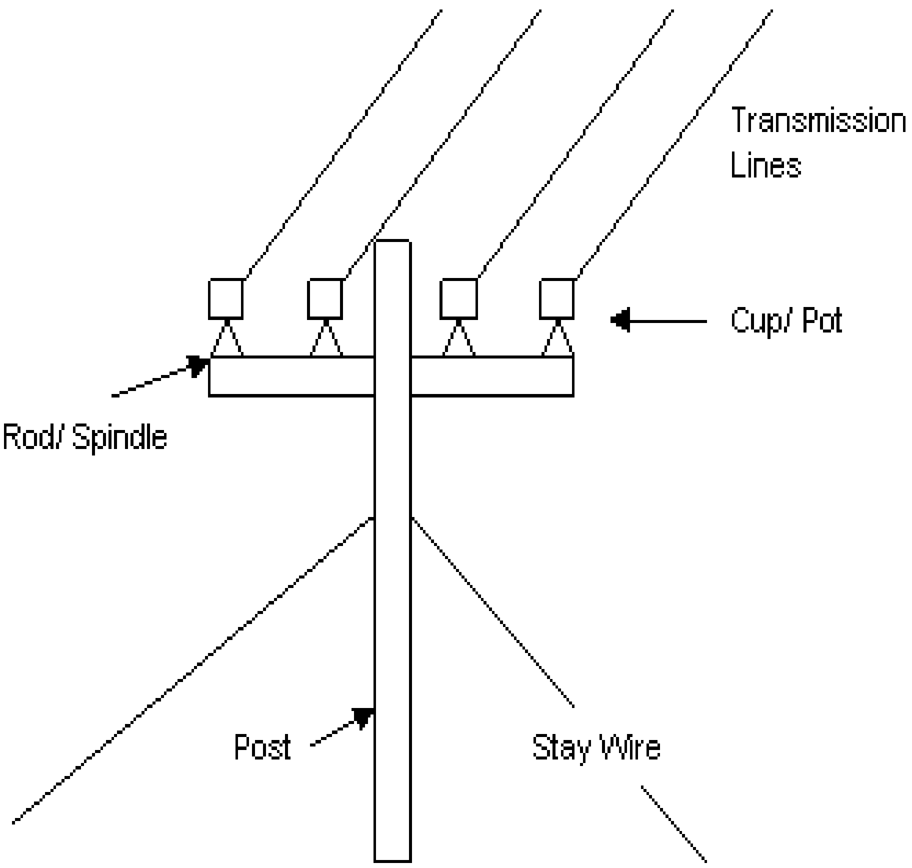


Figure 2 – Pole Diagram

END

Commonly Used Abbreviations

Abbreviation	Meaning
BER	Bit Error Rate
CDR	Cab Display Radio
MSS	Maintenance Support System
FNL	Far North Line
RETB	Radio Electronic Token Block
RSS	Received Signal Strength
SSI	Solid State Interlocking
TTU	Transportable Token Unit
VDU	Visual Display Unit
VSWR	Voltage Standing Wave Ratio
WHL	West Highland Line

General Overview of RETB

The Radio Electronic Token Block (RETB) system is a variant of Solid State Interlocking (SSI). It was devolved principally for single lines in rural areas of the UK to replace conventional token block working.

Each train operating over the single line is equipped with a Cab Display Radio (CDR) with a unique identity and a speech and data radio transmitter/receiver. At the start of the single line the driver calls the controlling signal box for authority to enter the section. If the line is clear the signaller at the signal box will (via an SSI interlocking) transmit a coded 'electronic token' data message that will be received by the train and shown as authority to proceed on the CDR. The driver will then call the signal box for confirmation to proceed.

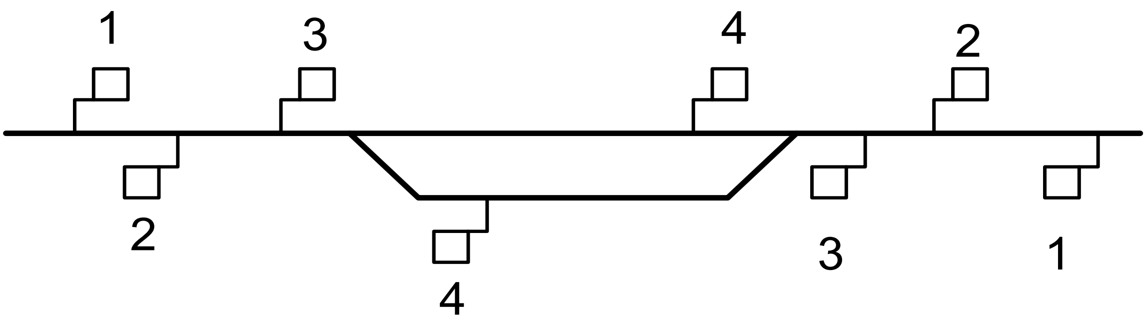
Once in the single line section the driver will advise the signaller that the train has cleared the loop track (a marker board is provided for assistance with this). At the end of the single line section the driver will call the signal box to offer back the 'electronic token'. A radio data 'handshake' procedure between the CDR and SSI then confirms that the token is safely removed from the CDR and restored to the SSI and the section released.

The signaller is equipped with a SSI controlled radio system which allocates the coded 'electronic tokens' to each section and prevents more than one token being issued for an occupied section.

The RETB Next Generation radio system has been configured as an auto-tuning system. This requires the CDR or TTU to be registered onto the radio network for the appropriate signaller. Once registered with the network the CDR or TTU will automatically tune to the strongest appropriate transmitter.

Note: The Hand portable units are not capable of auto-tuning and the appropriate radio channel must be manually selected.

Figures 1, 2 and 3 provide further system details.



1. Distant Board & AWS Magnet
2. Loop Clear Board
3. Points Indicator
4. Stop Board

Figure 1 - Block layout of Signalling on a Typical RETB Equipped Single Line & Passing Loop

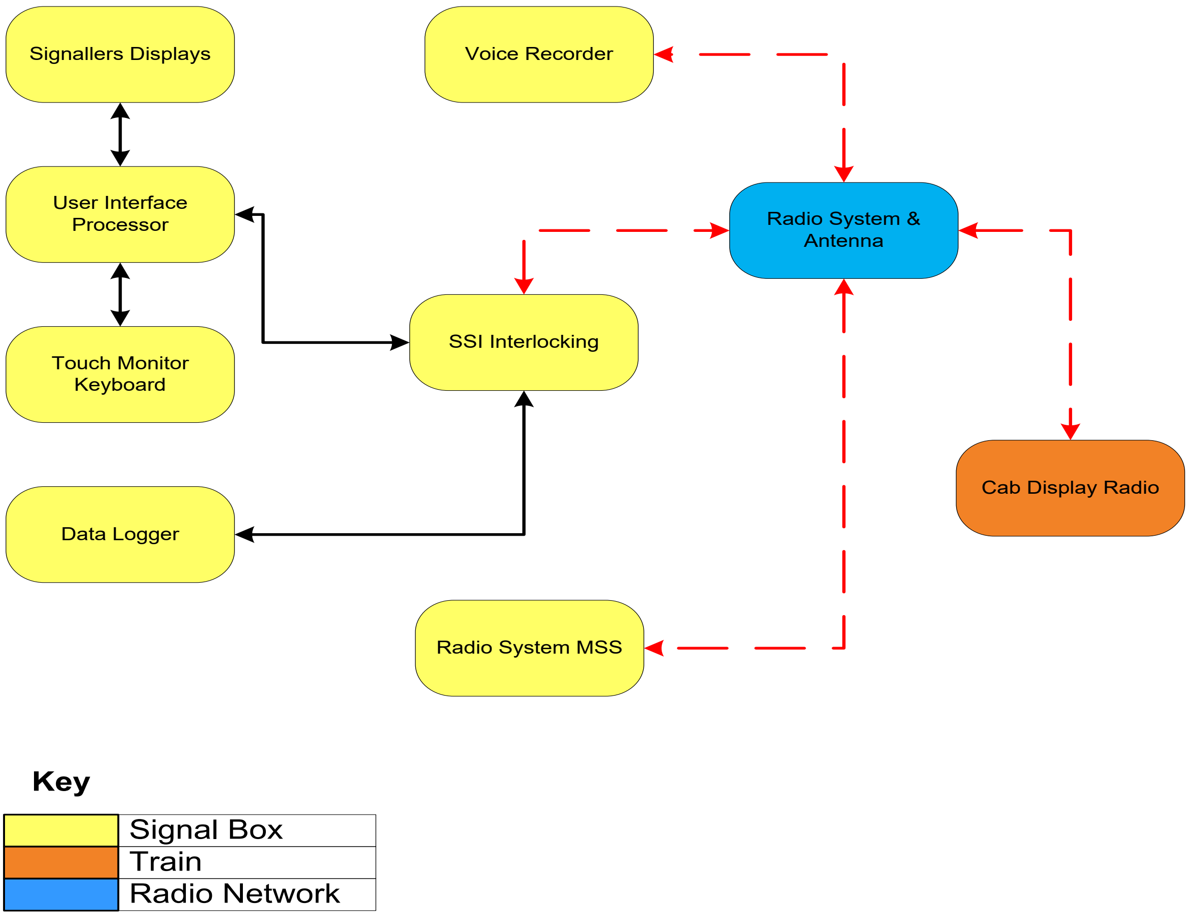


Figure 2 - Block Layout of an Mk.2 RETB System

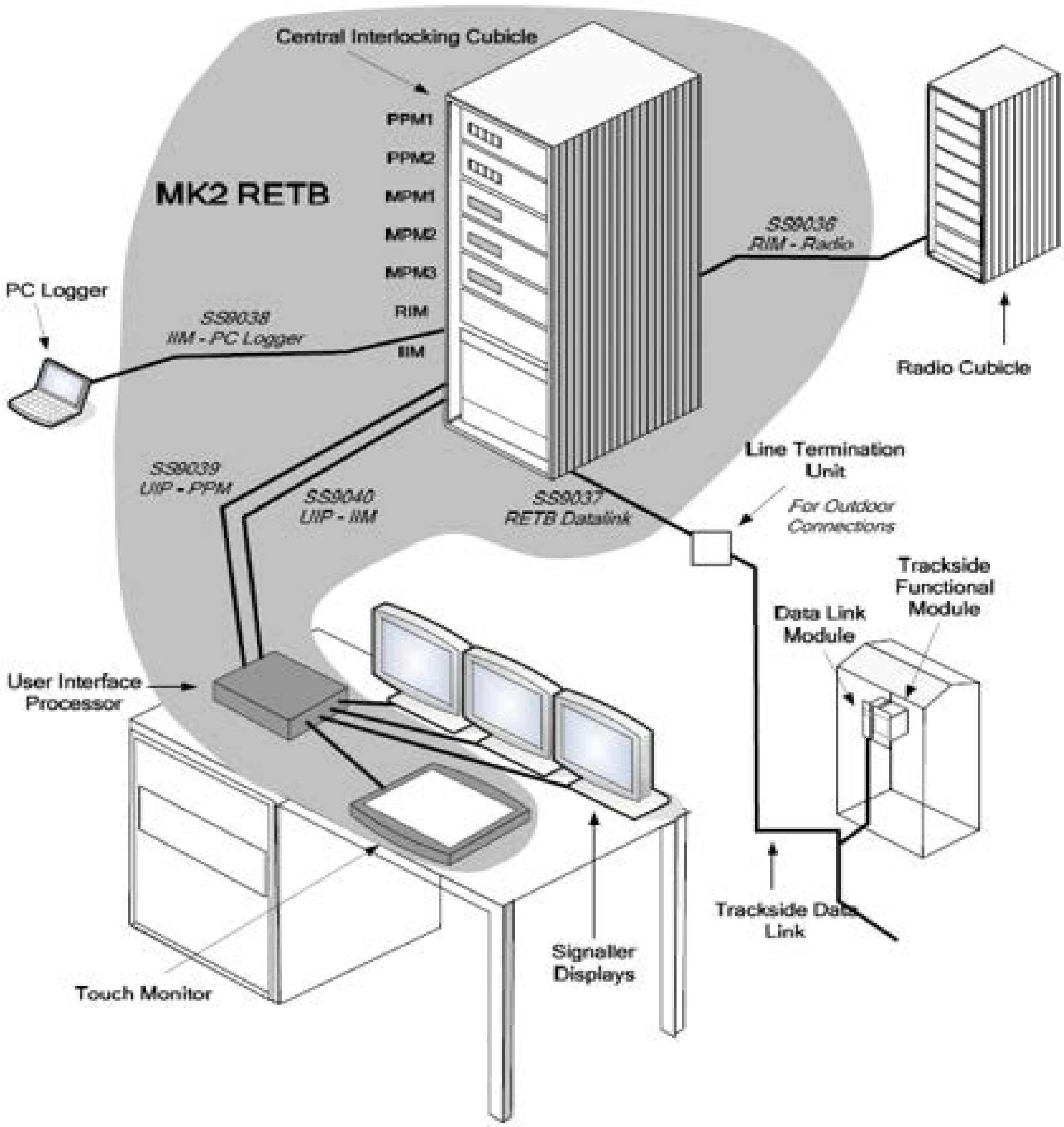


Figure 3 - Pictorial Representation of Mk.2 RETB Signal Box Equipment

END

General

See Appendix A for typical system diagram.

See Appendix B for PC-VDU installation and setup.

REGULAR TASK

1 Data Logger

1.1 Check the PC is logging the token issue/receipt correctly.

2 Display PC's & VDU's

2.1 Check all plug couplers are tight and fixing screws secure.

2.2 Check that PCs are adequately ventilated and there is no build-up of heat.

2.3 Clean and dust all surfaces on the PCs, monitors and desks including all leads and plugs.

2.4 Check the filter at the rear of the PC is free from dust, use vacuum cleaner as required.

2.5 Clean all VDU screens and housings with a proprietary anti-static dry screen cleaner.

2.6 Clean any housing containing PCs associated with driving the VDU equipment.

3 Signallers Audio Console

3.1 Examine Audio Console for alarms and fault reports and liaise with Network Rail control if action is required.

3.2 Carry out NR/SMS/PartB/Test 063 (Section 1 - Signallers Control Console checks).

3.3 Carry out NR/SMS/PartB/Test 063 (Section 2 - 2-Wire Dial-Up Interfaces checks).

4 Radio Rack

4.1 Monitor System operation including observation of LEDs on channel cards for normal operation.

4.2 Carry out NR/SMS/PartB/Test 063 (Section 5 - System Current issues checks).

4.3 Review MSS data download to confirm that downloads are being received.

SERVICE A

5 Radio Rack

5.1 Carry out NR/SMS/PartB/Test 063 (Section 3 - Basic Radio Rack checks).

5.2 Carry out NR/SMS/PartB/Test 063 (Section 4 - Extended Radio Rack checks).

5.3 Carry out NR/SMS/PartB/Test 063 (Section 6 - Network Data Integrity Test) to check the data (token) performance of the RETB radio network.

6 SSI Interlocking

6.1 Dust the equipment and clean the cubicle. Check the area around the cubicle is clean and tidy.

6.2 Examine the equipment, terminals, cable and cable connectors. Particularly look for physical damage, overheating and arcing.

6.3 On the MPM and PPM, check that the memory modules are securely fitted and sealed. Observe the following indications on these units, the IIM and RIM are illuminated and showing a steady light:

- Front Panel
- All System Indicators.
- Rear Panel
- Power;
- Fused Supply (MPM Only);
- System.

All indicators are red.

6.4 Where a DLM is fitted, observe that the red power indicator is illuminated and showing steady light.

Note in the site logbook any indicators that are not illuminated and report them to the SM(S).

APPENDIX A – TYPICAL SYSTEM DIAGRAM

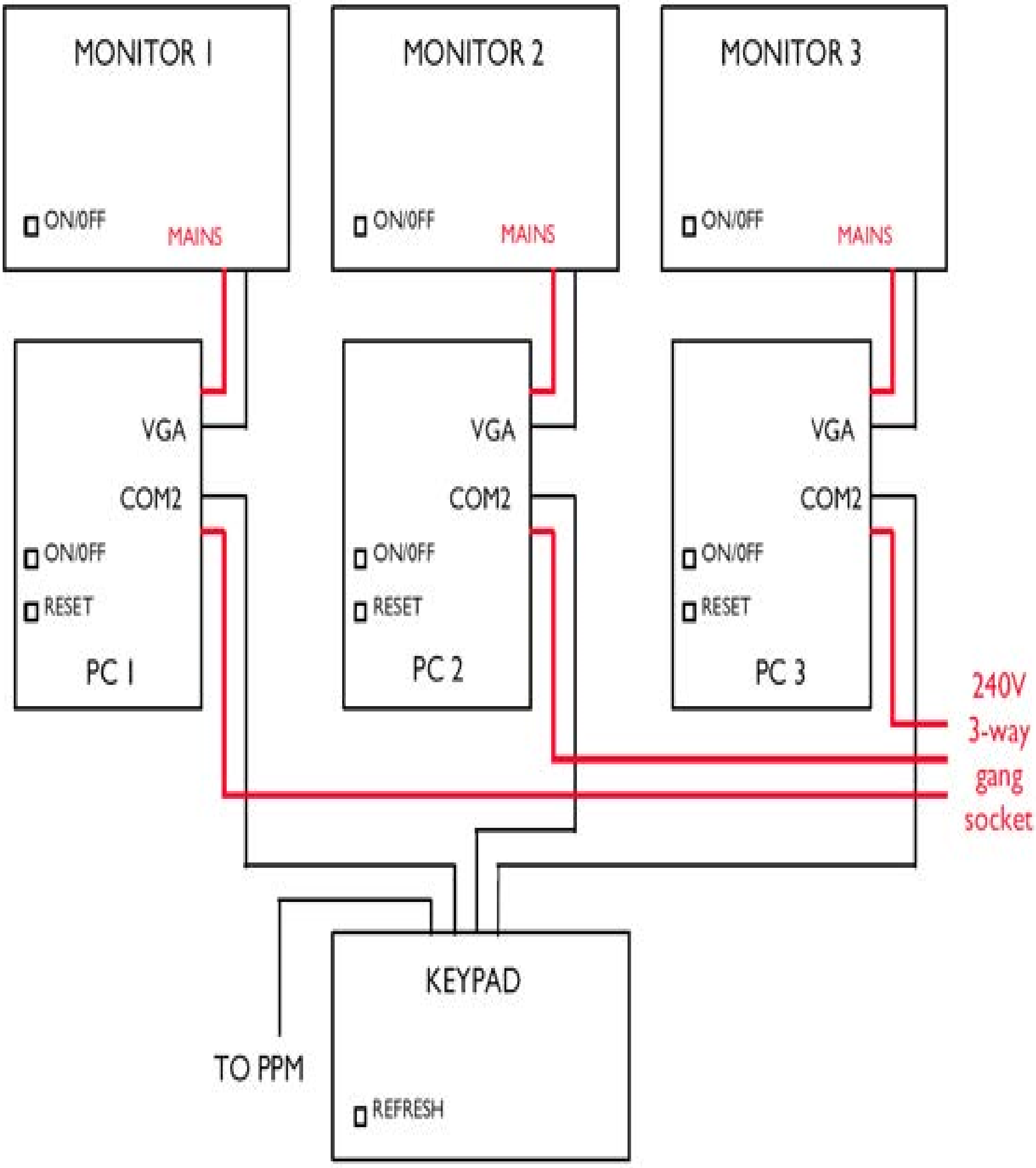


FIGURE 1 – tYPICAL SYSTEM DIAGRAM

APPENDIX B – PC-VDU installation and set up

Part 1: Install the PC-VDU Software

a) Use spare monitor if monitor is remote from PC.

b) Check “qwerty” keyboard is connected.

c) Turn on the PC.

d) When the C:\> prompt appears, fully insert the 3.5 inch floppy disk containing the program ET030-A3 into the floppy disk drive of the PC.

e) Change to the A drive by typing **a:** <return> on the PC “qwerty” keyboard.

f) Type **install** <return> at the PC “qwerty” keyboard. This can cause the RETB VDU program to be permanently installed on the hard disc.

g) Remove the 3.5 inch floppy disk and store in a safe place.

h) Switch off the PC.

i) Remove the PC “qwerty” keyboard.

j) Switch on the PC and check that the RETB program initialises with a title box and the correct program and version number, followed by a blank screen with a flashing cursor in the top left position of the screen. Note the program will not give a track display without connection to an RETB interlocking.

k) If the screen displays “keyboard error” the BIOS is not set up correctly and assistance should be sought.

l) Switch off the PC.

m) Label the PC with the following configuration control information: Site, ET 030-version A3, installed date, installed by.

Part 2: Check PC is set up correctly

a) Check "qwerty" keyboard is NOT connected.

b) Switch on the PC.

c) Check that the RETB program initialises with a title box and the correct program and version number, followed by a blank screen with a flashing cursor in the top left position of the screen. Note the program will not give a track display without

d) Connection to an RETB interlocking.

e) Leave the PC switched on for at least one hour and check that the monitor has not gone into "standby" mode (if so, the screen will be completely blank and the power indicator can be orange instead of green).

f) If possible, leave the PC switched on for a further 23 hours.

g) If the PC goes into standby mode the BIOS is not set up correctly and assistance should be sought.

PC BIOS set up

a) Set BIOS such that the PC can operate without a keyboard attached.

b) Set BIOS such that the PC power management is disabled (i.e. monitor does not turn off after a time).

END

General

More information on mast inspections and maintenance of antenna systems and feeders can be found in NR/L2/TEL/30088.

SERVICE A

Minimum equipment required:

- TTU
- Multimeter
- Engineering Terminal laptop & cables.

1 Control Rack Fixed Station Checks

1.1 Review any reported problems associated with the site (e.g. trouble accessing local cell).

1.2 Review site alarm activity reported by the MSS.

1.3 For sites with a 4-wire interface, carry out NR/SMS/PartB/Test 066 (Section 1 - 4-Wire Line Level Check). Note any gain adjustments that are required (to be performed on site).

1.4 For sites with a 2-wire dial-up interface, carry out NR/SMS/PartB/Test 066 (Section 2 – 2-Wire Dial-up Line Level Check). Note any gain adjustments that are required (to be performed on site).

1.5 Use the MSS graphing and reporting tools and carry out NR/SMS/PartB/Test 066 (Section 3 -Site Interface and Section 4 Radio Parameter Checks) over the maintenance period.

2 Site Radio & Fixed Site Interface Equipment

2.1 Carry out NR/SMS/PartB/Test 066 (Section 5 - On-site Installation Checks) Report any deficiencies to your SM(S).

2.2 Carry out NR/SMS/PartB/Test 066 (Section 6 - FSI LED Check).

2.3 At sites with a 2 or 4 wire interface, and only when indicated required by pre-visit tests, carry out NR/SMS/PartB/Test 066 (Section 7 - FSI Line Level Adjustment).

2.4 Carry out NR/SMS/PartB/Test 066 (Section 8 - Radio Tests – Reported Parameters) and observe installation for “normal” operation. Use system traffic instead of “Tx Key” for keying the transceiver.

Antenna Systems

2.5 Carry out NR/SMS/PartB/Test 065.

3 Fixed Station Power Supply

3.1 Visually inspect the battery/batteries for signs of swelling or leakage. Replace if damaged.

3.2 Carry out NR/SMS/PartB/Test 064 (Section 2 - PSU in-service health indication Check).

3.3 Carry out NR/SMS/PartB/Test 064 (Section 3 - Basic Check the PSU Output and Alarm Check). This generates an alarm and therefore this test should only be carried out with the co-operation of the signaller.

3.4 Where issues were identified in pre-visit checks, perform relevant fault diagnostics on the site equipment.

Refer to the Fixed Site Equipment Maintenance Manual doc ref: CDL P1062-MAN-001.

4 Final Checks

4.1 Obtain a Test Token and check that the TTU has registered on the appropriate Cell transmitter.

4.2 Use the FSI loudspeaker to monitor calls coming through the site. Listen for clear audio and tokens. Reduce the speaker volume before leaving the site.

SERVICE B

Minimum equipment required:

- Multimeter
- TTU
- RF power meter
- Battery tester (e.g. Hioki 3554)
- Engineering Terminal laptop & cables

These tests are intrusive or disruptive to network operation and should only be carried out with the co-operation of the signaller.

5 Fixed Station Radio & Site Interface Equipment

5.1 Using the Engineering Terminal, carry out NR/SMS/PartB/Test 066 (Section 8 - Radio Tests – Reported Parameters) and check the off-key (idle) and on-key (keyed) supply voltage and current reported by each radio.

5.2 For each radio fitted, carry out NR/SMS/PartB/Test 066 (Section 9 - Radio Test – TX Output Power).

5.3 Carry out NR/SMS/PartB/Test 066 (Section 10 - Radio Tests – Received Signal Strength) for each radio fitted.

This does not apply to local Cell radios.

5.4 Carry out NR/SMS/PartB/Test 066 (Section 10 - Radio Tests – Received Signal Strength) at Neighbour Sites for each radio fitted.

This does not apply to local Cell radios.

6 Antenna Systems

6.1 Carry out NR/SMS/PartB/Test 065 (Section 2 - Antenna VSWR Measurements).

7 Fixed Station Power Supply

7.1 Carry out NR/SMS/PartB/Test 064 (Sections 4 or 5 - Battery Tests) applicable to the PSU capacity.

7.2 Carry out NR/SMS/PartB/Test 064 (Sections 6 - Battery Charger Test).

8 Final Checks

8.1 Carry out engineering test token returns through the fixed Station using a TTU and observe correct functionality of Radio System.

END

Includes:	Lineside Telephones such as, Signal Post Telephones, Crossing Telephones, Point Zone Telephones. Operational building telephones, including, signal boxes (Magneto telephones only), token huts, GF huts and shunters cabins etc.
Excludes:	Phones located in the following places: • Non-operational rooms situated in operational buildings. • PETS units in Signalling/Operating Centres. • Lineside plug points and telephones connected to Tunnel Emergency Communication Systems. • GSM/GSM-R Crossing Phones. • GSM-R HMI's. • Concentrator HMI's.

GENERAL

This document is based on the requirements of NR/L3/TEL/30181/011. It should be noted that it is not a copy and some elements might differ.

Because all types of Operational phones are cover by this single SMS the user should identify the correct service from the list below and carry out only the required service:

- Appendix B - Maintenance of CB Type Telephones (Including VoIP ringdown).
- Appendix C - Maintenance of MAG/LB Type Telephones.
- Appendix D - Maintenance of Auto Type Telephones (Including VoIP keypad type).
- Appendix E - Maintenance of Autodial Type Telephones (including VOIP).
- Appendix F - Maintenance of PETS/KETS Type Telephones.

Appendix B - Maintenance of CB Type Telephones (Including VoIP ringdown)

SERVICE A

A1 Make a test call. When calling a Signaller or control centre, advise them that you are carrying out routine maintenance.

A2 Confirm that any associated indications (e.g. concentrator) are functioning and presented correctly. Confirm that the sounder/external bell operates correctly.

A3 Check that the speech quality is clear and that there is no significant line noise, crackling or audible crosstalk. Ask the recipient for an assessment of the speech level and noise. Report a defect if speech levels are poor, or there is a hum, crackle or crosstalk.

A4 Request a call back to the telephone. Check that the sounder and any visual indication, if fitted, operates correctly.

Answer the call.

A5 Check telephone, post and fixings for orientation and deterioration (where applicable) and telephone is securely mounted. Replace any damaged or worn handset cords.

A6 Check that locks, hinges and doors are lubricated and functional (where applicable).

A7 Clean the telephone exterior, handset compartment or cradle, handset and cord.

A8 Check that the internal/external telephone labels are present, readable and correct for the location (as per standard NR/SP/TEL/30032). The labels shall include the following:

a) External label which represents the telephone's function (SPT/Level Crossing etc).

b) Limited clearance identification (where applicable).

c) Instructions on how to use the telephone.

d) The name of the controlling signal box/electrical control room.

e) The circuit name/ID/number.

f) The location grid reference using a 6-figure grid reference (i.e. TQ123456).

g) The phonetic alphabet (where applicable).

In addition, for crossing telephones, the following shall include:

h) The public telephone number of the correct continuously staffed location.

i) A warning to the user that the call might be recorded (where applicable).

A9 Check the visible portion of the tail cable for damage and that the cable is fitted and sealed into the telephone unit with a gland (where applicable).

A10 Check the calling button/switch (if provided) is free to move.

A11 Call in to the Signaller/Controller and come to a clear understanding as to the purpose and implication of the test.

A12 Request the Signaller/Controller to attempt to clear the call.

A13 Keep the handset off the hook at the telephone until the timeout expires, which should be 3 minutes for crossing telephones and between 6 and 8 minutes for other telephones. Check that the call clears down (where applicable).

A14 Check, if provided, that it is possible to call the Signaller/Controller from another handset on the same circuit whilst the timed-out handset is still off the hook.

A15 Repeat A14 and A15 for all other phones on the circuit.

Appendix C - Maintenance of MAG/LB Type Telephones

SERVICE A

A1 Make a test call. When calling a Signaller or control centre, advise them that you are carrying out routine maintenance.

A2 Confirm that any associated indications (e.g. concentrator) are functioning and presented correctly. Confirm that the sounder/external bell operates correctly.

A3 Check that the speech quality is clear and that there is no significant line noise, crackling or audible crosstalk. Ask the recipient for an assessment of the speech level and noise. Report a defect if speech levels are poor, or there is a hum, crackle or crosstalk.

A4 Request a call back to the telephone. Check that the sounder and any visual indication if fitted, operates correctly.

Answer the call.

A5 Check telephone, post and fixings for orientation and deterioration (where applicable) and that the telephone is securely mounted.

A6 Check that locks, hinges and doors are lubricated and functional (where applicable).

A7 Clean the telephone exterior, handset compartment or cradle, handset and cord.

A8 Check that the internal/external telephone labels are present, readable and correct for the location (as per standard NR/SP/TEL/30032). The labels shall include the following (where applicable):

a) External label which describes the telephone's function (SPT / Level Crossing etc).

b) Limited clearance identification.

c) Instructions on how to use the telephone.

d) The name of the controlling signal box / electrical control room.

e) The circuit name/ID/number.

f) The location grid reference using a 6-figure grid reference (i.e. TQ123456).

g) The public telephone number of the correct continuously staffed location.

h) The phonetic alphabet (where applicable).

In addition, for crossing telephones, the following shall include:

i) The public telephone number of the correct continuously staffed location.

j) A warning to the user that the call might be recorded (where applicable).

A9 Check the visible portion of the tail cable for damage and that the cable is fitted and sealed into the telephone unit with a gland.

A10 Check the calling button is free to move.

A11 Check that the cell housing is clean and dry, and that the connecting cables are in good condition.

A12 Check battery voltage and current (5mA).

A13 Renew the cells at the phone and control point where not covered by other standards or maintenance regimes; correctly dispose of old cells.

A14 Call in to the Signaller/Controller and come to a clear understanding as to the purpose and implication of the test.

A15 Request the Signaller/Controller to attempt to clear the call.

Appendix D - Maintenance of Auto Type Telephones (Including VoIP keypad type)

SERVICE A

A1 Make a test call. When calling a recipient, advise them that you are carrying out routine maintenance.

A2 Check that the speech quality is clear and that there is no significant line noise, crackling or audible crosstalk. Ask the recipient for an assessment of the speech level and noise. Report a defect if speech levels are poor, or there is a hum, crackle or crosstalk.

A3 Request a call back to the telephone. Check that the sounder/external bell and any visual indication if fitted, operates correctly.

Answer the call.

A4 Check telephone, post and fixings for orientation and deterioration (where applicable) and telephone is securely mounted.

A5 Check that locks, hinges and doors are lubricated and functional (where applicable).

A6 Clean the telephone exterior, handset compartment or cradle, handset and cord.

A7 Check that the internal/external telephone labels are present, readable and correct for the location (as per standard NR/SP/TEL/30032). The labels shall include the following (where applicable):

a) External label which describes the telephone's function (SPT / Level Crossing etc).

b) Limited clearance identification.

c) Instructions on how to use the telephone.

d) The name of the controlling signal box / electrical control room.

e) The circuit name/ID/number.

f) The location grid reference using a 6-figure grid reference (i.e. TQ123456).

g) The public telephone number of the correct continuously staffed location.

h) The phonetic alphabet (where applicable).

In addition, for crossing telephones, the following shall include:

i) The public telephone number of the correct continuously staffed location.

j) A warning to the user that the call might be recorded (where applicable).

A8 Check the visible portion of the tail cable for damage and that the cable is fitted and sealed into the telephone unit with a gland.

A9 Check the calling button is free to move.

A10 Check that the cell housing is clean and dry, and that the connecting cables are in good condition.

A11 Check battery voltage and current (5mA).

A12 Renew the cells at the phone and control point where not covered by other standards or maintenance regimes; correctly dispose of old cells.

A13 Call in to the Signaller/Controller and come to a clear understanding as to the purpose and implication of the test.

A14 Request the Signaller/Controller to attempt to clear the call.

Appendix E - Maintenance of Autodial Type Telephones (including VOIP)

A1 Make a test call. When calling a Signaller or control centre, advise them that you are carrying out routine maintenance.

A2 Confirm that any associated indications (e.g. concentrator) are functioning and presented correctly. Confirm that the sounder/external bell operates correctly.

A3 Check that the speech quality is clear and that there is no significant line noise, crackling or audible crosstalk. Ask the recipient for an assessment of the speech level and noise. Report a defect if speech levels are poor, or there is a hum, crackle or crosstalk.

A4 Request a call back to the telephone. Check that the sounder and any visual indication if fitted, operates correctly.

Answer the call.

A5 Check telephone, post and fixings for orientation and deterioration (where applicable) and phone is securely mounted.

A6 Check that locks, hinges and doors are lubricated and functional (where applicable).

A7 Clean the telephone exterior, handset compartment or cradle, handset and cord.

A8 Check that the internal/external phone labels are present, readable and correct for the location (as per standard NR/SP/TEL/30032). The labels shall include the following:

a) External label which describes the telephone's function (SPT / Level Crossing etc).

b) Limited clearance identification (where applicable).

c) Instructions on how to use the telephone.

d) The name of the controlling signal box / electrical control room.

e) The circuit name/ID/number.

f) The location grid reference using a 6-figure grid reference (i.e. TQ123456).

g) The phonetic alphabet (where applicable).

In addition, for crossing telephones, the following shall include:

h) The public telephone number of the correct continuously staffed location.

i) A warning to the user that the call might be recorded (where applicable).

A9 Check the visible portion of the tail cable for damage and that the cable is fitted and sealed into the telephone unit with a gland.

A10 Check the dial or keypad is operating correctly.

Appendix F - Maintenance of PETS/KETS Type Telephones

SERVICE A - Crossing End Telephones Check

NOTE: *Carry out the following service on each crossing phone (including any non-emergency telephones for the crossing).*

A1 Check that access to the crossing telephone is possible and safe.

A2 Where fitted, check for presence and legibility of 3-sided telephone sign. Check that it is visible, and no undergrowth is close to obscuring it.

A3 Check the telephone labels are present, readable and correct for the site. The labels shall include the following:

a) ‘Black phone’, sign 787 on the housing.

b) Instructions on how to use the telephone.

c) The name of the controlling signal box.

d) The name of the level crossing.

e) The location grid reference using a 6-figure grid reference; (i.e. TQ123456).

f) The public telephone number of the correct continuously staffed location.

g) The phonetic alphabet.

h) A warning to the user that the call might be recorded (where applicable).

A4 Check telephone, post and fixings for orientation and deterioration. Repair or replace where required.

A5 Check for any substantial damage to the telephone housing and that the door can stay closed. Lubricate hinges where required.

A6 On non-emergency telephones, check that any locks are lubricated and functional.

A7 Check that the backlight for the instructions is functional and providing necessary illumination.

A8 Check the visible portion of the tail cable for damage and that the cable is fitted and sealed into the telephone unit with a gland.

A9 Check handset for damage. Replace where required.

A10 Check the cord for damage or substantial wear. Replace where required.

A11 Call in to the Signaller and advise that you are carrying out routine maintenance.

A12 Confirm with the Signaller that the sounder operates, and the correct indication is displayed on the concentrator or for standalone PETS/KETS units, the Signallers’ handset is correctly labelled. If there is no indication or it is incorrect then advise the Signaller of the crossing, the telephone concerned and report the defect to Infrastructure Fault Control.

A13 Check that the speech quality is clear and that there is no significant line noise, crackling or audible crosstalk.

A14 Request that the Signaller calls back to the crossing. Check that all the sounders operate correctly; answer the call.

Off hook test

A15 Take a handset off hook but do not call in. Wait for at least 30 seconds.

A16 Call in to the Signaller from another telephone whilst the first handset is off hook. The call should be successful. Confirm with the Signaller that they have received an "off hook" alarm.

A17 Request that the Signaller calls back. Answer the call.

A18 Return all telephone handsets to the 'on hook' position.

Intrusion Test

A19 Initiate a call from one of the public PETS/KETS telephones to the signal box. Once the call is in progress, initiate another call to the signal box from another public PETS/KETS telephone.

A20 Check that an intrusion tone is presented to the Signaller.

Time out test

A21 Call Signaller to inform that it is a timeout test, clear down the call and remove handset from cradle, wait at least 9 minutes.

A22 Call back Signaller using an alternative telephone and confirm that the "off-hook" alarm is present.

A23 Return handset on hook and check with Signaller all alarms have cleared.

A24 Repeat A21 – A23 for all other public telephones at crossing.

A25 Take 2 handsets off hook and wait 9 minutes.

A26 Call Signaller using an alternative telephone and confirm that a "multiple off-hook" alarm is present.

A27 Return all handsets on hook and check with Signaller all alarms have cleared.

END

Includes:	External Cable routes
Excludes:	Cables mounted to structures or inside buildings

GENERAL

Asbestos cement troughing can pose a serious risk to health if disturbed; under NO circumstance shall asbestos cement troughing or lids be disturbed. If any are discovered or you are unsure about the consistency of the troughing, ask your SM(S).

All known and discovered asbestos cement troughing shall be identified on the route records.

Working within certain inspection pits or chambers can be designated as Working in Confined Places requiring the correct competency and the use of specialist PPE and gas detection equipment. If you are in doubt, ask your SM(S).

On cable pits when the lids or coverings are removed for maintenance, safety precautions shall be taken to check that no one can accidentally fall into the exposed cable pit.

SERVICE A

1. Full Inspection and Minor Maintenance of Cable Routes

1.1 Check that all route lids are 'in-place' and if provided with secure fastenings, that these are present and functional. Where displaced lids or unsecured fastenings are identified they shall be refitted.

1.2 Check that the route has no visible damage, including crushed lids and troughs.

Where damage to the cable route is identified visually check, within the route for signs of damage.

Remove any pieces of ballast which have entered the route which could cause damage to the cables.

Exclude minor problems such as a chipped corner or crack which does not affect the structural integrity of the route.

1.3 Where ground anchors are installed, check that they and their associated securing ties are present and are correctly retaining the cable.

1.4 Visually check for exposure of the re-enforcing fabric used in the construction of the trough route and lids.

1.5 Visually check that no embankment, spoil or ballast is encroaching onto or covering the route, or that the route is not being displaced from either its horizontal or vertical alignment or is subject to damage by movement of the Permanent Way.

Note any areas where the route is surrounded or covered by vegetation which would either hinder access or cause exposure of the cable route to a heighten fire risk.

1.6 Check that the cable route/ducting has not become a conduit for water drainage. Check for evidence of silting or scouring.

1.7 Check that there are no lengths of rail, sleepers or other heavy items restricting access to the route.

1.8 Check that any ballast boards and their supports are in good order and are functional.

1.9 Where provided, check that ballast retaining walls for joint bays and locations are in good order, this shall include checking for crumbling concrete, loose brickwork and loose mortar.

1.10 Where the route is provided on supports, hangers or trestles, check that these structures are secure, in good order and all fittings are present and functional.

1.11 Where the route is provided through station platforms, check that there is no visual subsidence of the line of the route. Where subsidence is evident and where the extent of the subsidence poses a risk to persons or property, action shall be taken as is reasonable to warn station users of the hazard.

1.12 Check that joint bays are free from rubbish, soil, ballast and debris.

1.13 Check for signs of rodent incursion especially where cable route enters location cases, signal boxes or relay rooms and that any fire blocks provided are still intact.

SERVICE B

2. Cable Pit Inspection and Minor Maintenance

2.1 Remove the cable pit cover and check whether the cable pit contains any debris. Debris found in the pit shall be removed and disposed of.

2.2 Check that the pit retaining walls and lid surround are secure and intact, this shall include checking for:

a) Crumbling concrete.

b) Loose brickwork.

c) Loose mortar.

2.3 Check the existing draw wires or ropes between pits for free movement, where a draw wire or rope does not move freely then the pipe shall be further investigated to ascertain whether it is a blocked pipe.

This gives an indication as to the condition of the connecting duct pipes between the pits.

2.4 Check that the cables in the pit are not chafing against the sides of the pit or duct in a way to cause damage to the cable sheath. Where chafing is identified or if the outer sheath of the cable has been penetrated, this shall be reported as corrective maintenance.

2.5 Check that all covers and lids are in good order, can be secured and that all clips and fastenings are present and functional.

2.6 Restore all protective covers and lids on completion of the inspection, check that they are correctly seated and secured.

2.7 Where it is identified that a cable pit is in danger of subsidence or collapse or the pit covers or lid are missing, this shall be reported immediately.

The area shall be clearly identified and where it poses a risk to persons or property, take action as is reasonable to warn other persons of the hazard.

SERVICE C

These tasks may be undertaken from a cab of a train or by reviewing video footage.

3. Route Inspection

3.1 Examine the route by visual inspection, check that it is undamaged and intact. Note shall be taken of the following:

a) Any areas where the cable route is obscured by ballast, rails, landslip or dense vegetation etc.

b) Where the cable route has been displaced from its original alignment by landslip, earthworks or building works adjacent to the route.

c) Where cables are exposed or are hanging unsupported, when they would be expected to be afforded protection by the cable route.

d) Where visual evidence indicates that the cable route could have been crushed by heavy machinery gaining access to the railway.

e) Any areas where the cable route is flooded.

f) Any areas where the cable route is now remote from the operational railway due to the abandonment of sidings / land.

g) Any signs of fire damage to, or adjacent to the cable route (embankment fires etc).

h) Any signs of contamination to the cable route by hazardous substances such as acid, diesel, oil etc.

END

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]

[illegible]

INDEX

END

1. Signals

1.1 Signal Lamp and Module Voltages.

Conventional SL35 Filament Lamps	
Heads & PLJIs all areas except SIMIS-W interlockings.	10.5V to 12.1V
Heads & PLJIs SIMIS-W interlockings only.	10.5V to 10.8V
MSL/MWL Light Units.	11.3V to 11.7V

No conventional SL35 lamp shall be left with a voltage of less than the minimum listed.

Change lamps running on auxiliary filaments as soon as possible.

The setting of all auxiliary filament voltages should be approximately the same as the main filament to retain the same light output.

The preferred maximum voltage for a conventional SL35 lamp is 10.9V, although it might not be practicable in areas where the mains supply is prone to variation.

In these areas, a higher voltage setting could be required to check the minimum voltage does not drop below 10.5V. If you are in any doubt, ask your SM(S).

In SIMIS-W interlocking areas the target voltage for conventional SL35 lamps is 10.7V. Due to the transformer tapings the exact voltage might not be achievable, in this case a slightly higher voltage can be used.

The target voltage for 10V 50W QH lamps is 10V.

8000 Hour SL35 Filament Lamps	
Main filament only, all areas except SIMIS-W interlockings.	11V to 12.1V
Main filament, SIMIS-W interlocking areas only.	10.5V to 10.8V
Where BR942 spec relays are used as a UECR on PLJIs.	10.5V to 12.1V

No 8000hr SL35 lamp shall be left with a voltage of less than the minimum listed.

The auxiliary filament of an 8000hr lamp is not long life therefore this shall be set to the range listed for a conventional SL35.

The main filament in long life lamps shall be set to the higher range of the limits to check correct operation of the filament. In areas that are prone to voltage variations this is sometimes not possible. If you are in any doubt, ask your SM(S).
Change lamps running on auxiliary filaments as soon as possible.

The setting of all auxiliary filament voltages should be approximately the same as the main filament to retain the same light output.

In SIMIS-W interlocking areas the target voltage for 8000hr SL35 lamps is 10.7V. Due to the transformer tapings the exact voltage might not be achievable, in this case a slightly higher voltage can be used.

The target voltage for 10V 50W QH lamps is 10V.

Ansaldo Interlocking Areas (Manchester South only)	
SD321 Colour light Signal (Quartz Halogen Lamps)	11.6V to 12.2V

If the voltage on any unlit SD321 lamp exceeds 0.8V, report the situation to your SM(S) immediately.

Other Filament Lamps	
12V lamps (**Except** electric lit semaphores).	11.3V to 11.7V
12V lamps (Electric lit semaphores only).	10.3V to 11.7V
10V 50W QH Lamps (SIMIS-W interlocking's only)	9.8V to 10.2V
4V lamps (Electric lit semaphores)	3.7V to 3.9V
4.5V lamps (Electric lit semaphores)	4.4V to 4.6V
6V lamps (Electric lit semaphores)	5.7V to 6V
110V lamps (All signals & indicators **not** fed direct from a bus bar)	100V to 110V
110V lamps (All signals & indicators fed direct from a bus bar)	99V to 121V

In some areas electric lit semaphore signals have series resisters in the B12 lamp feed; this is to provide a lamp voltage of 10.7V.

This is to provide a light output similar in hue to an oil lamp which cannot be distorted by the hue of the coloured lenses.

Quartz Halogen Lamps	
12V QH lamps (Except fibre optic heads)	11.7V to 12.3V
10V QH lamps (All applications)	9.7V to 10.3V

12V quartz halogen lamps fitted in a signal head with a 110/10V transformer can blacken. Technicians shall replace them with a 10V rated quartz halogen lamp or advise their SM(S).

Replacement of the 110/10V signal head transformer should be considered by the SM(S), if 10V quartz halogen lamps are not available.

Set Quartz Halogen lamps to run as close as possible to their rated voltage.

LED Light Engines	
Howells LED SL35 Light Engine (MK1 Light Engine)	11V to 13V
Howells LED SL35 Light Engine (MK2 Light Engine)	10.5V to 11.5V
Howells LED SL35 Light Engine (MK3 Light Engine)	11.5V to 12.5V

LED Universal Semaphore Lamp	
LED Universal Semaphore Lamp	4V to18V

LED Signal Module	
Input to SLM	90V to 120V

LED Semaphore Signal Modules	
Low Intensity	Low Intensity
High Intensity	High Intensity

2. SIMIS-W INTERLOCKING AREAS

2.1 Current Ranges.

Type of Lamp and SOM	**Current**
SL35 lamps Som /Som 5	140mA – 170 mA
SL35 lamps Som 6	140mA – 175 mA
10V QH Lamps Som / Som 5	350mA – 457 mA
10V QH Lamps Som 6	350mA – 470 mA

3. Signal Arm

3.1 Balance Lever and Light Repeater Contact Settings.

Arm Position	Contact Detail
Arm / Slot ON	–5 to 5 degrees
Arm / Slot WRONG	5 to 35 degrees
Arm / Slot OFF	35 to 65 degrees
Arm / Slot WRONG	65 or more degrees
AWS energised	25 to 65 degrees

Lower quadrant signals have the same measurements below the horizontal (0° being the horizontal).

4. SPEED & DISTANCE MEASUREMENTS.

4.1 The Formula for working out Speed & Distance Measurements is as follows.

a) Miles per hour * 0.489 for the distance in **yards** covered in one second.

b) Miles per hour * 0.447 for the distance in **metres** covered in one second.

5. SIGNAL VISIBLITY CHARTS

2 Seconds		
Permissible Speed (mph)	Viewing Distance (Yds.)	Viewing Distance (M.)
20	20	18
25	24	22
30	29	27
35	34	31
40	39	36
45	44	40
50	49	45
55	54	49
60	59	54
65	64	58
70	68	63

2 Seconds		
Permissible Speed (mph)	Viewing Distance (Yds.)	Viewing Distance (M.)
75	73	67
80	78	72
85	83	76
90	88	80
95	93	85
100	98	89
105	103	94
110	108	98
115	112	103
120	117	107
125	122	112

4 Seconds		
Permissible Speed (mph)	**Viewing Distance**	
	(Yds.)	**(M.)**
20	39	36
25	49	45
30	59	54
35	68	63
40	78	72
45	88	80
50	98	89
55	108	98
60	117	107
65	127	116
70	137	125

4 Seconds		
Permissible Speed (mph)	**Viewing Distance**	
	(Yds.)	**(M.)**
75	147	134
80	156	143
85	166	152
90	176	161
95	186	170
100	196	179
105	205	188
110	215	197
115	225	206
120	235	215
125	244	224

5 Seconds		
Permissible Speed (mph)	**Viewing Distance**	
	(Yds.)	**(M.)**
20	49	45
25	61	56
30	73	67
35	86	78
40	98	89
45	110	101
50	122	112
55	134	123
60	147	134
65	159	145
70	171	156

5 Seconds		
Permissible Speed (mph)	**Viewing Distance**	
	(Yds.)	**(M.)**
75	183	168
80	196	179
85	208	190
90	220	201
95	232	212
100	244	224
105	257	235
110	269	246
115	281	257
120	293	268
125	306	279

10 Seconds		
Permissible Speed (mph)	**Viewing Distance**	
	(Yds.)	**(M.)**
20	98	89
25	122	112
30	147	134
35	171	156
40	196	179
45	220	201
50	244	224
55	269	246
60	293	268
65	318	291
70	342	313

10 Seconds		
Permissible Speed (mph)	**Viewing Distance**	
	(Yds.)	**(M.)**
75	367	335
80	391	358
85	416	380
90	440	402
95	464	425
100	489	447
105	513	469
110	538	492
115	562	514
120	587	536
125	611	559

END

1. Track Gauge

Type of switch	Measurement
Plain Line	1435mm nominal (1432mm – 1438mm depending on sleeper type) Gauge widening may be applied on tight curves
Vertical S&C	1432mm (gauge widening on tight curves only permitted on tight curves)
Inclined S&C	1435mm (gauge widening on tight curves only permitted on tight curves)

Further details on track gauge can be found in NR/L2/TRK/001.

2. Switch Openings

Points Type		At Lock Arm	At Toe
RCPL Plain Lead		105mm to 110mm (Optimum 108mm)	105mm to 110mm (Optimum 108mm)
IBCL Plain Lead		105mm to 110mm (Optimum 108mm)	105mm to 110mm (Optimum 108mm)
IBCL Mk3 Plain Lead	Where fitted to NR60 Mk2 with mechanical back drive:	128mm to 132mm (Optimum 130mm)	128mm to 132mm (Optimum 130mm)
	elsewhere	105mm to 110mm (Optimum 108mm)	105mm to 110mm (Optimum 108mm)
HPSS		N/A	112mm to 114mm
RCPL Switch Diamonds		82mm to 87mm (Optimum 82mm)	85mm to 90mm (Optimum 85mm)
Mechanical or Machine (All types)		N/A	102mm to 120mm (Optimum 108mm)
Unistar		150mm	150mm to 165mm (Optimum 160mm)
Unistar Switch Diamonds		90mm	85mm to 95mm (Optimum 90mm)

NOTE: *Unistar measured at Drive/Lock Rod.*

3. Residual Switch Opening (except Unistar, HPSS)

Position of gauge	**Measurement**	
From first to last stretcher bar (all permutations)	**Nominal**	**Maximum**
	1.5mm	4.0mm

4. Residual Switch Opening Unistar

Position of gauge	**Measurement**	
	Nominal	**Maximum**
NR56 V Turnouts. Toe to final supplementary drive	1.5mm	4.0mm
NR60 Mk2 Switch Diamonds Toe to end of switch planing (head cut)	1.5mm	8mm

5. Residual Switch Opening HPSS

Position of gauge	**Measurement**
at the toe of the switch (in-line with the toe sensor)	0mm
at the end of the switch rail Planning (head cut)	2.5mm to 3mm
at all supplementary sensor positions shall be less than	2.0mm #1
from the first to the last stretcher (excl. supp, sensors pos’n)	0mm to 3mm

#1 - except for **CEN54 ‘C’** switches which can be 2mm to 3mm.

See NR/L2/SIG/11400 for more details.

6. Free Wheel Clearances

Switch Type	Clearance	Comment
RT60 & NR60	60mm	Minimum gap throughout the moveable length of the switch.
Other types	50mm	Minimum gap throughout the moveable length of the switch in proximity to the rear stretcher bar, the minimum FWC shall be enlarged if track gauge is wider than the nominal value.
Single & double slips	45mm	Minimum gap throughout the moveable length of the switch where the line speed is ≤60mph
	50mm	Minimum gap throughout the moveable length of the switch where the line speed is >60mph

More details on RSO and FWC can be found in NR/L2/TRK/001.

7. Calculating Wheel Free Clearance

Formula for Calculating Required Free Wheel Clearance at Each Stretcher Bar is:

RFWC(SB) = NFWC(SB) + MTG(SB) – NTG

Acronym	Meaning
RFWC (SB)	Required Free Wheel Clearance at specific stretcher bar
NFWC(SB)	Nominal Free Wheel Clearance at specified stretcher bar
MTG (SB)	Measured Track Gauge (static) at specific stretcher bar
NTG	Nominal Track Gauge

NOTE: *Further information on calculating FWC can be found in NR/L3/TRK/6100/Mod03 (Installing stretcher bars and setting them to the correct length).*

If you are in doubt about any measurement or calculation of FWC or FWP, ask your SM(S).

Typically for:

- Plain leads in vertical S&C with designed FWC of 50mm the FWP value would be 1432mm minus 50mm which equals 1382mm.
- Slips in vertical S&C (where there is a permitted 45mm FWC) the FWP would be 1432mm minus 45mm which equals 1387mm.
- CEN60 in inclined S&C with a designed FWC of 60mm the FWP value would equal 1435mm minus 60mm which equals 1375mm.

8. Kicking Strap Clearances

S&C Type	Clearance	
	Minimum	**Maximum**
S&C with conventional slide chairs	3mm	6mm
S&C fitted with rollers	6mm	9mm
S&C fitted with Unistar POE	N/A	N/A

9. Facing Point Lock

Will Lock	Will Not Lock
1.5mm	3.5mm

10. Detection

Type of Detection	Detection	
	Made	**Broken**
RCPL	2.5mm	4mm
IBCL (Mk2 and Mk3)	3.5mm	5mm
HPSS (CEN54)	N/A	8mm
HPSS (NR60/RT60)	N/A	10mm
BR998 & other supp. types	6mm	8mm
SO Hydraulic Supplementary	2mm	4mm
Unistar	1.5mm	3.5mm
Unistar – Supplementary Drives	2.0mm	4.0mm
All Others	3.5mm	5mm

11. POINT FITTINGS

Point fixings are required to be torque tightened/checked to confirm a secure connection.

Some torque wrenches apply a direct torque to the fixing, others utilise an extension piece connected to the wrench, which changes the amount of torque applied to the fixing.

Where an extension piece is required, the relevant tables below include a “Torque Wrench Setting” column.

This is the value the torque wrench should be set to, when using the correct extension piece.

12. TUBULAR STRETCHER BARS

12.1 Installation Torque Values.

All Bolts on Tubular Stretcher Bar Assemblies (All Locations)		
	Torque Wrench Setting	Applied Torque
All Switch Rail Bolts	340Nm	440Nm
All Motion Unit to Tube Bolts	340Nm	440Nm
Kicking Strap Nuts	200Nm	250Nm
Locking Devices on Tubular Stretcher Bar Assemblies (All types of tubes)		
Primary Locking Collars	340Nm	440Nm
Secondary Cap Screws	Until washers are compressed	

12.2 Check Torque Values

All Bolts on Tubular Stretcher Bar Assemblies require to be checked during SMTH Testing		
	Torque Wrench Setting	Applied Torque
All Switch Rail Bolts	270Nm	350Nm
All Motion Unit to Tube Bolts	270Nm	350Nm

See NR/L2/TRK/6100/Mod04 (Tubular Stretcher Bars) for full details of the correct tooling to be used to secure all fastenings on tubular stretcher bars.

13. Fixed Stretcher Bars

13.1 Installation Torque Values.

Hardlock Nuts on Fixed Stretcher Bars (All Locations)	
Male Nut (Convex)	250Nm
Female Nut (Concave)	250Nm
Square and Hex Nuts on Fixed Stretcher Bars (All Locations)	
All Nuts	250Nm

13.2 Check Torque Values.

Hardlock Nuts on Fixed Stretcher Bars (All Locations)	
Male Nut (Convex)	N/A
Female Nut (Concave)	200Nm
Square and Hex Nuts on Fixed Stretcher Bars (All Locations)	
All Nuts	200Nm

See NR/L2/TRK/6100/Mod05 (Fixed Stretcher Bars) for full details of the correct tooling to be used to secure all fastenings on fixed stretcher bars.

14. Adjustable Stretcher Bars

14.1 Installation Torque Values.

Hardlock or Full/Half Nuts on 35mm Square Section Adjustable Stretcher Bars (Adjustable Bar only)

Using LTTK11 (fitted with the 46mm A/F long Extension		
	Torque Wrench Setting	Applied Torque
Male Nut (Convex)	⅓ turn to compress bush	
Female Nut (Concave)	255Nm	300Nm
Full Nut	⅓ turn to compress bush	
Half Nut	255Nm	300Nm
Using Version 1 of Insulated LTTK16 (fitted with the 46mm A/F long Extension		
Male Nut (Convex)	⅓ turn to compress bush	
Female Nut (Concave)	140Nm	300Nm
Full Nut	⅓ turn to compress bush	

Half Nut	140Nm	300Nm
Using Version 2 of Insulated LTTK16 (fitted with the 46mm A/F long Extension		
Male Nut (Convex)	⅓ turn to compress bush	
Female Nut (Concave)	Position B	300Nm
Full Nut	⅓ turn to compress bush	
Half Nut	Position B	300Nm

14.2 Check Torque Values.

Hardlock or Full/Half Nuts on 35mm Square Section Adjustable Stretcher Bars (Adjustable Bar only).

Using LTTK11 (fitted with the 46mm A/F long Extension		
	Torque Wrench Setting	Applied Torque
Male Nut (Convex)	N/A	
Female Nut (Concave)	160Nm	200Nm
Full Nut		
Half Nut		
Using Version 1 of Insulated LTTK16 (fitted with the 46mm A/F long Extension		
Male Nut (Convex)	N/A	
Female Nut (Concave)	95Nm	200Nm
Full Nut	N/A	
Half Nut	95Nm	200Nm
Using Version 2 of Insulated LTTK16 (fitted with the 46mm A/F long Extension		
Male Nut (Convex)	N/A	
Female Nut (Concave)	Position A	200Nm
Full Nut	N/A	
Half Nut	Position A	200Nm

See NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars) for full details of the correct tooling to be used to secure all fastenings on adjustable stretcher bars (Non HPSA Point Systems).

15. Torque Prevailing Nuts

15.1 Installation Torque Values

Torque Prevailing Nuts (Fixed and 35mm Square Section Adjustable Stretcher Bars, Bracket to Rail Fastenings,) Installation Value	
Torque Prevailing Nut	250Nm

15.2 Check Torque Values

Torque Prevailing Nuts Non HPSA Point Systems (Fixed and Adjustable Stretcher Bars, Bracket to Rail Fastenings) Test Value	
Torque Prevailing Nut	200Nm

See NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars) for full details of the correct tooling to be used to secure all fastenings on adjustable stretcher bars (Non HPSA Point Systems).

16. Unistar HR – Torque Values

Item	**Size Fitting**	**Installation Torque**	**Check Torque**
Switch Rail Bracket Main Bolts - Philidas	M20	230Nm	230Nm
Rod End retainer bracket Tabs	M8	25Nm	25Nm
Mounting Plate Fixation Anchors (Slab)	Spike screw	200Nm	200Nm
DLD to mounting Plate Bolts (Slab)	M20	230Nm	230Nm
Locking Collar Bolts for DLD Plate fasteners	M8	25Nm	25Nm
DLD to Buttress Plate Bolts	M20	230Nm	230Nm
Power Pack Mounting Plate to Concrete Kerb Anchors	M8	30Nm	30Nm
Power Pack Mounting Plate to Roller Stool Nuts and Bolts	M20	35Nm	35Nm
Power Pack to Mounting Plate securing Nuts and Bolts	M16	35Nm	35Nm
Drive Rod End Nut	M27	-	N/A
Detector Rod End Nut	M27	-	N/A
Locking Collar for Drive and Detector Rod Ends securing nut	M8	25Nm	N/A

17. Unistar HR Hose fittings - Torque Values

Item	Size	Installation Torque	Check Torque
All fittings	M18x1,5	110Nm	80Nm

18. Unistar HR Internal Security Bolts – Torque Values

Item	Size	Installation Torque	Check Torque
Locking Collars	M8	25Nm	N/A
All other secure screws	M8	25Nm	N/A

19. In-Bearer Clamp Locks (IBCL) Mk 2 - Torque Values

Item	Size Fitting	Installation Torque	Check Torque
Lock and Detector Mechanism Retaining Nuts	M20	250Nm	225Nm
Switch Rail Bracket Retaining Nuts	M20	250Nm	225Nm
Detector Blade Lug Retaining Nuts	M16	70Nm	65Nm
Detector Blade Adjuster Lock Nut	M16	70Nm	65Nm
Adjustable Tie Bar Retaining Nuts	M16	150Nm	135Nm
Actuator Socket Mounting Bolts	M16	150Nm	135Nm
Locking Piece Retaining Screws	M12	60Nm	55Nm
Adjustable Tie Bar Lock Nut (Use 39/52030)	-	100Nm	90Nm
Centre Thrust Bracket Retaining Bolts	M16	150Nm	135Nm
Hydraulic Ram Socket Mounting Retaining Bolts	M16	150Nm	135Nm
A9 Pivot Pin retaining nut (where fitted)	M20	30Nm	25Nm

20. In-Bearer Clamp Locks (IBCL) Mk 3 - Torque Values

Item	Size	Installation Torque	Check Torque
Lock and Detector Mechanism Retaining Nuts	M20	250Nm	225Nm
Switch Rail Bracket Retaining Nuts (Vargal)	M20	290Nm	260Nm
Detector Blade Lug Retaining Nuts	M16	70Nm	65Nm
Detector Blade Adjuster Lock Nut	M24	90Nm	75Nm
Detector Blade Adjuster Lock Nut	M16	70Nm	65Nm
Locking Piece Retaining Screws	M12	60Nm	55Nm
Centre Thrust Bracket to Bearer Bolts	M16	150Nm	135Nm
Centre Thrust Bracket to Ram Bolts	M12	60Nm	55Nm
Cylinder Rod Adjuster Lock Nuts	M27	100Nm	90Nm
Cylinder Rod Adjuster Locking Pin	M8	Min 2 clear threads	Min 2 clear threads
A9 Pivot Pin retaining nut (where fitted)	M20	30Nm	25Nm

21. Hose fittings (Clamp Lock (All Types)) - Torque Values

Item	Size	Installation Torque	Check Torque
Power Pack Hydraulic Hose Unions	¼” BSSP	16.5Nm	N/A
Hydraulic Ram Hose Unions	¼” BSSP	16.5Nm	N/A
SO Back Drive Manifold Retaining Cap Head Bolt (Hy-Drive only)	M10	60Nm	N/A
SO Back Drive Manifold Hydraulic Hose Union Connections (Hy-Drive only)	½” BSSP	16.5Nm	N/A

22. Hy-Drive- Torque Values

22.1 Installation Torque Values

Hy-Drive stretcher bar to Switch Rail fastenings	
Torque Prevailing Nut	250Nm
Hy-Drive Kicking Strap fastenings	
Torque Prevailing Nut	250Nm

22.2 Installation Torque Values

Hy-Drive stretcher bar to Switch Rail fastenings	
Torque Prevailing Nut	200Nm
Hy-Drive Kicking Strap fastenings	
Torque Prevailing Nut	200Nm

See NR/L3/SIG/19808 for full details of the correct tooling to be used to secure all fastenings on Hy-Drive stretcher bars.

23. High Performance Switch System (HPSS) – Torque Values

23.1 High Performance Switch Actuator (HPSA)

Item	No. Bolts	Socket Size	Installation torque	Check Torque
Toe sensor to stock bolts	2	19mm #1	50Nm	30Nm
Motor bolts	4	10mm	#2	#2
Brake bolts	3	10mm	#2	#2
ECU bolts	4	4mm #3	#2	#2
Gearbox mounting bolts	6	17mm	150Nm	80Nm
Gearbox packing plate bolts (where fitted)	6	17mm	150Nm	80Nm#6
Carriage top cap bolts	4	17mm	150Nm	#4
Carriage shaft bolts	2	22mm	300Nm	#4
Switch rail drive bracket fasteners	2	30mm	220Nm	#4

23.2 PowerLink Backdrive

Item	Socket Size	Installation torque	Check Torque
Supp. sensor drive bracket bolts (tabbed washer)	13mm	30Nm	20Nm #5
Supp. sensor drive bracket bolts (Durlok) #7	13mm	44Nm	20Nm
Supp. sensor to mounting bracket bolts	19mm	80Nm	#4
Supp. sensor mounting bracket to bearer bolts	19mm	80Nm	#4
Shear pin module mounting bolts	22mm	300Nm	100Nm
Torque tube (serrated joint F/SG only) fasteners	24mm	200Nm	#4
Bearing block (mounting to hollow bearer) fasteners	30mm	420Nm	100Nm

Bearing block (clamping half) fasteners	19mm	80Nm	#4
Bearing block, bearing journal fasteners	19mm	70Nm	#4
Stretcher bar to dropper bracket fasteners	30mm	300Nm	100Nm
Web drive bracket to switch rail fasteners	30mm	420Nm	100Nm
Covers and end plate bolts	17mm	150Nm	80Nm
Lost motion thimble locknut	36mm	#2	#2
Gauge stop (countersink version)	17mm	250Nm	#4

23.3 System Wide Components

Item	Socket Size	Installation torque	Check Torque
CEN54 baseplate bolt	36mm	210Nm	#4
RT60 fast-clip block fastener	17mm	420Nm	#4
Anchor plate fasteners CEN54/RT60	30mm	420Nm	#4

#1: Deep socket required.
#2: Bolts to be secure but not over tightened.
#3: A/F hex key.
#4: Not a Maintenance requirement.
#5: Not required where locking tab washers are installed and correctly folded over.
#6: It is only possible to Check Torque 4x of these fasteners due to the Gearbox covering the other 2x.

See NR/L2/SIG/11400 for full details of the correct tooling to be used to secure all fastenings on HPSA and PowerLink Backdrive (HPSS Point Systems).

APPENDIX A - Action Tables

1. Gear Box - Broken Bolts

Defect	Minimum Action	Follow Up Actions
4 or more gearbox mounting bolts broken **Or** 2 or more packing piece bolts broken	**BLOCK THE LINE** and renew the broken bolts **Or** If unable to replace the bolts, clip and scotch the points and impose 20mph speed restriction **Or** Ban facing moves	Renew all intact gearbox/packing piece bolts and torque tighten to 150Nm within 36 hours Where the broken bolts cannot be removed contact IAD team – Route Services.
3 gearbox mounting bolts broken **and/or** 1 packing piece bolts broken	Impose 60mph speed restriction and inspect bolts every 12 hours **Or** If unable to replace the bolts, clip and scotch the points. Point end shall be in full detection and the clip and/or scotched padlocked. **Or** Ban facing moves	Renew all intact gearbox/packing piece mounting bolts and torque tighten to 150Nm within 36 hours Where the broken bolts cannot be removed contact IAD team – Route Services.
1 or 2 gearbox mounting bolts broken	Inform the SM[S]	Contact IAD to arrange for the renewal of the broken bolts Renew the remaining (not broken) Durlok bolts within 72 hours

2. Gear Box - Loose Bolts

Defect	Minimum Action	Follow Up Actions
3 or more loose gearbox mounting bolts **and/or** 2 or more loose packing piece bolts	Re-tighten immediately to 150Nm and inform the SM[S] **Or** Impose 60mph speed restriction and inspect bolts every 12 hours **Or** Ban facing moves **Or** Clip and scotch point	Renew all gearbox/packing piece mounting bolts within 7 days
1 or 2 loose gearbox mounting bolts **and/or** 1 loose packing piece bolts	Re-tighten to 150Nm within 12 hours	Renew all gearbox/packing piece mounting bolts within 7 days

END

1. TRACK CIRCUITS

1.1 Drop Shunt Values

TC Type	**Minimum**	**Desired**
50Hz AC Double Rail with Impedance Bonding	0.3Ω	0.6Ω to 1.0Ω
50Hz AC Single Rail with Impedance Bonding	0.5Ω	0.8Ω to 1.2Ω
50Hz AC Single or Double Rail Without Impedance Bonding	0.5Ω	0.8Ω to 1.2Ω
50Hz AC VT1(SP) (Single rail)	0.5Ω	1.5Ω to 2.5Ω
DC (basic configuration)	0.5Ω	0.8Ω
DC (With feed end relay)	0.5Ω	0.8Ω
DC (With relay end adjustable resister)	1Ω	1.3Ω to 1.5Ω
DC (With relay end adjustable resister & 60Ω relay)	1.2Ω	1.5Ω to 1.7Ω
DC Coded Track	0.5Ω	0.8Ω to 1.0Ω
Rectified AC (Diode)	0.5Ω	1.5Ω
Westrak/Relay End Fed	0.5Ω	0.8Ω
Reed Type RT Without Impedance Bonding	0.5Ω	1-1.2Ω
Reed Type RT With Impedance Bonding	0.3Ω	1-1.2Ω
Aster U Type	0.5Ω #1	0.8Ω
ET200 Low Power/Low Power Plus Without Impedance Bonding	0.5Ω	1.5Ω to 1.9Ω
ET200 Low Power/Low Power Plus with Impedance Bonding	0.3Ω	1.5Ω to 1.9Ω
ET200 Normal Power Without Impedance Bonding	0.5Ω	1.0Ω to 2.8Ω
ET200 Normal Power with Impedance Bonding	0.3Ω	1.0Ω to 2.8Ω
ET400 Open Line Frequencies (fA to fH)	0.5Ω	1.0Ω to 2.8Ω
ET400 Station Area Frequencies (f1 to f8)	1.0Ω at TX 1.4Ω at RXs	1.5Ω
FS2600 (Double rail)	0.6 Ω	1Ω
HVI (relay end rails, electrified. area)	1.0Ω	3.0Ω #2
HVI (relay end rails, non-electrified areas.)	0.5Ω	2.5Ω #2
BR-WR Quick Release	0.5Ω	0.8Ω

Table 1 - 1.1 Drop Shunt Values

#1: The minimum drop shunt value with the train shunt applied across the rails at the TX-tuning unit is 0.3Ω.

#2: This is a maximum value.

1.2 50Hz AC Double Rail Track Capacitance Value

See NR/SMS/PartB/Test/260 for details.

2. IMPEDANCE BOND TORQUE SETTINGS

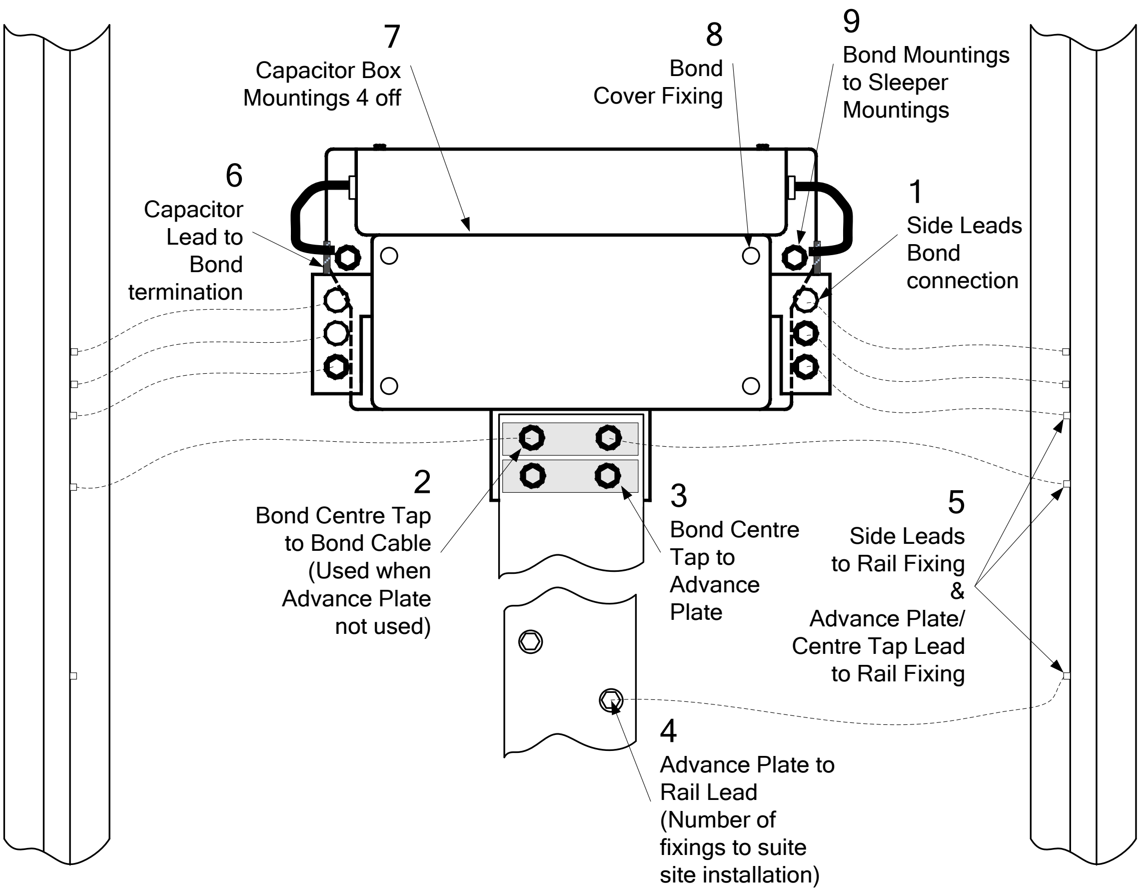


Figure 1 – Fixing Identification Diagram

Figure 1 Ref Number	Item Description	Fixing Size	Torque Nm
1	Side Leads Bond connection (Copper crimps)	M16	Install : 110 Check : 90
1	Side Leads Bond connection (Aluminium crimps)	M16	Install : 90 Check : 70

Figure 1 Ref Number	Item Description	Fixing Size	Torque Nm
2	Bond Centre Tap to Bond cable (Copper Crimp)	M16	Install : 110 Check : 90
2	Bond Centre Tap to Bond cable (Aluminium Crimp)	M16	Install : 90 Check : 70
3 .	Bond Centre Tap to Advance Plate (Aluminium) Note the Correct Installation procedure shall be used incorporating the spreader plates for all new installations.	M16	Pre Tighten : 70 Install : 140 Check : 120
3	Bond Centre Tap to Advance Plate (Aluminium) Non-Preferred Solution	M16	Install : 90 Check : 70
7	Capacitor Box Mountings 4 off	M6	7
6	Capacitor Lead to Bond termination #5 (Copper crimp)	M10	Install : 35 Check : 25
4	Advance Plate to Rail Lead Connection (Copper crimp)	M16	Install : 90 Check : 70
4	Advance Plate to Rail Lead Connection (Aluminium crimp)	M16	Install : 90 Check : 70
4	Advance Plate to Rail Lead Connection (Copper crimp)	M12	Install : 72 Check : 60
4	Advance Plate to Rail Lead Connection (Aluminium crimp)	M12	Install : 72 Check : 60
5	Side Leads to Rail Fixing and Advance Plate / Centre Tap Leads to Rail Fixing (Copper crimp) Uses Cembre or Glenaire rail fixings	M12	Install : 72 Check : 60
5	Side Leads to Rail Fixing and Advance Plate / Centre Tap Leads to Rail Fixing (Aluminium crimp) Uses Cembre or Glenaire rail fixings	M12	Install : 72 Check : 60
5	Side Leads to Rail Fixing and Advance Plate / Centre Tap Leads to Rail Fixing (Copper crimp)	Bolt	Install : 110 Check : 90
8	Bond Cover Fixing (Uses lifting bolt holes)	M10	Tighten manually using best judgement
9	B3 3000 Bond to concrete sleeper fixing including Bond Bottom Packing Covers.	M16 #1	110 Nm to fix bolt. 80 Nm to fix Bond
9	B3 3000 Bond to timber sleeper fixing including Bond Bottom Packing Covers.	M16 / $^5/_8$ inch #2	60

Figure 1 Ref Number	Item Description	Fixing Size	Torque Nm
9	B3 3000 Bond to timber sleeper fixing including Bond Bottom Packing Covers. Blind Bolt #3, Jam nut, Philidas nut	M12	Jam Nut 17 Nm Philidas nut 50Nm
	WH3/HR3 Bond to concrete sleeper fixing. 2 off Hilti HAS 12 x 110 (66337) used at the plate end only	M12	50Nm in accordance with Hilti installation instructions
	WH3/HR3 Bond to timber sleeper fixing. 6-inch coach screw with gimlet point	2 off M16 / 5/8inch.	As required to install coach screws #4

Table 2 – Fixing Details

Traction Bonding connections are not covered in this table.

Number	Comment	Installation
#1	M16 bolt or stud. Expanding metal sleeve type	Expanding bolt/stud shall be fixed to sleeper using following procedure: • Fix bolt/stud to sleeper with Torque of 110 Nm • Remove nut/washer, install bond/ Bond Bottom Packing Covers and replace with new Face Washer / Spring Washer / Full Depth Nut. • Torque Full Depth Nut to 80 Nm
#2	Use special M16 (5/8") coach screws with gimlet point.	Intermediate Bond Cover bottom packing covers shall be installed between sleeper and Bond.
#3	Supplied by The Blind Bolt Company or accepted equivalent	
#4	Coach screws shall not be tightened down, leaving 25mm clear and fixed at the plate end only (2 screws).	
#5	Torque values to be applied if ETU also terminated on M10 stud depending on application design.	

Table 3 – Key to hash comments in Table 2

3. IRJ CLEARANCES

Detail	**Clearance**	**Notes**
Clearance Point	4880mm	Beyond 1970mm vehicle fouling point (1970mm is measured between running edges at right angles to diverging line).
Maximum IRJ physical stagger	2600mm	Between adjacent insulated joints
	2100mm	For single rail overlap on electrified lines
Minimum effective length	18.3m	
Maximum parallel bonded	13.0m	
Minimum distance between 2 sets of IRJs	18.3m	Conventional
	11.0m	Where both staggers are less than 1600mm

Table 4 - IRJ Clearances

4. MECHANICAL TREADLES

Type	**Detail**	**Measurement**
59	Arm top to rail top	11mm ±1mm
69		16mm ±1mm
Both	Arm to running edge	10mm + 2mm to - 5mm

Table 5 - Mechanical treadles

5. AXLE COUNTER THALES (AZL SERIES) SYSTEM

Torque Settings for Rail Contact Fittings AzL Series		
Location	**Nut Size**	**Torque**
Rail Fixings	19mm	40-45Nm
Contact Head Adjustment	13mm	12-15Nm

Torque Settings for Rail Contact Fittings AzLM / AzLE Series		
Location	**Nut Size**	**Torque**
Rail Fixings (SK30 & SK30H)	19mm	45Nm
TX Contact Head Adjustment (SK30 & SK30H)	13mm	25Nm

Location	**Drive Size**	**Torque**
Rail Fixings (SK30K)	10mm Hex Drive	58Nm
Rail Clamp (SK30K)	10mm Hex Drive	58Nm

Table 6 – Torque settings

5.1 EAK H - TORQUEING POINTS

a) Lid to base - M8 bolts set to 10Nm.

Figure 2 - Lid

b) Base to post - M12 bolts set to 90Nm.

Figure 3 - Base plate to Post

5.2 EAK K - TORQUEING POINTS

a) The cover securing bolts shall be torqued to 8 Nm. This is to guarantee the unit does not suffer water ingress issues.

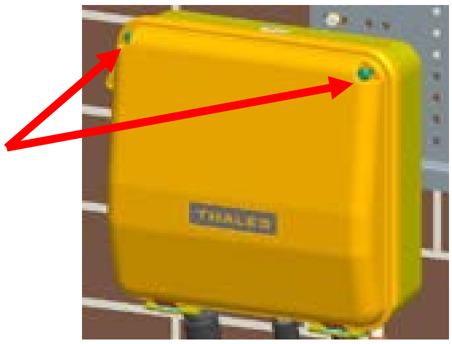


Figure 4 – Front cover

5.3 EAK K – EARTHING POINT

a) Earth Bonding point - 35Nm

Only use the bolt provided, use of a treaded bar or longer bolt can damage the casing leading to water ingress. Extension lugs are available to allow larger crimps to be fitted.

Figure 5 – Earthing point

5.4 Locking fittings

If self-locking nuts are fitted (e.g. Nyloc), and a nut is removed it shall not be reused.

If Nord lock washers are used, they shall be fitted correctly as shown in Figure 6.

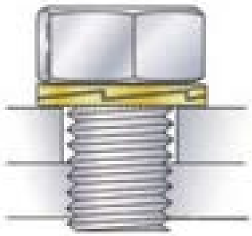


Figure 6 – Nord lock washers

6. AXLE COUNTER SIEMENS (AZS SERIES) SYSTEMS

6.1 Torque Settings for Rail Contact Fittings ZP43V series

Location	Nut Size	Torque
Rail Fixings	12mm	70-80Nm

6.2 Expected Readings from the PEGA 1121 Test Box

Function	Indication	Value	Range
Supply U60	U60=	60 V DC	30V to 72 V

For external power supply, measure across terminals K10, K11 as required

Function	Indication	Value	Range
Operating voltage	U24=	22 V DC	21.3V to 22.4V
Wheel detector frequency	FS	43 kHz	42.8 kHz to 43.2 kHz

Adjust to 43 kHz as precisely as possible using the rotary switch on the back plane.

Function	Indication	Value	Range
Standard voltage UR1	Ur 1	5.5 V DC	5.3V to 6.0V
Standard voltage UR2	Ur 2	5.5 V DC	5.2V to 5.9V

Using a 0.6 x 2.8 mm screwdriver, adjust the potentiometer marked f1 on the front of the generator board until a voltage of approx. 5.5 V DC is reached.

Function	Indication	Value	Range
frequency f1	F 1	3.60 kHz	3.55 kHz to 3.65 kHz
frequency f2	F 2	6.52 kHz	6.42 kHz to 6.62 kHz

Using a 0.6 x 2.8 mm screwdriver, gradually adjust the potentiometer marked f1 or f2 on the front of the generator board to the signal frequency of 3.60 kHz (f1) 6.52kHz (f2).

Function	Indication	Value	Range
Receive voltage UE1	uE 1	NA	60mV to 150mV
Receive voltage UE2	uE 2	NA	60mV to 150mV

For very small rail profiles, up to 200 mV

Function	Indication	Value	Range
WDE output voltage UL	uL	Min1.0 V AC	Direct feeding: 0.48V to 1.8V; external supply 0.7V to 2.7 V

If a Double usage board is in use then a measurement across terminals K18, K19 is required.

END

1. Boom and Road Light Tolerances.

Barrier Position	Setting
Fully raised (AHBC)	80° min, 85° max
Fully raised (other)	83° min, 85° max
Boom lights lit at	80°

NOTE: *Red road lights (flashes per min) 70 to 90*

2. Circuit Controller Band Settings.

Band	Made Between
DN KR	0° and 4°
HJPR	42° and 90° (#)
MR	0° and 83°
UP KR	81° and 90°

#: The HJPR band on early installations can be set to make sooner than 42°. Check the diagrams for the correct setting for the installation you are at.

It is important to obtain the overlap between the UP KR band making and the MR band breaking. So, if a barrier drops slightly, it drives up again without the red road lights operating.

On barrier units that use limit switches in place of circuit controllers, make reference to the diagrams for the positions of the cams.

3. Out of Balance (Tip) Force

Barrier Type	Barrier Length (pivot to tip)	Out of Balance (tip) Force
BR 843 (Metal)	3600 to 4100	7.6 ±0.5kg
	4600 to 7600	6.1 ±0.5kg
Barrier Type	**Barrier Length (pivot to tip)**	**Out of Balance (tip) Force**
BRB AHB Mk1 & Mk2 (timber)	3990 to 6020	2.4 ±0.1kg

Table 1 - Out of Balance (Tip) Force

The out of balance (tip) force is measured with a weight measuring device by using the following method:

a) At the tip end slowly lift the boom until it is approximately 4° to 5° from the horizontal.

b) Connect the weight measuring device to the tip end of the boom.

c) Release the boom onto the measuring device checking that the boom has not fully lowered then take a reading.

To obtain the correct out of balance (tip) force, the approximate number of counter balance weights required are detailed in the tables 1, 2 & 3.

Boom length is the dimension when measured from the main shaft pivot centre to the tip of the boom.

4. Mk.1 Barrier (GWE Style) – Barrier Details

Boom Length	No/ Thickness of Weights (mm)									
	With Skirt					Without skirt				
	8	12	15	25	30	8	12	15	25	30
3.6m	To be determined on site					1	-	-	-	-
4.1m						-	-	-	1	-
4.6m						-	-	-	2	-
5.1m						1	1	-	2	-
5.6m	-	1	-	5	-	-	-	-	4	-
6.1m	1	-	-	8	-	1	1	-	4	-
6.6m	1	1	-	8	-	-	-	-	6	-
7.1m	-	2	-	12	-	-	2	-	8	-
7.6m	-	1	-	14	-	-	-	-	10	-
8.1m	1	-	-	16	-	-	2	-	10	-
8.6m	-	1	-	18	-	1	-	-	12	-
9.1m	-	2	-	20	-	1	1	-	13	-

Table 2 - Mk.1 Barrier (GWE Style) – Barrier Details

5. Mk.2 Barrier SPX (Formally Smiths) – Barrier Details

Boom Length	No/ Thickness of Weights (mm)									
	With Skirt					Without skirt				
	8	12	15	25	30	8	12	15	25	30
3.6m	-	-	1	-	2	-	-	1	-	1
4.1m	-	-	1	-	3	-	-	1	-	2
4.6m	-	-	-	3	-	-	-	-	1	-
5.1m	1	-	-	3	-	1	1	-	1	-
5.6m	-	1	-	4	-	-	-	-	3	-
6.1m	-	1	-	6	-	1	1	-	3	-
6.6m	1	1	-	7	-	-	1	-	5	-
7.1m	1	2	-	10	-	-	2	-	8	-
7.6m	1	-	-	13	-	-	-	-	10	-
8.1m	1	-	-	15	-	-	2	-	11	-
8.6m	-	1	-	17	-	1	-	-	12	-
9.1m	-	2	-	19	-	1	1	-	13	-

Table 3 -Mk.2 Barrier SPX (Formally Smiths) – Barrier Details

6. Audible Warning Devices (AWD)

The audible warning is measured at a 3m radius from the source, in normal daytime operating conditions. It should be between 60 dB(A) and 80 dB(A), normally at the higher end of the range.

A site-specific assessment determines the level required at each level crossing, taking into account local conditions, noise nuisance etc.

7. Predictor HPX-3

7.1 Frequency Settings Based on the Approach Length Tolerances for HPX-3.

Channel	Freq.	Approach Length (based on a ballast of 4 Ω per 1,000 feet of track)		Approach Length (based on a ballast of 2 Ω per 1,000 feet of track)	
		Min	Max	Min	Max
1	86 Hz	720	7500	720	5000
2	114 Hz	615	6000	615	4250
3	151 Hz	560	5200	560	3700
4	156 Hz	550	5150	550	3675
5	172 Hz	535	4900	535	3550
6	210 Hz	485	4400	485	3100
7	211 Hz	485	4400	485	3100
8	267 Hz	440	4000	440	2800
9	285 Hz	425	3850	425	2700
10	326 Hz	400	3550	400	2500
11	348 Hz	380	3450	380	2425
12	392 Hz	360	3250	360	2300
13	430 Hz	340	3100	340	2200
14	452 Hz	330	3050	330	2150
15	522 Hz	315	2850	315	2000
16	525 Hz	315	2850	315	2000
17	560 Hz	305	2700	305	1925
18	630 Hz	290	2550	290	1800
19	645 Hz	290	2500	290	1770
20	686 Hz	275	2450	275	1750
21	753 Hz	265	2350	265	1675
22	790 Hz	260	2300	260	1630
23	816 Hz	255	2250	255	1600
24	881 Hz	250	2200	250	1550
25	970 Hz	240	2050	240	1455
26	979 Hz	240	2050	240	1450

Table 4 - Frequency settings

END

1. Cable Resistance

1.1 Typical Cable Values

Type	**Strands/Size**	**Length**	**Loop Resistance**
Tail	50/0.25	20m to 100m	0.33Ω to 1.64Ω
Type	**Core/Size**	**Length**	**Loop Resistance**
Lineside	1/0.85	100m to 500m	6.64Ω to 33.2Ω
	1/1.53	100m to 500m	1.99Ω to 9.96Ω

Table 1 - Typical Cable Values

2. Specific Cable Resistances

2.1 Metric Signalling Cables (Copper Conductor)

Group	**Cores/Size**	**Nominal Area (mm^2)**	**Resistance Ω / Km #**
A	1/0.85	0.6	33.20
	9/0.30	0.65	31.70
	N/A	**0.75**	24.80
B	1/1.13	1.0	18.20
	16/0.30	**1.15**	17.80
	N/A	**1.5**	12.20
C	1/1.53	1.85	9.96
	50/0.25	2.45	8.21
	7/0.67	**2.5**	7.56
	1/1.78	**2.5**	7.56
D	7/0.85	4.0	4.70
	7/1.04	6.0	3.11
	7/1.35	**10.0**	1.84
E	7/1.70	**16.0**	1.16
F	7/2.14	25.0	0.73
	19/1.53	35.0	0.53

Group	Cores/Size	Nominal Area (mm^2)	Resistance Ω / Km #
	N/A	**0.75**	24.80
G	19/1.78	**50.0**	0.39
	19/2.14	**70.0**	0.27
H	19/2.52	**95.0**	0.20
J	37/2.03	120.0	0.15
K	37/2.25	150.0	0.13

Table 2 - Metric Signalling Cables

The table 2 shows by group (A to K) cables which are considered operationally equivalent (with a greater or equal number of cores).

The replacement of obsolete types is defined in NR/GN/SIG/11213

2.2 Imperial Signalling Cables (Obsolete)

Group	Cores/Size (inch)	Nominal Area ($inch^2$)	Resistance Ω / Km #
A	9/0.12	0.001	25.60
	1/0.036	0.001	24.97
B	1/0.044	0.0015	16.71
	16/0.012	0.0018	14.45
C	3/0.029	0.002	13.08
	1/0.064	0.003	7.90
	3/0.036	0.003	8.41
	7/0.029	0.0045	5.59
D	7/0.036	0.007	3.59
	7/0.044	0.010	2.41
E	7/0.052	0.0145	1.72
	7/0.064	0.0225	1.14

Group	Cores/Size (inch)	Nominal Area (inch^2)	Resistance Ω / Km #
F	19/0.044	0.03	0.89
	19/0.052	0.04	0.64
	19/0.064	0.06	0.42
G	19/0.083	0.10	0.25
H	37/0.072	0.15	0.17
J	37/0.083	0.20	0.13
K	37/0.103	0.30	0.08

Table 3 - Imperial Signalling Cables (Obsolete)

See the Metric Table for the preferred NR/PS/SIG/00005 operational equivalent(s) in each group.

2.3 Telecoms Cables

Conductor Strands	Diameter (mm)	Resistance Ω / Km #
1	0.63	58.00
1	0.90	27.50
1	1.27	13.75
Aluminium Conductors		
1	16.0	1.89
1	25.0	1.20
1	35.0	0.87
1	50.0	0.65
1	70.0	0.44
1	95.0	0.33

The resistance values are for one core at 20°C; double for loop resistance.

3. Cable Insulation Resistance

3.1 Signalling Cables

Cable Description	Core to Core Resistance (MΩ/km)	Core to Earth Resistance (MΩ/km)
New lineside	50	50
New tail	30	30
Existing lineside	1 (#)	1 (#)
Existing tail	1 (#)	1 (#)

Test at 1000V with 600/1100V grade insulation; test at 250V with 250/440V grade insulation.

 # Values under 1M ohm but above 500k ohms

It is permissible for an on-call manager with SFI Level 2 competency to give authority for cables and wires to continue in service with readings under 1M ohm, but above 500k ohms.

When this authority is used the name of the person giving the authority shall be recorded, along with the date and time on the cable testing record sheet.

When this authority is used the Signal & Telecom Maintenance Engineer shall be advised at a convenient time.

 # Values below 500k ohms but above 200k ohms

It is permissible for an on-call manager with SFI Level 3 competency to give authority for cables and wires to continue in service with values below 500k ohms but above 200k ohms while repair/replacement is arranged.

This requires an assessment of the risks of leaving the cable in service, it shall include as a minimum;

- The signalling functions running through the cable.
- If single cut circuits or earth return circuits run through the cable.
- The type of signalling relay technology employed.
- The condition of the cable route.

- The weather conditions at the point of testing and if they are likely to deteriorate.

As part of the risk assessment, possible mitigation measures can include:

- Implementing special block working measures.
- Imposition of a speed restriction.
- Restricting signalling equipment.
- Temporary monitoring earths or relay states.
- Additional earth testing and/or cable testing.
- Control of work in the area which could disturb cable routes.

When this authority is used the Route Asset Manager (S) shall be advised at a convenient time.

When this authority is used the name of the person giving the authority shall be recorded, along with the date and time on the cable testing record sheet.

Values below 200k ohms but above 20k ohms

It is permissible for the Route Asset Manager (S) to give authority for cables and wires to continue in service with values below 200k ohms but above 20k ohms while repair/replacement is arranged.

This requires an assessment of the risks as described above.

When this authority is used the name of the person giving the authority shall be recorded, along with the date and time on the cable testing record sheet.

Under NO circumstances shall cables or wires with an insulation value of less than 20k ohms remain in service.

3.2 Telecom Cables

Cable Description	Core to Core (MΩ/km)	Core to Earth (MΩ/km)	Moisture Barrier Earth Res. (MΩ/km)
New lineside	1500	1500	150
New tail	1500	1500	150
Existing lineside	50	10 (#)	10 (#)
Existing tail	50	10 (#)	10 (#)

Test at a voltage commensurate with the grade of insulation (e.g. 250V).

\# Under special arrangements authorised by the S&TME, cables with a resistance value less than 10MΩ but not below 1MΩ can be reinstated when found during faulting, or remain in use when identified under testing.

When this authority is used the name of the person giving the authority shall be recorded, along with the date and time on the cable testing record sheet.

A plan of action shall be agreed with the Telecoms Engineer for the restoration of the cable to the agreed minimum value of 10MΩ.

END

1. Primary Cells

Minimum Voltage using a 1Ω Shunt	0.9V

NOTE: *In some cases, it is advisable to replace the cell at a higher threshold (e.g. 1.1V) if there is a possibility due to the loading of the cell of it failing before the next maintenance visit.*

2. Secondary Cells

2.1 Voltages (Per Cell)

Cell Type	**Minimum**	**Nominal**
Lead Acid	2V	2.2V
Alkaline	1V	1.1V

Cell Type	**Nominal**
Cyclon	2.2V

Cell Type	**Nominal**	**Maximum**
Vantage	1.42V to 1.43V	1.43V

2.2 Specific Gravity

Lead Acid Cells	1.220 minimum

3. Voltages for Vantage Batteries

No. of Cells in Battery	**Nominal Voltage**	**Maximum Voltage**
1	1.42V	1.43V
2	2.84V	2.86V
3	4.26V	4.29V
5	7.1V	7.15V
10	14.2V	14.3V
15	21.3V	21.45V
20 #1	28.4V	28.6V
25	35.5V	35.75V

No. of Cells in Battery	Nominal Voltage	Maximum Voltage
30	42.6V	42.9V
35	49.7V	50.05V
40 #2	56.8V	57.2V
45	63.9V	64.35V
50	71V	671.5V
55	71.8V	78.65V
60	85.2V	85.8V
65	92.3V	92.95V
70	99.4V	100.1V
75	106.5V	107.25V
80	113.6V	114.4V
85 #3	120V	121.55V
90	127.8V	128.7V
95	134.9V	135.85V
100	142V	143V

#1: 24V Battery.
#2: 50V Battery.
#3: 110V Battery.

4. Modular Power Box Voltage Tolerances

4.1 Voltage Matrix

Voltage	Minimum	Nominal	Maximum
24V dc	20V dc	24V dc	30Vdc
36V dc	30V dc	36V dc	45V dc
110V ac	92V ac	110V ac	137Vac
120V dc	100Vdc	120V dc	150V dc

END

1. DC BUSBAR EARTH LEAKAGE VALUES

Bus Bar Volts	Reportable		Maximum Acceptable		Safety Maximum	
	V1 or V2	V1 + V2	V1 or V2	V1 + V2	V1 or V2	V1 + V2
10	**5**	**7**	**6**	**8**	**7.5**	**9**
11	**5.5**	**7.7**	**6.6**	**8.8**	**8.2**	**9.9**
12	**6**	**8.4**	**7.2**	**9.6**	**9**	**10.8**
20	**10**	**14**	**12**	**16**	**15**	**18**
22	**11**	**15.4**	**13.2**	**17.6**	**16.5**	**19.8**
24	**12**	**16.8**	**14.4**	**19.2**	**18**	**21.6**
42	**21**	**29.4**	**25.2**	**33.6**	**31.5**	**37.8**
46	**23**	**32.2**	**27.6**	**36.8**	**34.5**	**41.4**
50	**25**	**35**	**30**	**40**	**37.5**	**45**
100	**50**	**70**	**60**	**80**	**75**	**90**
110	**55**	**77**	**66**	**88**	**82**	**99**
120	**60**	**84**	**72**	**96**	**90**	**108**

2. AC BUSBAR EARTH LEAKAGE VALUES

Volts (Vb)	Reportable		Maximum Acceptable		Safety Maximum	
	V1 + V2	V1 - V2 #	V1 + V2	V1 - V2 #	V1 + V2	V1 - V2 #
9	**7.2**	**1**	**8.1**	**1**	**13.5**	**1**
8.5	**6.8**	**0.95**	**7.6**	**0.95**	**12.7**	**0.95**
8	**6.4**	**0.9**	**7.2**	**0.9**	**12**	**0.9**

#: or V2-V1 if V2 is greater than V1.

3. Electronic Monitoring Device Parameters

3.1 Bender IR425 and IR425-D4 (excluding the FAWRS and NYL schemes).

Alarm Levels	DC	AC
Alarm Level 1	100KΩ	20KΩ
Alarm Level 2	50KΩ	11KΩ

3.2 Bender IR425-D4 - FAWRS and NYL schemes ONLY

The alarm levels are customised for each location/site, and the details of these levels can be found on the wiring diagrams.

3.3 Busbar Monitoring Device.

Severity Level	DC	AC
Reportable	150KΩ	50KΩ
Minimum Acceptable	100KΩ	20KΩ
Safety Minimum	50KΩ	11KΩ

END

AUTOMATIC WARNING SYSTEM (AWS)

1. “BR” and Howells Style AWS Magnets

1.1 Height

Above/below rail level	±12mm

1.2 Inductor Wiring

Yellow Inductor: 12V Operation (Parallel Coils)				
Magnet Type	**Connections**			
	Strap		**B12**	**N12**
Old Pattern	1 and 2	3 and 4	4	1
New Pattern (First Issue)	1 and 2	3 and 4	1	4
New Pattern (Latest Issue)	1 and 2	3 and 4	4	1

Yellow Inductor: 24V Operation (Series Coils)			
Magnet Type	**Connections**		
	Strap	**B12**	**N12**
Old Pattern	2 and 3	4	1
New Pattern (First Issue)	2 and 3	1	4
New Pattern (Latest Issue)	2 and 3	4	1

Green Inductor: 60V Operation (Extra Strength)			
Magnet Type	**Connections**		
	Strap	**B12**	**N12**
Green	None	4	1

1.3 Voltage & Current Readings

Electro-Magnet Voltages/Current Permutations						
Inductor	**Coils Parallel /Series**	**Voltage Nominal**	**Voltage Min**	**Voltage Max**	**Current Nominal**	**Casing Extends Below Sleeper Level?**
Yellow Electro Mk1	P	12V	10.5V	-	0.75A	Yes
	S	24V	21V	-	0.38A	
Yellow Electro Mk2	P	12V	10.8V		0.85A	No
	S	24V	21.6V	24V	0.45A	No

Electro-Magnet Voltages/Current Permutations						
Inductor	**Coils Parallel /Series**	**Voltage Nominal**	**Voltage Min**	**Voltage Max**	**Current Nominal**	**Casing Extends Below Sleeper Level?**
Green Electro Mk1	P	24V	-	-	2.3A	Yes
	S	48V	-	-	1.15A	Yes
Green Electro Mk2	-	60V	51V	60V	1.5A	No
Yellow Supp.	-	24V	22.8V	25.8V	1.26A	Yes
Yellow Supp. (Vortok Hardwired Variant 062/006813)	-	24V	22.8V	26.4V#	1.5A	No
Green Supp. Mk2	-	110V	93.5V	121V	2.3A	No

It is acceptable for this voltage to be as high as 32V DC where the AWS is fed via a full wave rectification T/J, and the multimeter used is not a True RMS meter.

1.4 Coil Resistances

The Coil Resistances shown below are nominal @20oC, for each 1oC the temperature increases, the resistance increases by approx. 0.4%

Standard Strength - Electro-Magnets	
24V Operation (Coils Wired in Series)	60Ω
12V Operation (Coils Wired in Parallel)	15Ω

Extra Strength Mk1 - Electro-Magnets	
Electro Magnet	Not Available
Suppressor Magnet	Not Available

Extra Strength Mk2 - Electro-Magnets	
Electro Magnet	37Ω
Suppressor Magnet	48Ω

When testing the AWS standard strength suppressor magnet using a calibrated S&P meter it should be noted that in some track circuited areas the ‘E’ and ‘P’ indicator can oscillate between the two indications when ‘suppression’ is active. This is not a fault condition.

2. Vortok AWS Magnets

NOTE: *There are 2 Series of Vortok AWS magnets. The newer Series 2 range are identified by the words "SERIES II" cast into the top of the magnet cover.*

They are plug compatible and fixing compatible with the earlier Series 1 and can be used as functional replacements.

Reference shall be made to the table entries for the Current values for the Series 2 range.

When testing any plug coupled equipment an approved break out device shall be used.

Meter leads or prods shall not be brought into contact with the plug coupled pins or sockets.

2.1 Height

The top surface of the Vortok AWS magnet shall be installed with respect to new rail	-2 to -5mm

NOTE: *The RFF mounting kit provides the correct spacers to place the magnet at the required height.*

2.2 Inductor Wiring

NOTE: *Plug coupler contact allocations specified in standard drawing T00036.*

Magnet Type	**Plug coupler contact number**	
	Feed	**Return**
Yellow or Green	1/A	2/B

2.3 Voltage and Current Readings

Voltages/Current Permutations measured at the magnet					
Inductor	**Voltage Nominal**	**Voltage Min (-20% Nom)**	**Voltage Max (+10% Nom)**	**Max Current Nominal** (Not Drawing More)	**Casing Extends Below sleeper level?**
Yellow Electro (YE)	24V	19.2VDC	26.4VDC	0.5A	No
Yellow Supp. (YS)	24V	19.2VDC	26.4VDC	1.5A	No
Green Electro (GE)	110VAC	88VAC	121VAC	1.5A	No
Green Supp (GS)	110VAC	88VAC	121VAC	2.5A	No
Yellow Electro (YE) Series 2	24V	19.2VDC	26.4VDC	0.5A	No
Yellow Supp. (YS) Series 2	24V	19.2VDC	26.4VDC	1.4A	No
Green Electro (GE) Series 2	110VAC	88VAC	121VAC	1.25A	No
Green Supp (GS) Series 2	110VAC	88VAC	121VAC	2.0A	No
Yellow Electro (YE110) Series 2	110VAC	88VAC	121VAC	0.5A	No
Yellow Supp (YS110) Series 2	110VAC	88VAC	121VAC	0.75A	No

2.4 Coil Resistances

Coil Impedances – All variants	
There are no valid testable Coil Impedance values as the coil is electronically switched and this therefore an effective Open Circuit when not powered.	N/A

3. Yardene Single Arm AWS Magnets

These magnets should not be tested using a “Strength and Polarity Meter”

Figure 1 - Standard Strength Magnet (Yellow)

Figure 2 - Extra Strength Magnet (Green)

There is no maintenance on this type of magnet, but to allow these magnets to be eliminated during fault or incident investigation, their height may need to be measured.

Height

Above/below rail level	-17mm to -35mm

4. Train Protection and Warning System (TPWS)

4.1 Module types and details

TPWS Interface Module		
Type	**Arm freq.**	**Trigger freq.**
Signaling Interface Module (red)	NA	NA

Overspeed Sensor Module		
Type	**Arm freq.**	**Trigger freq.**
Normal direction (yellow)	64.25kHz f1	65.25kHz f2
Opposite direction (blue)	64.75kHz f4	65.75kHz f5

Train Stop Module		
Type	**Arm freq.**	**Trigger freq.**
Normal direction (green)	66.25kHz f3	65.25kHz f2
Opposite direction (brown)	66.75kHz f6	65.75kHz f5

Table 1 - Module types and details

4.2 TPWS Testing Values

Maintenance Jig Readings (all track types)		
Loop NOT energised	**Minimum**	**Maximum**
All Loops	NA	2mV (at the TPWS frequency)
Loop Energised	**Minimum**	**Maximum**
Standard Transmitter Loop	29mV	53mV
Buffer Stop Mini-Loop	59mV	107mV (use 500mV AC range)

Table 2 - Maintenance Jig Readings

Commissioning Jig Readings (Loop Energised)		
Location	**Loop Type**	**Minimum**
NOT on concrete slab track	Standard Transmitter Loop	5.65mV
	Buffer Stop Mini-Loop	4.26mV
On concrete slab track	Standard Transmitter Loop	6.70mV
	Buffer Stop Mini-Loop	4.69mV

Table 3 - Commissioning Jig Readings

4.3 TPWS Transmitter Loop Heights

Loop Type	**Height Below Rail Level**	
	Minimum	**Maximum**
NOT On Concrete Slab Track		
All Loops	60mm	100mm
On Concrete Slab Track (Standard Tx Loop)		
0 to 50m	20mm	60mm #
50 to 150m	20mm	50mm #
150 to 250m	20mm	40mm #
250 to 350m	20mm	30mm #
350 to 500m	20mm	20mm #
Buffer Stop Mini-Loop	20mm	60mm

Table 4 - Loop Heights

Suggested maximum.

To compensate for the attenuation effect caused by the length of TPWS loop feeder cabling, it is suggested that the depth of the standard TPWS transmitter loop on concrete slab track is reduced for longer lengths of loop feeder cabling as above.

5. Eurobalise

5.1 Centreline Fitment Tolerance

All Balise/Beacons	**Tolerance from Centre Line**
All types	±15mm

5.2 Torque Values

Alstom Atlas 200	
Mounting method	**Torque Values**
Vortok installation	20Nm
Direct mounting	30Nm

Ansaldo	
Mounting Method	**Torque Values**
E-Clip Bracket	10Nm
Fast Clip Bracket	
Timber/concrete Bracket	

Siemens S21	
Mounting Method	**Torque Values**
Vortok installation	38Nm
Direct mounting	

Tracklink III	
Mounting Method	**Torque Values**
Concrete or Wooden Sleeper	40Nm ± 5Nm

TASS	
Mounting Method	**Torque Values**
Bracket mounting bolts	Up to 15Nm
Bracket mounted Balise	5Nm
Concrete mounting	20-25Nm

5.3 Bolts and Spacers

Balise	**Bolt**	**Spacer**	**Washer**	**Nuts**
Alstom Atlas	See Alstom Atlas 200 table below		2 Tab washers 2 Thrust washers	N/a
Ansaldo	M12 x 70mm	Nylon bush	4 M12 Nordlock 4 Tab washers	N/a
Siemens S21	See Siemens S21 table below.		N/a	N/a

TASS	M12x80mm (Concrete) M6x60mm (Timber)		8x25mm washers	M8 Nylock
Tracklink III	M10 x 75mm (concrete)	n/a	n/a	n/a

For Alstom Atlas 200 Only

Alstom Atlas 200 ONLY	
Height of overall spacer used	**Length of M12 bolt required**
No Spacer	**90mm**
20mm	**110mm**
25mm	**115mm**
30mm	**120mm**
35mm	**125mm**
40mm	**130mm**

For Siemens S21 Only

Siemens S21 ONLY		
Shim Height	**M10 Bolt Length**	**M12 Woodscrew**
0mm	**50mm**	**80mm**
10mm	**60mm**	**90mm**
20mm	**70mm**	**100mm**
30mm	**80mm**	**120mm**
40mm	**90mm**	**130mm**
50mm	**100mm**	**140mm**
60mm	**110mm**	**160mm**
70mm	**120mm**	**170mm**
80mm	**130mm**	**180mm**
90mm	**140mm**	**190mm**
100mm	**150mm**	**200mm**

END