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Compliance date:	02 March 2024

Level 3

Work Instruction

Signal Maintenance Testing Handbook

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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

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

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Issue record

Issue	Date	Comments
12	September 2018	Update for new and updated SMTH items
13	June 2019	Update for new and updated SMTH items
14	Mar 2020	Update for new and updated SMTH items
15	December 2020	Update for new and updated SMTH items
16	September 2021	Update for new, updated and re-organised SMTH items
17	June 2022	Update for new and updated SMTH items
18	March 2023	Update for new and updated SMTH items
19	December 2023	Update for new and updated SMTH items

Legislation

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

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Contents

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1 Purpose

This document contains the index to the Signal Maintenance Testing (NR/SMTH) The SMTH provides a maintenance testing regime for the replacement or installation of signalling equipment that does not affect the application logic of the system or, the controls of the system that have previously been tested to signal works testing.

2 Scope

Signalling equipment that is replaced or renewed on a like for like basis under corrective maintenance, temporary design as a result of an incident or engineering works and minor signalling renewals that do not affect the application logic of the system or, the controls of the system that have previously been tested to signal orks testing.

3 Definitions

Definition	Meaning
Application Logic	Any technology-based method that configures a product so as to provide site specific command and control instructions. Application logic includes: a) mechanical logic (e.g. in lever frames); b) electro-mechanical logic (e.g. in relay interlocking); c) electronic switching or code (e.g. in electronic interlocking, telephone concentrators or cab secure radio); d) any combination of the above.
Maintenance Testing	The removal and restoration of a product in a previously operational system, where the work does not change the configuration or functionality of the system. Engineering details are not provided for the work, and instead the existing infrastructure records are used as the reference documents. Typically, such work is carried out to replace/repair defective or life-expired products. The work may involve replacing the original item of equipment with the exact same new or refurbished item or replacing it with a different make that is identical in all areas (apart from visual appearance) to the original. Work undertaken by maintenance testing shall not exceed the definition of extensive and simultaneous.

Definition	Meaning
Works Testing	Works testing consists of the construction/installation of new or modified products and/or application logic where the work changes, or potentially changes, the configuration or functionality of the system. The work is carried out in accordance with engineering details supplied for the purpose. For the purposes of this document, the definition includes: a) the installation of totally new systems. b) the alteration of existing systems; and c) the abolition (also known as 'recovery') of existing systems.
Maintenance Tester	An individual with the competencies and authority to work appropriate to the required work assigned to specify and/or perform the tests necessary to ensure that the physical implementation of a design is correct and meets all the specified test and acceptance criteria.
Test Plan	A test plan comprises any document or suite of documents that determines and defines the processes, resources and specifications required for the testing and commissioning of a product at a specific location.

4 Links to Section Indexes

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5 Master Index

This Index contains the current master list of documents, Issue, Issue Date and Compliance Dates.

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Module 03	Responsibilities of Staff Prior to Testing Starting	1	04/09/2021	04/12/2021
Module 04	Competency of Staff	3	02/12/2023	02/03/2024
Module 05	Test Plan Requirements	1	04/09/2021	04/12/2021
Module 06	Independence Exempt Test Plans	1	04/09/2021	04/12/2021
Module 07	Maintenance Testing - Like for Like Replacement	1	04/09/2021	04/12/2021
Module 08	Pre-Planned Work and Non-Corrective Maintenance Testing	1	04/09/2021	04/12/2021
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Module 10	Completion of the SMTH Log sheet	3	02/12/2023	02/03/2024
Module 11	Testing Where No Maintenance Test Plan Exists	1	04/09/2021	04/12/2021
Module 12	The Diversion of a Circuit/Relay Contact or Emergency Equipment Relocation	2	04/06/2022	03/09/2022
Module 13	Procedure for Monitoring a Damaged Cable	1	04/09/2021	04/12/2021
Module 14	Site and Testing Records	3	02/12/2023	02/03/2024
Module 15	Balise – Certificate of Conformity Requirements	1	04/09/2021	04/12/2021
Module 16	Action Definitions	2	04/06/2022	03/09/2022

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Form 02	Maintenance Test Plan List (including G130 Test Plans)	1	04/09/2021	04/12/2021
Form 04	Balise – Certificate of Conformity	1	04/09/2021	04/12/2021
Form 06	Point Permutation Chart: One Point End	1	04/09/2021	04/12/2021
Form 07	Point Permutation Chart: Two Point Ends	1	04/09/2021	04/12/2021
Form 08	Point Permutation Chart: Three Point Ends	1	04/09/2021	04/12/2021
Form 09	Point Permutation Chart: Four Point Ends	1	04/09/2021	04/12/2021
Form 10	Point Permutation Chart: Five Point Ends	1	04/09/2021	04/12/2021

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Form 12	Train Protection Warning System (TPWS) Failure Report Form	1	04/09/2021	04/12/2021
Form 13	Wrong Side Failure or Incident Check Sheets	1	04/09/2021	04/12/2021
Form 14	Intermittent / Obscure Failure Check Sheets	1	04/09/2021	04/12/2021
Form 15	Wire Count Grid Sheet - Bus Bar and Terminal Wire	2	04/06/2022	03/09/2022
Form 16	Wire Count Grid Sheet – BR930 Series Relay Base	2	04/06/2022	03/09/2022
Form 17	Wire Count Grid Sheet - Cable Core	3	04/03/2023	03/06/2023
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Form 20	Wire Count Grid Sheet - WAGO Terminations	1	04/06/2022	03/09/2022
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Check A03	Defined Check: Check for Safe Insulation	6	04/06/2022	03/09/2022
Check A04	Defined Check: Check for Correct Installation	7	04/06/2022	03/09/2022
Check A05	Defined Check: Check for Correct Isolation	6	04/06/2022	03/09/2022
Check A06	Defined Check: Check for Correct Labelling	8	04/03/2023	03/06/2023
Check A07	Defined Check: Correlation Check	6	04/06/2022	03/09/2022
Test B01	Defined Test: Wire Count	8	04/09/2021	04/12/2021
Test B02	Defined Test: Continuity Test	5	05/03/2011	03/09/2011
Test B03	Defined Test: Insulation Test	7	05/12/2020	05/06/2021
Test B04	Defined Test: Cable Function Test	5	05/03/2011	03/09/2011
Test B05	Defined Test: Earth Test (DC up to a nominal 120V)	6	03/03/2018	31/05/2018
Test B06	Defined Test: Earth Test (AC up to a nominal 110V)	5	05/03/2011	03/09/2011
Test B07	Defined Test: Aspect Test	6	03/03/2018	31/05/2018
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Test B10	Defined Test: Tokenless Block Controls Test (BRB Type)	6	05/12/2020	05/06/2021

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Test B13	Defined Test: Token Block Controls Test	5	05/03/2011	03/09/2011
Test B14	Defined Test: Tablet Block Controls Test	6	05/12/2020	05/06/2021
Test B15	Defined Test: No Signaller Key-Token Block Controls Test	5	05/03/2011	03/09/2011
Test B16	Defined Test: No Signaller Token Remote (NSTR), No Signaller Token (NST) Block Controls Test	5	05/03/2011	03/09/2011
Test B17	Defined Test: Absolute Block Recovery Test	8	05/12/2020	05/06/2021
Test B18	Defined Test: Tokenless Co-operative Cancel Test (Direction Lever)	5	05/03/2011	03/09/2011
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Test B24	Defined Test: SSI Trackside Functional Module Test	5	05/03/2011	03/09/2011
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AC02	Replace a ATP LEU (Chilterns)	7	04/09/2021	04/12/2021
AC03	Replace an ATP Interface (Chilterns)	7	04/09/2021	04/12/2021
AG01	Replace an ATP Beacon (GWML)	7	04/09/2021	04/12/2021
AG02	Replace an ATP Loop (GWML)	7	04/09/2021	04/12/2021
AG03	Joint/Add a Length of Cable to a ATP Loop (GWML)	6	05/12/2020	05/06/2021
AG04	Replace an ATP Encoder (GWML)	6	05/12/2020	05/06/2021
AG05	Replace an ATP Parameter Plug (GWML)	6	05/12/2020	05/06/2021
AG06	Replace an ATP LIT (GWML)	6	05/12/2020	05/06/2021
AP01	Replace a TPWS Plug-in Module	6	01/06/2019	07/09/2019
AP02	Replace or Repair a TPWS Transmitter Loop	8	04/09/2021	04/12/2021
AP04	Replace a TPWS Baseplate or Trackside Enclosure Plugboard Panel	7	01/06/2019	07/09/2019
AP05	Replace a TPWS Failure Indication Unit (FIU)	6	01/06/2019	07/09/2019
AW01	Replace an AWS Permanent Magnet	8	04/09/2021	04/12/2021
AW02	Replace an AWS Electro-Inductor	10	04/09/2021	04/12/2021
AW03	Replace a TrainStop/Trip Cock Tester	7	05/12/2020	05/06/2021
AW04	Replace a Trainstop Power Pack	6	05/12/2020	05/06/2021
AW05	Replace an Indusi Trainstop	6	05/12/2020	05/06/2021

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AX01	Replace an AzL 70, 70/30 and 70/30s Evaluator Card	7	04/09/2021	04/12/2021
AX02	Replace an AzL 70, 70/30 and 70/30s Count Head or Lineside Amplifier	8	04/09/2021	04/12/2021
AX03	Replace a SK30H Rail Contact (AzLM)	8	02/12/2023	02/03/2024
AX04	Replace a EAK30H Unit (AzLM)	8	02/12/2023	02/03/2024
AX05	Replace an EAK30H Board (AzLM)	8	02/12/2023	02/03/2024
AX06	Replace a EP/EPCM CPU Card (AzLM)	8	02/12/2023	02/03/2024
AX07	Replace an ACE Serial/Parallel Card (AzLM)	8	02/12/2023	02/03/2024
AX08	Remove and Refit Rail Contact (All Azl & AzLM)	4	02/12/2023	02/03/2024
AX09	Replace an EAK30K Unit (AzLM)	3	02/12/2023	02/03/2024
AX10	Replace an Rail Contact Adaptor (RCA) (AzLM)	3	02/12/2023	02/03/2024
AX11	Replace a SK30K Rail Contact (AzLM)	3	02/12/2023	02/03/2024
AX20	Replace a Siemens AzS 350 U Axle Counter Card (VESBA)	3	04/06/2022	03/09/2022
AX21	Replace a Siemens AzS 350 U Axle Counter Card (SIRIUS2, STEU, VAU)	3	04/06/2022	03/09/2022
AX22	Replace a Siemens AzS 350 U Axle Counter Card (BLEA12)	4	02/12/2023	02/03/2024
AX23	Replace a Siemens AzSM(E) Axle Counter VENUS2 CPU Card	2	05/12/2020	05/06/2021
AX24	Replace a Siemens AzSM (E) Axle Counter non CPU Card	2	05/12/2020	05/06/2021
AX25	Replace a Siemens AzSM (E) Axle Counter ZAN Card	2	07/03/2020	06/06/2020
AX26	Replace a Siemens Axle Counter DEK 43 Wheel Detector or Trackside Connection Box	3	04/09/2021	04/12/2021
AX27	Replace a Siemens Axle Counter ZP 43 PCB Card	4	04/03/2023	03/06/2023
AX28	Replace a Siemens WSD Wheel Detector (ACM 100 Axle Counter)	3	03/03/2018	31/05/2018
AX29	Replace a Siemens Axle Counter ACM 100 Module	2	03/03/2018	31/05/2018
AX30	Replace a Siemens Axle Counter System Sub-Components	2	03/03/2018	31/05/2018
AX31	Replace a Siemens WSD Wheel Detector secured with Rail Clamp (ACM 100 Axle Counter)	4	04/06/2022	03/09/2022
AX40	Replace a Frauscher wheel sensor RSR123	9	02/12/2023	02/03/2024
AX41	Replace an Advanced Evaluation Board AEB	2	04/06/2022	03/09/2022
AX42	Replace a COM-AdC and/or COM-WNC Board	3	04/06/2022	03/09/2022

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AX43	Replace a (Compact Flash) CF Card	2	07/03/2020	06/06/2020
AX44	Replace an Overvoltage Protection Unit BSI005	4	04/03/2017	31/05/2017
AX45	Replace a Power Supply Board (Crowbar)	2	04/06/2022	03/09/2022
AX46	Replace an Input/Output Extension Board IO-EXB	2	04/06/2022	03/09/2022
AX50	Replace a Frauscher IMC Board	4	07/03/2020	06/06/2020
AX51	Replace a Frauscher ASC2000 Axle Counter Board ACB	2	07/03/2020	06/06/2020
AX52	Replace a Frauscher ACS2000 : SIC Fuse Board	2	07/03/2020	06/06/2020
AX53	Remove and Refit Frauscher Wheel Sensor RSR123	2	02/12/2023	02/03/2024
AX60	Replace a Converter ISDN Ethernet (CIE) (AzLM)	2	02/12/2023	02/03/2024
AX61	Replace a Converter ISDN Ethernet (CIE) DC - DC Power Supply (AzLM)	2	02/12/2023	02/03/2024
AX62	Replace a Single Channel Controller (SCC) CPU Card (AzLM) in a 2oo2 system	3	02/12/2023	02/03/2024
AX63	Replace a Power Data Coupling Unit (PDCU) (AzLM)	2	02/12/2023	02/03/2024
AX64	Replace a DC - DC Convertor (Power Supply to EAK) (AzLM)	2	02/12/2023	02/03/2024
AX65	Replace an ACE DC - DC Power Card (AzLM) 2oo2 ACE	2	02/12/2023	02/03/2024
AX66	Replace an ISDN V.24 Converter	3	02/12/2023	02/03/2024
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AX70	Replace a Sedlbauer unit (PMC Transformer) (AzLM)	2	02/12/2023	02/03/2024
AX73	Replace a Single Channel Controller (SCC) CPU Card (AzLM) in a 2oo3 system	1	02/12/2023	02/03/2024
AX74	Replace an ACE DC - DC Power Card (AzLM) 2oo3 ACE	1	02/12/2023	02/03/2024
AX95	Replace a RSE Wheel Sensor Assembly	2	04/09/2021	04/12/2021
AX96	Replace a RSE Wheel Sensor Assembly Cable Junction Box	2	04/09/2021	04/12/2021
AX97	Replace a ARS 4 Evaluation Board or Enclosure	1	03/03/2018	31/05/2018
AX98	Replace a ARS 4 Power Supply	1	03/03/2018	31/05/2018
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BA03	Replace a Balise or Beacon	2	04/09/2021	04/12/2021
BA07	Program a Balise or Beacon	2	05/12/2020	05/06/2021
BA08	Replace an Alstom Switchable Balise	3	04/09/2021	04/12/2021

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BA12	Replace a KVB Balise	2	04/09/2021	04/12/2021
BA13	Replace a KVB Encoding Plug	1	01/09/2018	01/12/2018
BA14	Replace a KVB UCS Processor Card	1	01/09/2018	01/12/2018
BA15	Replace a KVB ECI (Input) or KVB SBI (Output) Card	1	01/09/2018	01/12/2018
BA16	Replace a KVB Attenuator	1	01/09/2018	01/12/2018
BA17	Replace a KVB Encoder Power Card	1	01/09/2018	01/12/2018
BA18	Replace a KVB Encoder Rack-Housing	1	01/09/2018	01/12/2018
BA19	Program a Siemens S21 Switchable (Transparent) Eurobalise	1	04/09/2021	04/12/2021
BA20	Replace a Siemens S21 Switchable (Transparent) Eurobalise	1	04/09/2021	04/12/2021
BA22	Replace a Siemens S21 MS Lineside Electronic Unit (LEU)	1	04/09/2021	04/12/2021
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BL02	Replace a Block Switch	6	05/12/2020	05/06/2021
BL03	Replace a Block Winder	6	05/12/2020	05/06/2021
BL04	Replace a Single Line Block Instrument	6	05/12/2020	05/06/2021
BL05	Replace a Control Instrument	6	05/12/2020	05/06/2021
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CA02	Renew a Lineside Multi-Core Cable	7	04/06/2022	03/09/2022
CA03	Renew a Cable or Wire	9	04/06/2022	03/09/2022
CA04	Joint or Add a Length of Cable or Line Wire	7	04/06/2022	03/09/2022
CA05	Divert a Faulty Cable Core	8	04/06/2022	03/09/2022
CA06	Renew a Plug Coupled Cable (“interconnect”) with a Non-Certified Replacement	2	04/06/2022	03/09/2022
CA07	Renew a Plug Coupled Cable (“interconnect”) with a Certified Replacement	2	04/06/2022	03/09/2022
CA08	Replacing one end of a damaged “interconnect” cable	4	04/03/2023	03/06/2023
CA09	Replace a panel mounted wired receptacle or plug (Non-Cert)	3	04/06/2022	03/09/2022
CA10	Replace a panel mounted wired receptacle or plug (Certified Replacement)	2	04/06/2022	03/09/2022
CA11	Replace a Non-Standard Westrace Plug Coupler Wiring Loom	1	01/06/2019	07/09/2019
CA12	Remove and Refit a Multi-Core Cable	1	04/06/2022	03/09/2022
CA13	Re-termination of a Broken Existing Cable Core or Wire	1	04/06/2022	03/09/2022
CA14	Replace AZLM Axle Counter Lineside Cable	1	04/03/2023	03/06/2023
CA21	Renew a Single Ended Plug Coupled Cable (“lead”) with a Certified Replacement	1	04/06/2022	03/09/2022

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CA22	Renew a Single Ended Plug Coupled Cable ("lead") with a Non-Certified Replacement	1	04/06/2022	03/09/2022
CA31	Renew a Telegraph Line Wire	1	04/06/2022	03/09/2022
CA32	Remove and Refit a Telegraph Line Wire	1	04/06/2022	03/09/2022
CA40	Replace a Frauscher Concentrator 'Hotlink' Crossover Cable	1	04/06/2022	03/09/2022
CE01	Replace a Secondary Cell or Battery	9	04/06/2022	03/09/2022
CE02	Replace a Primary Cell or Battery	8	04/06/2022	03/09/2022
DE01	Replace a Detonator Placer	6	05/12/2020	05/06/2021
EL01	Replace a Fuse Holder	7	04/09/2021	04/12/2021
EL02	Replace a Barrelled or Clip in Component	7	02/12/2023	02/03/2024
EL03	Replace a Wire Ended Component	6	05/12/2020	05/06/2021
EL04	Replace a Filament Lamp	9	04/09/2021	04/12/2021
EL05	Replace a Filament Lamp Holder and/or Springs	6	05/12/2020	05/06/2021
EL06	Replace a Terminal Block	7	07/03/2020	06/06/2020
EL07	Replace a Non Plug in Unit	6	05/12/2020	05/06/2021
EL08	Replace a Plug in Unit	9	04/09/2021	04/12/2021
EL09	Remove and Replace a Plug in Unit - Relay	2	07/03/2020	06/06/2020
EL10	Replace an Audible Unit	7	04/06/2022	03/09/2022
EL11	Replace a Push Button or Switch Unit	6	01/09/2018	01/12/2018
EL12	Replace a Plugboard	6	05/12/2020	05/06/2021
EL13	Re-allocate a Contact	6	05/12/2020	05/06/2021
EL14	Replace a Geographical Relay Unit	6	05/12/2020	05/06/2021
EL15	Replace a Contact	7	07/03/2020	06/06/2020
EL16	Replace a Panel Tile	6	05/12/2020	05/06/2021
EL17	Replace an Electromagnetic Lock	2	03/03/2018	31/05/2018
EL18	Remove and Refit a Contact Bank	6	05/12/2020	05/06/2021
EL19	Replace a Printed Circuit Board (PCB) in an Ansaldo T72 Point Machine Junction Box	2	05/12/2020	05/06/2021
EL20	Removing Dim resistor associated with LED signal head/signal module	2	05/12/2020	05/06/2021
EL21	Replace a Light Emitting Diode (LED) Signal Light Module (SLM)	7	05/12/2020	05/06/2021
EL22	Replace a Howells LED SL35 Light Engine	4	04/06/2022	03/09/2022
EL23	Replace a Dispatch Interface Unit	1	04/09/2021	04/12/2021
EL24	Replace an Encapsulated LED Indicator	1	04/09/2021	04/12/2021
EL25	Replace an Automatic Gate Closer	1	03/03/2018	31/05/2018
EL26	Replace an ABB Power Switch	1	01/06/2019	07/09/2019
EL27	Replace an Intelligent Infrastructure Busbar Monitor	2	05/12/2020	05/06/2021
EL28	Replace a CHINFA DRP20 Redundancy Unit	1	01/06/2019	07/09/2019
EL29	Replace a Furse Surge or Lightning Protector	1	01/06/2019	07/09/2019
EL30	Replace a GE UPS Inverter Module	1	01/06/2019	07/09/2019

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EL31	Replace a GE UPS Inverter Monitor Module	1	01/06/2019	07/09/2019
EL32	Replace a GE UPS Rectifier Controller Module	1	01/06/2019	07/09/2019
EL33	Replace a GE UPS Rectifier Module	1	01/06/2019	07/09/2019
EL34	Replace a Miniature Circuit Breaker	2	04/06/2022	03/09/2022
EL35	Replace a SIPLUS LOGO Power Supply	1	01/06/2019	07/09/2019
EL36	Replace a PULS Power Supply	1	01/06/2019	07/09/2019
EL37	Replace a PULS Redundancy Unit	1	01/06/2019	07/09/2019
EL38	Replace a Powerone AC-DC Converter	1	01/06/2019	07/09/2019
EL39	Replace a Schneider Relay	1	01/06/2019	07/09/2019
EL40	Replace a Standard Shunt	1	01/06/2019	07/09/2019
EL42	Replace a Siemens SITOP PSU200M Power Supply Unit	1	01/06/2019	07/09/2019
EL43	Replace a Siemens SITOP UPS1600 UPS Unit	1	01/06/2019	07/09/2019
EL44	Replace a Phoenix Contact - Battery Management Module Unit	1	04/06/2022	03/09/2022
EL45	Replace a Phoenix Contact - Power Supply Unit	1	04/06/2022	03/09/2022
EL46	Replace a Phoenix Contact - Quint DC-UPS Unit	1	04/06/2022	03/09/2022
EL48	Replace a Meanwell - Power Supply Unit	1	04/06/2022	03/09/2022
EL49	Replace a Lineside Disconnection Box	2	04/06/2022	03/09/2022
EL50	Upgrade a TRTS Push Button	1	04/09/2021	04/12/2021
EL51	Replace a Missing Link	1	04/09/2021	04/12/2021
EL52	Replace a STEGO Heater	1	04/06/2022	03/09/2022
EL53	Replace a Hygrotherm	1	04/06/2022	03/09/2022
EL54	Replace a Remote Disconnection Device (RDD)	1	02/12/2023	02/03/2024
HD01	Remove and Refit a Phoenix MB HABD Equipment (for Tamping Work)	1	04/09/2021	04/12/2021
HD02	Remove and Refit EPOS HABD Equipment (for Tamping Work)	2	04/06/2022	03/09/2022
HD03	Remove and Replace an EPOS HABD - Rail Sensor	1	04/06/2022	03/09/2022
HD04	Remove and replace an EPOS HABD - Sensor Module	1	04/06/2022	03/09/2022
IE02	Cambrian ERTMS: Replace a Vital Single Programmable Printed Circuit Board and/or associated Dongle	2	03/03/2018	31/05/2018
IE03	Cambrian ERTMS: Replace a Non Programmable Printed Circuit Board	2	05/12/2020	05/06/2021
IE06	Cambrian ERTMS: Replace an Item of Plug and Play Equipment	2	04/06/2022	03/09/2022

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IE07	Cambrian ERTMS: Replace a Non-Vital Programmable Device	3	02/12/2023	02/03/2024
IE08	Replace a PVF rack (Ansaldo Interlocking)	3	01/06/2019	07/09/2019
IE09	Cambrian ERTMS: Replace a Plug in Power Supply	2	04/06/2022	03/09/2022
IE12	Replace an Ansaldo Eurobalise Mounting Bracket	2	07/03/2020	06/06/2020
IE14	Replace a CRCD Board (Ansaldo Interlocking)	3	01/06/2019	07/09/2019
IE15	Cambrian ERTMS: Replace an ISDN/V24 Converter	2	04/06/2022	03/09/2022
IE16	Cambrian ERTMS: Replace a Fibre Optic or LAN Patch Cord	2	04/06/2022	03/09/2022
IE18	Replace a CALMS2 Board (Ansaldo Interlocking)	2	01/06/2019	07/09/2019
IE19	Replace a CALS Board (Ansaldo Interlocking)	2	01/06/2019	07/09/2019
IE20	Replace a CAP Board (Ansaldo Interlocking)	2	01/06/2019	07/09/2019
IE21	Replace a CAP Dongle (Ansaldo Interlocking)	2	01/06/2019	07/09/2019
IE22	Replace a CIER2 Board (Ansaldo Interlocking)	2	01/06/2019	07/09/2019
IE23	Replace a CME+ Board (Ansaldo Interlocking)	2	01/06/2019	07/09/2019
IE24	Replace a CP module (Ansaldo Interlocking)	1	03/03/2018	31/05/2018
IE26	Replace a CVO Board (Ansaldo Interlocking)	2	01/06/2019	07/09/2019
IE27	Replace a CVO Dongle (Ansaldo Interlocking)	1	03/03/2018	31/05/2018
IE29	Replace a IOM-AG module (Ansaldo Interlocking)	2	01/06/2019	07/09/2019
IE30	Replace a IOM-SX module (Ansaldo Interlocking)	2	01/06/2019	07/09/2019
IE31	Replace a MTOR Dongle (Ansaldo Interlocking)	2	01/06/2019	07/09/2019
IE32	Replace a MTOR2 Board (SEI-CLSS)	2	01/06/2019	07/09/2019
IE33	Replace a RIF computer (Ansaldo Interlocking)	1	03/03/2018	31/05/2018
IE34	Replace a VSS or 24VP fuse (Ansaldo Interlocking)	2	01/06/2019	07/09/2019
IF01	Replace an Atlas 200 ETCS Network Transmission Gateway LRU	3	02/12/2023	02/03/2024
IF02	Replace an Atlas 200 RBC Computing Subsystem Module	3	02/12/2023	02/03/2024
IF03	Replace an Atlas 200 RBC Fan Unit	1	03/03/2018	31/05/2018
IF04	Replace an Atlas 200 RBC Front Panel Fuse	1	03/03/2018	31/05/2018
IF05	Replace an Atlas 200 RBC I/O Subsystem Module	1	03/03/2018	31/05/2018

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IF06	Replace an Atlas 200 RBC Main PSU	2	04/09/2021	04/12/2021
IF07	Replace an RBC Maintenance Supervision System (MSS) Gateway PC / Wyse Terminal	3	04/09/2021	04/12/2021
IF08	Replace an RBC Maintenance Supervision System (MSS) Sub-Component	4	02/12/2023	02/03/2024
IF10	Replace an Atlas 200 LEU COBALT Micro-Coder	1	03/03/2018	31/05/2018
IF11	Replace an Atlas 200 LEU Configuration Key	1	03/03/2018	31/05/2018
IF12	Replace an Atlas 200 LEU MIPS200 Power Supply	1	03/03/2018	31/05/2018
IG10	Replace a Futur 2500 Radio Block Centre (RBC) System - Vital Printed Circuit Board and Associated Dongle	1	03/03/2018	31/05/2018
IG11	Replace a Moviola - Vital Printed Circuit Board and Associated Dongle	1	03/03/2018	31/05/2018
IG12	Replace a Reliable Data Storage - Vital Printed Circuit Board and Associated Dongle	1	03/03/2018	31/05/2018
IG13	Replace a Thameslink RBC System - RBC Processor Mk2	1	03/03/2018	31/05/2018
IG14	Replace a Thameslink RBC System - RBC Processor Mk2 Card	1	03/03/2018	31/05/2018
IG15	Replace a Thameslink RBC System - STRATUS TCC FTS	1	03/03/2018	31/05/2018
IG16	Replace a Thameslink RBC System - ISDN Unit	1	03/03/2018	31/05/2018
IG17	Replacement of Printed Circuit Cards (PCCs) – SIOM, LAN and DPM Cards (Thameslink Only)	2	02/12/2023	02/03/2024
IG18	Replace an NCL RBC System – RBC Processor Mk2	1	02/12/2023	02/03/2024
IG19	Replace an NCL RBC System - RBC Processor Mk2 Card	1	02/12/2023	02/03/2024
IG20	Replace an NCL RBC System – TCC	1	02/12/2023	02/03/2024
IG21	Replace an NCL RBC System – ISDN Board	1	02/12/2023	02/03/2024
IG22	Replacement of Printed Circuit Cards (PCCs) – SIOM, LAN and DPM Cards (NCL Only)	1	02/12/2023	02/03/2024
IG23	Replace an NCL RBC System- 48V DC Power Supply	1	02/12/2023	02/03/2024
IG24	Replace an NCL RBC System- 230V AC 2U 10 Way PDU Strip	1	02/12/2023	02/03/2024
IG25	Replace an NCL RBC System- Future 2500 Series E Fan Module	1	02/12/2023	02/03/2024
IH01	Replace an ElectroLogIXS Central Power Supply (CPS) Module	2	01/06/2019	07/09/2019

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IH02	Replace an ElectroLogIXS Chassis Information (CI) Module	2	01/06/2019	07/09/2019
IH03	Replace an ElectroLogIXS Communication Input/Output Protocol Converter (PCA) Module	3	04/06/2022	03/09/2022
IH04	Replace an ElectroLogIXS Input / Output (IO) Module	2	01/06/2019	07/09/2019
IH05	Replace an ElectroLogIXS Vital Peripheral Master (VPM) Module	2	01/06/2019	07/09/2019
IH06	Replace an ElectroLogIXS Personality Module (VIO24-86S and VIO50-86S)	2	01/06/2019	07/09/2019
IH07	Replace an ElectroLogIXS Personality Module (VLD – R8AC)	2	01/06/2019	07/09/2019
IH08	Replace an ElectroLogIXS Chassis	1	01/06/2019	07/09/2019
IK01	Replace an ARAMIS System - Fan Units	2	07/03/2020	06/06/2020
IK02	Replace an ARAMIS System - Power Supply Units	2	07/03/2020	06/06/2020
IK03	Replace a Client PC - Hard Drive	1	03/03/2018	31/05/2018
IK05	Replace an ARAMIS System – SAN Controller	1	07/03/2020	06/06/2020
IK06	Replace an ARAMIS System – Amulet	1	07/03/2020	06/06/2020
IK07	Replace an ARAMIS System – Maintenance Terminal	1	07/03/2020	06/06/2020
IK08	Replace an ARAMIS System – KVM Rack	1	07/03/2020	06/06/2020
IM01	Replace a Smartlock SmartIO COM Module	2	04/06/2022	03/09/2022
IM02	Replace a Smartlock SmartIO Configuration Key	2	04/06/2022	03/09/2022
IM03	Replace a Smartlock SmartIO PS Module	1	04/09/2021	04/12/2021
IM04	Replace a Smartlock SmartIO Generic Module	1	04/09/2021	04/12/2021
IM05	Replace a Smartlock Point Drive Isolation Module (PDIM)	1	04/09/2021	04/12/2021
IM06	Replace a SmartIO Supply Monitoring Devices	1	04/09/2021	04/12/2021
IM07	Replace a SmartIO Redundant or Non-Service Critical Device	2	04/06/2022	03/09/2022
IM08	Replace a SmartIO Service Critical Device or Cable	2	04/06/2022	03/09/2022
IS01	Replace a WESTeX Level Crossing Predictor Card	1	03/03/2018	31/05/2018
IS10	Replace a Module in HXP-3 Level Crossing Processor	1	05/12/2020	05/06/2021
IS15	Replace a Module in VHLC (Vital Harmon Logic Controller)	1	05/12/2020	05/06/2021

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IS16	Replace a HIMatrix Programmable Logic Controller (PLC) F30 and F3	1	04/06/2022	03/09/2022
IS17	Download Data to a HIMatrix Programmable Logic Controller (PLC) F30 and F3	1	04/06/2022	03/09/2022
IS20	Replace a SIMIS-W ACC EOM Card	1	05/12/2020	05/06/2021
IS21	Replace a SIMIS-W ECC BUREP Card	1	05/12/2020	05/06/2021
IS22	Replace a SIMIS-W ECC-CU Card	1	05/12/2020	05/06/2021
IS23	Replace a SIMIS-W IIC/OMC Non-CPU Card	1	05/12/2020	05/06/2021
IS24	Replace a SIMIS-W IIC/OMC VENUS3 CPU Card	1	05/12/2020	05/06/2021
IS25	Replace an SIMIS-W SOM 6 Connector Plug	1	05/12/2020	05/06/2021
IS26	Replace a Siemens PAM Point Detection Module	1	05/12/2020	05/06/2021
KL01	Replace a Keylock within an Electric Release Instrument or Mechanical Lever	6	05/12/2020	05/06/2021
LD01	Replace a Barrier Boom	7	04/09/2021	04/12/2021
LD02	Replace a Barrier Power Pack	6	04/03/2017	31/05/2017
LD03	Replace a Level Crossing Gate	6	05/12/2020	05/06/2021
LD04	Replace a Level Crossing Local Control Unit (LCU)	7	04/09/2021	04/12/2021
LD05	Replace a Level Crossing Flasher Unit	8	04/09/2021	04/12/2021
LD06	Replace a Level Crossing Gate Post Mechanical Equipment Lock	6	05/12/2020	05/06/2021
LD07	Replace an S60 Machine (Down Position) Damper Spring	1	03/03/2018	31/05/2018
LD08	Replace a Level Crossing Light Unit	7	04/09/2021	04/12/2021
LD09	Replace a barrier boom light	2	04/09/2021	04/12/2021
LD10	Replace a Level Crossing Audible Warning Control Unit (AWCU)	6	05/12/2020	05/06/2021
LD11	Replace a Level Crossing Gate Machine	6	05/12/2020	05/06/2021
LD12	Replace a PCB Board in an Invensys S60 Barrier Machine	1	05/12/2020	05/06/2021
LD14	Replace EBI Gate 630 Barrier Crank Handle Gear Mechanism	2	04/09/2021	04/12/2021
LD15	Replace an EBI Gate 630 Barrier Machine	2	01/09/2018	01/12/2018
LD16	Replace an EBI Gate 630 Barrier Boom	2	01/09/2018	01/12/2018
LD17	Replace EBI Gate 630 Motor	2	01/09/2018	01/12/2018
LD18	Replace EBI Gate 630 Cog Belt	2	01/09/2018	01/12/2018
LD19	Replace EBI Gate 2000 - Modular Components	1	03/03/2018	31/05/2018
LD20	Replace a EBI Gate 200 Level Crossing System Sub-Component	2	04/03/2017	31/05/2017
LD21	Replace GateCare NR2 Power Operated Gate Opener (POGO) Sub-Components	2	04/06/2022	03/09/2022

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LD23	Replace A Shunt (HXP-3)	1	03/03/2018	31/05/2018
LD30	Replace a Coe 300 CCTV Module	1	03/03/2018	31/05/2018
LD32	Replace a Newgate Barrier - Transformer	1	01/06/2019	07/09/2019
LD33	Replace a Newgate Barrier - Door Access Safety Switch	1	01/06/2019	07/09/2019
LD34	Replace a Newgate Barrier - BLSS Limit Switch	1	01/06/2019	07/09/2019
LD35	Replace a Newgate Barrier - Control Module	1	01/06/2019	07/09/2019
LD36	Replace a Newgate Barrier - Proximity Switch Assembly	2	07/03/2020	06/06/2020
LD37	Replace a Newgate Barrier - Hand Pump	1	01/06/2019	07/09/2019
LD38	Replace a Newgate Barrier - Hydraulic Hose or Damper Cylinder	1	01/06/2019	07/09/2019
LD39	Replace a Newgate Barrier – Brake Release Safety Switch	1	01/06/2019	07/09/2019
LD40	Replace a Newgate Barrier – Locking Pin Safety Switch	1	01/06/2019	07/09/2019
LD41	Replace a Newgate Barrier – Barrier Cage	1	01/06/2019	07/09/2019
LD42	Replace a Newgate Barrier Machine - Heater and Thermostat	1	01/06/2019	07/09/2019
LD50	Replace a Digital Barriers X-Net Unit	2	04/06/2022	03/09/2022
LD51	Replace an X-Net PSU 240V Power Supply Unit	1	01/06/2019	07/09/2019
LD52	Replace an X-Net Encoder PSU	1	01/06/2019	07/09/2019
LD58	Replace a Level Crossing Filament Light Unit	1	04/09/2021	04/12/2021
LD60	Replace a BR843 Level Crossing Barrier Pedestal	1	04/09/2021	04/12/2021
LD61	Replace an LCSS Cincoze DS-1200 – Maintenance PC	1	04/06/2022	03/09/2022
LE22	Replace a Vamos Crossing System Sub-Component (Power Equipment)	2	04/06/2022	03/09/2022
LE23	Replace a Vamos Crossing System Sub-Component (Modular Equipment)	2	04/06/2022	03/09/2022
LE24	Replace a Vamos / Flex Crossing System Sub-Component (External Equipment)	2	04/06/2022	03/09/2022
LF01	Replace a Flex Crossing - Sub-Components – Power	1	04/06/2022	03/09/2022
LF02	Replace a Flex Crossing - Sub-Component – Control	1	04/06/2022	03/09/2022
LF03	Replace a Flex Crossing - Sub-Component – Modules	1	04/06/2022	03/09/2022
LF04	Replace a Flex Crossing - Sub-Components – Relay and Temperature	1	04/06/2022	03/09/2022
LV01	Replace an Electric Lever Lock	7	04/09/2021	04/12/2021

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LV02	Replace a Circuit Controller	7	04/09/2021	04/12/2021
LV03	Replace a Plunger	6	05/12/2020	05/06/2021
LV04	Replace a Key Release Instrument	6	05/12/2020	05/06/2021
LV05	Replace a Mechanical Interlocking Component	6	04/09/2021	04/12/2021
LV06	Replace a Lever or Lever Component	6	04/09/2021	04/12/2021
LV07	Replace a AB Type 803 Style F Rotating Cam Switch	6	04/09/2021	04/12/2021
LV08	Replace a Microswitch sub-component within Ultra circuit Controller	2	04/06/2022	03/09/2022
LV09	Replace a Lever frame Key	1	04/03/2017	31/05/2017
LV10	Replace a Lever frame key lock	5	04/03/2017	31/05/2017
LV11	Re-allocate a Band	1	04/03/2023	03/06/2023
MS01	Replace a PM SOM24 MAU	2	01/09/2018	01/12/2018
MS02	Replace an Invensys Rail Object Controller TPWS, or Points Equipment Panel	3	02/12/2023	02/03/2024
MS03	Remove and Refit a Fibre Optic Patch Cord, Fibre Optic Patch Panel, Ethernet cables Fibre Optic lead	2	07/03/2020	06/06/2020
MS05	Replace a Surge Protection Unit, Surge Suppression Unit	2	04/06/2022	03/09/2022
MS06	Replace a Switch Rack	2	07/03/2020	06/06/2020
MS07	Replace a Battery Pack	2	04/06/2022	03/09/2022
MS08	Replace an individual Power Rack Module	2	07/03/2020	06/06/2020
MS10	Replace a Charger Rack	2	07/03/2020	06/06/2020
MS11	Replace a Power Box Temperature Sensor	2	04/06/2022	03/09/2022
MS12	Replace an Invensys Rail Modular Technicians Facility PC	2	07/03/2020	06/06/2020
MS13	Replace a Rextron KAG12 Switch	2	04/06/2022	03/09/2022
MS14	Replace an Object Controller	2	04/06/2022	03/09/2022
MS15	Replace a Feeder Pillar	2	04/06/2022	03/09/2022
MS16	Replace a Power Box	2	04/06/2022	03/09/2022
NW02	Replace an Ethernet Extender Unit	1	01/06/2019	07/09/2019
NW03	Replace an GE RSTi Modbus TCP- IP Network Adapter	1	01/06/2019	07/09/2019
NW04	Replace an GE RSTi ST Module Non-Configurable	1	01/06/2019	07/09/2019
NW05	Replace an GE RSTi ST Module Configurable	1	01/06/2019	07/09/2019
NW06	Replace CISCO SFP Transceiver Module	1	01/06/2019	07/09/2019
NW07	Replace a StackWatch Modem	1	07/03/2020	06/06/2020
NW08	Replace a Dell KMM Rack Mounted Monitor	1	01/06/2019	07/09/2019
NW09	Replace a Dell KVM Switch	1	01/06/2019	07/09/2019
NW10	Replace a Patch Panel	1	01/06/2019	07/09/2019
NW11	Replace a Network / Ethernet Switch	3	04/06/2022	03/09/2022

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NW12	Replace a Network Time Protocol (NTP) Server	1	07/03/2020	06/06/2020
NW13	Replace a Network Time Protocol (NTP) Antenna	2	04/09/2021	04/12/2021
OD01	Replace an MCB-OD RADAR Scanner	2	04/06/2022	03/09/2022
OD02	Replace a Level Crossing LIDAR Scanner	2	07/03/2020	06/06/2020
OD03	Replace an MCB-OD RADAR Scanner Replaceable Component	2	04/06/2022	03/09/2022
PA01	Replace Rodding, Drives, Lock and Detector Equipment	7	04/09/2021	04/12/2021
PA02	Replace or Adjust a Point Stretcher Bar	7	04/06/2022	03/09/2022
PA03	Replace a Crank or Signal Wheel	7	04/09/2021	04/12/2021
PA04	Replace or Adjust a Tubular Stretcher Bar	4	04/03/2023	03/06/2023
PB01	Replace a Complete Clamp Lock Body	7	04/09/2021	04/12/2021
PB02	Replace a Hydraulic Power Pack	7	04/09/2021	04/12/2021
PB03	Replace a Hydraulic Actuator	7	04/09/2021	04/12/2021
PB04	Replace a Hose	8	04/09/2021	04/12/2021
PB05	Replace an Electric Point Detector or Microswitch	7	04/09/2021	04/12/2021
PB06	Replace a Clamp Lock Detector and Lock Arm Assembly	6	05/12/2020	05/06/2021
PB07	Replace A Break Out Device As Used Within Hy-Drive System	2	04/06/2022	03/09/2022
PB08	Replace an SO Unit	3	04/09/2021	04/12/2021
PB09	Replace a Hy-drive Bypass Valve	1	05/12/2020	05/06/2021
PB18	Remove and Refit Hydraulic Derailer Unit	2	04/06/2022	03/09/2022
PC02	Replace an Electric Motor	6	05/12/2020	05/06/2021
PC03	Replace a HW2000 Point Machine Clutch	6	05/12/2020	05/06/2021
PC04	Replace an Ansaldo T72 Point Machine VCC ‘C’ Arm Assembly	2	05/12/2020	05/06/2021
PC05	Replace an Ansaldo T72 Point Machine VCC Lock Frame Assembly	2	04/09/2021	04/12/2021
PC06	Replace an Ansaldo T72 Point Machine VCC Detector Unit	2	04/09/2021	04/12/2021
PC07	Replace a WRSL Style 63 Point Machine Circuit Controller	2	04/09/2021	04/12/2021
PC08	Replace a HW2000 Point Machine Variable Resistor	2	04/09/2021	04/12/2021
PC09	Replace a HW Style Point Machine Gearbox	4	04/03/2023	03/06/2023
PC10	Upgrade a HW1121 Point Machine Snubbing Resistor	1	04/09/2021	04/12/2021
PC11	Replace an HW Style Throw bar Assembly	1	05/12/2020	05/06/2021
PC51	Replace a Complete Point Machine	1	04/09/2021	04/12/2021
PC81	Replace a Unistar HR Machine	1	02/12/2023	02/03/2024

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Part 04				
PC82	Replace a Unistar HR Pump Unit	1	02/12/2023	02/03/2024
PD01	Replace an Electro-Pneumatic (EP) Valve	6	04/09/2021	04/12/2021
PD02	Replace an Electro-Pneumatic (EP) Piston	6	04/09/2021	04/12/2021
PD03	Replace an Electro-Pneumatic (EP) Slide Bar Assembly	6	04/09/2021	04/12/2021
PH01	Replace a HPSS Electrical Component	9	04/09/2021	04/12/2021
PH02	Replace a HPSS Mechanical Component	8	04/09/2021	04/12/2021
PH03	Replace a supplementary sensor mounting bracket	1	01/06/2019	07/09/2019
PT01	Replace a Hydro-Pneumatic Unit	7	04/06/2022	03/09/2022
PW01	Replace a Transformer-Rectifier or Battery Charger	6	04/09/2021	04/12/2021
PW02	Replace a Transformer	6	04/09/2021	04/12/2021
PW03	Replace a Non-Plug in Inverter or Converter	6	04/09/2021	04/12/2021
RE11	Replace a Solar Panel	1	05/12/2020	05/06/2021
RE12	Replace a Wind Turbine Nacelle	1	05/12/2020	05/06/2021
RE13	Replace a Metron4	1	05/12/2020	05/06/2021
RE14	Replace a TriStar Charge Controller	1	05/12/2020	05/06/2021
RE20	Replace a Direct Methanol Fuel Cell Unit	1	07/03/2020	06/06/2020
RE21	Replace a Direct Methanol Fuel Cell Cartridge	1	07/03/2020	06/06/2020
RE22	Replace a Direct Methanol Fuel Cell Cartridge Sensor	1	07/03/2020	06/06/2020
RE23	Replace a Direct Methanol Fuel DuoCartSwitch	1	07/03/2020	06/06/2020
SB01	Replace a Back Projection Lamp Unit	2	04/09/2021	04/12/2021
SG01	Replace an LED Buffer Stop Unit	1	05/12/2020	05/06/2021
SG02	Replace a Lens	6	04/09/2021	04/12/2021
SG03	Replace a Signal Wire (or part of)	6	04/09/2021	04/12/2021
SG05	Replace a Reflective Board, Sign or Support Structure	1	04/09/2021	04/12/2021
SG06	Replace a Lamp Case or Pyrometer	6	04/09/2021	04/12/2021
SG07	Replace a Signal Arm or Fittings	6	04/09/2021	04/12/2021
SG08	Replace a Mechanical Searchlight Mechanism	6	04/09/2021	04/12/2021
SG11	Replace an Ansaldo SD 321 Signal Head Filter Unit	2	04/09/2021	04/12/2021
SG12	Replace an Ansaldo SD 321 Signal Head Optical Unit	2	05/12/2020	05/06/2021
SG15	Replace a Ground Position Light LED Signal	2	05/12/2020	05/06/2021
SG51	Replace a Filament Type Signal Head	1	04/09/2021	04/12/2021
SG52	Replace an Electro-Mechanical Signal	1	04/09/2021	04/12/2021
SG53	Replace an Electro-Mechanical Indicator	1	04/09/2021	04/12/2021
SG54	Replace a Fibre Optic Signal	1	04/09/2021	04/12/2021

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Part 04				
SG55	Replace a Light Emitting Diode (LED) Signal Head	1	04/09/2021	04/12/2021
SL01	Replace a SMARTLOCK CIXL I/O Subsystem Module	2	04/06/2022	03/09/2022
SL02	Replace a SMARTLOCK CIXL Computing Subsystem Module	2	04/06/2022	03/09/2022
SL03	Replace a SMARTLOCK CIXL Main PSU	2	04/06/2022	03/09/2022
SL04	Replace a SMARTLOCK TICC Front End Module	2	04/06/2022	03/09/2022
SL05	Replace a SMARTLOCK TICC GW Module	2	04/06/2022	03/09/2022
SL06	Replace a SMARTLOCK SSys Component	2	04/06/2022	03/09/2022
SL07	Replace a SMARTLOCK SSys Client PC	2	04/06/2022	03/09/2022
SS01	Replace an SSI MPM or PPM	6	05/12/2020	05/06/2021
SS02	Replace an SSI TFM, DLM, or LDT	6	01/09/2018	01/12/2018
SS03	Replace an Ansaldo Interlocking Plug in Module	2	05/12/2020	05/06/2021
SS04	Replace a VHLC Card	1	03/03/2018	31/05/2018
SS05	Replace an SSI TFM Plug Coupler	2	04/09/2021	04/12/2021
SW10	Replace a Siemens Train Staff Lockout Device	1	04/09/2021	04/12/2021
TC00	Partial Testing of EBI Track 200 (TI21), 50Hz AC, Reed, FS2600, HVI, EBI Track 400 Track Circuits for Defined Tasks	7	04/03/2023	03/06/2023
TC01	Replace Plug in Track Circuit Equipment	7	04/09/2021	04/12/2021
TC02	Replace Track Circuit Equipment	9	04/09/2021	04/12/2021
TC03	Testing Track Circuits After IRJ Renewal	3	04/03/2023	03/06/2023
TC04	Replace a Trackside Track Tuning Unit	8	04/03/2023	03/06/2023
TC05	Replace a Track Circuit Interrupter	7	07/03/2020	06/06/2020
TC06	Replace an Impedance Bond	7	04/09/2021	04/12/2021
TC07	Replace a Track Loop	6	05/12/2020	05/06/2021
TC08	Replace a Track Circuit Aid (TCAID) Unit	7	04/06/2022	03/09/2022
TC09	Replace ZKL3000-RC	1	02/12/2023	02/03/2024
TQ01	Replace a Mechanical Treadle	7	04/09/2021	04/12/2021
TQ03	Replace a GETS or Siemens Electronic Wheel Sensor	3	04/06/2022	03/09/2022
TQ04	Replace a GETs Electronic Treadle Unit (ETU)	1	03/03/2018	31/05/2018
TQ11	Replace a Treadle Timing Screw	2	01/06/2019	07/09/2019
TS10	Replace JE Style Trainstop (Complete) and or Trip Arm	1	03/03/2018	31/05/2018
TS11	Replace JE Style Trainstop - Motor Assembly	1	03/03/2018	31/05/2018
WC01	Replace WESTCAD-E MCR Modules (except CPU-4)	2	07/03/2020	06/06/2020
WC02	Replace WESTCAD-E MCR CPU-4 Modules	2	07/03/2020	06/06/2020

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Part 04				
WC03	Replace WESTCAD-E MCR Housing	2	07/03/2020	06/06/2020
WC04	Replace WESTCAD Level Crossing Touch Screen Device (Integral Processor)	1	01/09/2018	01/12/2018
WC05	Replace WESTCAD Level Crossing Touch Screen Device (External Processor)	1	01/09/2018	01/12/2018
WC06	Replace a WESTCAD – WESTLOCK Ancillary Components	1	07/03/2020	06/06/2020
WL01	Replace a WESTLOCK Interlocking Module	4	04/03/2023	03/06/2023
WL03	Replace a WESTLOCK Power Supply Unit (PSU)	3	04/03/2023	03/06/2023
WL04	Replace a WESTLOCK CSG or TW(L) Module	3	04/03/2023	03/06/2023
WL05	Replace a WESTLOCK CIP or TIF Baseplate	4	04/03/2023	03/06/2023
WL06	Replace a WESTLOCK FEP Housing Backplane	3	04/03/2023	03/06/2023
WL07	Replace a Siemens Zone Controller Module	5	04/03/2023	03/06/2023
WL08	Replace a Siemens Zone Controller Housing Backplane	4	04/03/2023	03/06/2023
WL09	Replace a Siemens Zone Controller PM Backplane	3	04/03/2023	03/06/2023
WL10	Replace a Siemens Zone Controller Surge Interface Board	3	04/03/2023	03/06/2023
WL11	Replace a Siemens Zone Controller MAU Backplane	2	04/03/2023	03/06/2023
WL12	Replace a WESTLOCK FEP PM Backplane	3	04/03/2023	03/06/2023
WL13	Replace a Siemens FEP/ZC Addressing Plug	4	04/03/2023	03/06/2023
WL14	Replace a Siemens Zone Controller Housing	2	04/03/2023	03/06/2023
WL15	Replace a Siemens Zone Controller Power Distribution Housing	3	04/03/2023	03/06/2023
WL16	Replace a Siemens FEP/ZC Power Supply Modules	3	04/03/2023	03/06/2023
WL17	Replace a Siemens Zone Controller Power Buffer Unit	3	04/03/2023	03/06/2023
WL18	Replace a Siemens Zone Controller TPWS Circuit Breaker	4	04/03/2023	03/06/2023
WL19	Replace a Siemens Zone Controller I/O Cable	2	04/03/2023	03/06/2023
WL20	Replace a Siemens Ethernet Switch Power Supply	3	04/03/2023	03/06/2023
WL21	Replace a Siemens Ethernet Switch Power Buffer Unit	3	04/03/2023	03/06/2023
WL22	Replace a Siemens AMI-SRA Modular Technicians Facility PC	3	04/03/2023	03/06/2023
WL23	Replace a Siemens BlueChip C110 Technicians Facility PC	3	04/03/2023	03/06/2023

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Part 04				
WP01	Replace a WESTPLEX Module	2	05/12/2020	05/06/2021
WP02	Divert a Faulty WESTPLEX Cable Core	2	05/12/2020	05/06/2021
WP03	Replace a WESTPLEX LAN End of Line (EOL) Unit	2	05/12/2020	05/06/2021

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Part 05				
Index	Index – Wrong Side Failure and Incident Investigation	19	02/12/2023	02/03/2024
Module S01	Wrong Side Failure Testing Principles	1	04/09/2021	04/12/2021
Module S02	Wrong Side Failure Testing Competence	1	04/09/2021	04/12/2021
Module S03	Single Obvious Cause - Exempted Failures	1	04/09/2021	04/12/2021
Module S04	Management of Track Circuit Wrong Side Failures	2	04/06/2022	03/09/2022
Module S05	Protecting the Line	1	04/09/2021	04/12/2021
Module S06	Wrong Side Failure Testing Procedure	2	04/06/2022	03/09/2022
Module S07	Evidence - Data Loggers and Condition Monitoring Systems	1	04/09/2021	04/12/2021
Module S08	Escalation Procedure	1	04/09/2021	04/12/2021
Module S09	Record Keeping	1	04/09/2021	04/12/2021
Module S10	Test Result Reporting	1	04/09/2021	04/12/2021
Module S11	Signing Back, Using the Sign Back Matrix and Feedback	1	04/09/2021	04/12/2021
Module S12	Sign Back Matrix	2	04/03/2023	03/06/2023
Module S13	Wrong Side Failures on Recently Commissioned Equipment	1	04/09/2021	04/12/2021
Module S14	Specialist Investigation of Equipment	1	04/09/2021	04/12/2021
Module S15	Derailments	1	04/09/2021	04/12/2021
Module S16	Signals Passed At Danger (SPAD)	1	04/09/2021	04/12/2021
Module S17	Serious Incident Procedure	1	04/09/2021	04/12/2021
Module S18	Investigation Types	1	04/09/2021	04/12/2021
Module S19	Rail Accident Investigation Board (RAIB) Liaison	1	04/09/2021	04/12/2021
Module S20	Schedules of Reportable Events	1	04/09/2021	04/12/2021
Module S21	Failure and Incident Testing Flowchart	1	04/09/2021	04/12/2021
Module S22	Management of Obscured Signals	1	02/12/2023	02/03/2024

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Part 06				
Index	Index - Test Plans for Telecom, DOO and RETB	7	04/06/2022	03/09/2022
CAB001	Replace or Repair a Telecoms Tail Cable	5	04/06/2022	03/09/2022

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Part 06				
DOO 001	Removal, Replacement and Adjustment of a CCTV Camera	5	04/09/2021	04/12/2021
DOO 002	Realign a CCTV Camera	4	03/03/2018	12/06/2018
DOO 003	Remove and Replace a DOO CCTV Coaxial Cable	4	03/03/2018	12/06/2018
DOO 004	Removal, Replacement and Adjustment of a DOO CCTV Monitor	5	04/09/2021	04/12/2021
DOO 005	Remove and Replace a DOO CCTV Train Detection Unit	4	03/03/2018	12/06/2018
DOOTFI001	Failure Investigation for Driver Only Operation (DOO) CCTV	6	04/09/2021	04/12/2021
IR67	Replace a Power supply module and battery pack	1	03/03/2018	31/05/2018
IR68	Replace a Base station radio modules	1	03/03/2018	31/05/2018
IR69	Replace a system control radio rack card/module	1	03/03/2018	31/05/2018
IR70	Replace a RETB TPWS frequency converter	1	03/03/2018	31/05/2018
TEL001	Replace an Operational Telephone	5	04/06/2022	03/09/2022
TELTFI001	Operational Telephones	5	04/06/2022	03/09/2022

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Part 08				
Index	Index - Wrong Side Failure Test Guides	4	02/12/2023	02/03/2024
T001	Signalling Failure and Incident Testing Guides	1	04/09/2021	04/12/2021
T002	Wrong Side Failure Test Guide: Track Circuits	1	04/09/2021	04/12/2021
T003	Wrong Side Failure Guide: Depression Bar	1	04/09/2021	04/12/2021
T004	Wrong Side Failure Test Guide: Thales Axle Counters	1	04/09/2021	04/12/2021
T005	Wrong Side Failure Guide: Block	1	04/09/2021	04/12/2021
T007	Wrong Side Failure Test Guide: Lamp – No Light (Any Type)	1	04/09/2021	04/12/2021
T008	Wrong Side Failure Test Guide: Colour Light Signal	1	04/09/2021	04/12/2021
T009	Wrong Side Failure Test Guide: Mechanical Signal	1	04/09/2021	04/12/2021
T010	Wrong Side Failure Test Guide: Points	1	04/09/2021	04/12/2021
T011	Wrong Side Failure Test Guide: Automatic Warning System (AWS)	2	02/12/2023	02/03/2024
T012	Wrong Side Failure Test Guide: Automatic Level Crossings	1	04/09/2021	04/12/2021

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Part 08				
T013	Wrong Side Failure Test Guide: Manned Level Crossings	1	04/09/2021	04/12/2021
T014	Wrong Side Failure Test Guide: Staff Warning Systems	1	04/09/2021	04/12/2021
T015	Wrong Side Failure Test Guide: Electro-Hydraulic Trainstop	1	04/09/2021	04/12/2021
T018	Wrong Side Failure Test Guide: Balise (TASS)	1	04/09/2021	04/12/2021
T019	Wrong Side Failure Test Guide: Train Protection Warning System (TPWS)	1	04/09/2021	04/12/2021
T020	Wrong Side Failure Test Guide: EBI Gate 200 Level Crossing System	2	04/06/2022	03/09/2022
T021	Wrong Side Failure Test Guide: Vamos Crossing System	2	04/06/2022	03/09/2022
T022	Wrong Side Failure Test Guide: Harmon Crossing Predictor HXP-3	2	04/03/2023	03/06/2023
T023	Wrong Side Failure Test Guide: VHCL systems	1	04/09/2021	04/12/2021
T024	Wrong Side Failure Test Guide: Flex Crossing System	1	04/06/2022	03/09/2022
T025	Wrong Side Failure Test Guide: Track Circuit Rail Head Contamination – Remote Condition Monitoring (Not Fitted)	1	04/09/2021	04/12/2021
T026	Wrong Side Failure Test Guide: Track Circuit Rail Head Contamination – Remote Condition Monitoring (Fitted)	1	04/09/2021	04/12/2021
T027	Wrong Side Failure Test Guide: Automatic Train Protection (ATP) (GWML)	1	04/09/2021	04/12/2021
T028	Wrong Side Failure Test Guide: ATP (GWML) Reported WSF of signal, no allegation against ATP equipment	1	04/09/2021	04/12/2021
T029	Wrong Side Failure Test Guide: Thameslink ERTMS Irregular Movement Authority	1	04/09/2021	04/12/2021
T030	Wrong Side Failure Test Guide: Cambrian ERTMS Irregular Movement Authority	1	04/09/2021	04/12/2021
T031	Wrong Side Failure Test Guide: Cambrian ERTMS Incorrect Information is received from a Balise by a train	1	04/09/2021	04/12/2021
T032	Wrong Side Failure Guide: Siemens ACM 100	1	04/09/2021	04/12/2021
T033	Wrong Side Failure Test Guide: Balise	1	04/09/2021	04/12/2021
T034	Wrong Side Failure Test Guide: SDO Beacon	1	04/09/2021	04/12/2021
T036	Wrong Side Failure Test Guide: Colour Light Signal – Degraded by Sunlight	1	04/09/2021	04/12/2021

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Part 08				
T037	Wrong Side Failure Test Guide: Colour Light Signal – Obscured by Obstruction	2	02/12/2023	02/03/2024
T038	Wrong Side Failure Test Guide: Mechanical Signal – Obscured by Obstruction	2	02/12/2023	02/03/2024
T039	Wrong Side Failure Test Guide: Automatic Train Protection (ATP) (Chilterns)	1	04/09/2021	04/12/2021
T040	Wrong Side Failure Test Guide: ATP (Chilterns) Reported WSF of Signal, No Allegation Against ATP Equipment	1	04/09/2021	04/12/2021
T041	Wrong Side Failure Test Guide: Automatic Warning System (AWS) Reduced Testing of Extra-Strength (Green) AWS Magnet following Code 5 failure	1	04/03/2023	03/06/2023
T042	Wrong Side Failure Test Guide: Temporary Automatic Warning System (AWS) Associated with Speed Restrictions	1	02/12/2023	02/03/2024
T044	Wrong Side Failure Test Guide: NCL ERTMS Irregular Movement Authority	1	02/12/2023	02/03/2024

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Part 09				
Index	Index - Intermittent or Obscure Failure Guides	3	02/12/2023	02/03/2024
U001	Use of the Signalling Intermittent and Obscure Failure Guides	1	04/09/2021	04/12/2021
U002	Intermittent/Obscure Failure Guide: Point Machines	1	04/09/2021	04/12/2021
U003	Intermittent/Obscure Failure Guide: Rail Clamp Point Lock	1	04/09/2021	04/12/2021
U004	Intermittent/Obscure Failure Guide: Electro-Pneumatic Points	1	04/09/2021	04/12/2021
U005	Intermittent/Obscure Failure Guide: Track Circuits	2	04/03/2023	03/06/2023
U006	Intermittent/Obscure Failure Guide: Colour Light Signals	1	04/09/2021	04/12/2021
U007	Tests Following an Alleged Signal Passed at Danger (SPAD)	2	02/12/2023	02/03/2024
U008	Tests Following an Alleged Change of Aspect (COA)	1	04/09/2021	04/12/2021
U009	Right Side Failure Test Guide: Automatic Warning System (AWS)	1	04/09/2021	04/12/2021
U011	Intermittent/Obscure Failure Guide: Automatic Half Barrier Crossings	1	04/09/2021	04/12/2021

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Part 09				
U012	Intermittent/Obscure Failure Guide: Manually Controlled Barriers (including CCTV)	1	04/09/2021	04/12/2021

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Part 10				
Index	Index - Faulting Guides	2	04/06/2022	03/09/2022
FF02	Faulting Guide: DC Track Circuits	1	04/09/2021	04/12/2021
FF04	Faulting Guide: EBI Track 200 Track Circuit	1	04/09/2021	04/12/2021
FF05	Faulting Guide: SF15 / U Type Aster Track Circuit	1	04/09/2021	04/12/2021
FF06	Faulting Guide: High Voltage Impulse (HVI) Track Circuits	1	04/09/2021	04/12/2021
FF07	Faulting Guide: 50Hz AC Track Circuits	1	04/09/2021	04/12/2021
FF08	Faulting Guide: EBI Gate 200 Level Crossing System	1	04/09/2021	04/12/2021
FF09	Faulting Guide: Power Operated Gate Opener (POGO)	1	04/09/2021	04/12/2021
FF10	Faulting Guide: Frauscher Advanced Axle Counter	1	04/09/2021	04/12/2021
FF11	Faulting Guide: Platform Identification Beacon	1	04/09/2021	04/12/2021
FF12	Faulting Guide: Train Protection Warning System (TPWS)	2	04/06/2022	03/09/2022
FF13	Faulting Guide: Train Protection Warning System (TPWS) Fault Finding Flow Charts	1	04/09/2021	04/12/2021
FF14	Faulting Guide: Signalling Power Supplies above 175V	1	04/09/2021	04/12/2021
FF15	Faulting Guide: Signalling Power supplies above 175V Flowchart	1	04/09/2021	04/12/2021
FF16	Faulting Guide: Direct Methanol Fuel Cell System	1	04/09/2021	04/12/2021
FF17	Faulting Guide: Siemens ACM 100	1	04/09/2021	04/12/2021
FF18	Faulting Guide: VHLC	1	04/09/2021	04/12/2021
FF19	Faulting Guide: EBI Gate 2000 Level Crossing System	1	04/09/2021	04/12/2021
FF21	Faulting Guide: JE Style Trainstop	1	04/09/2021	04/12/2021
FF23	Faulting Guide: SmartIO resilient power supply sub-system	1	04/09/2021	04/12/2021
FF24	Faulting Guide: ARAMIS	1	04/09/2021	04/12/2021
FF25	Faulting Guide: Vehicle Identification Loops (VIS)	1	04/06/2022	03/09/2022
FF26	Faulting Guide: KVB Balise	1	04/09/2021	04/12/2021
FF27	Faulting Guide: Residual Voltage Fault	1	04/09/2021	04/12/2021

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Part 10				
FF28	Faulting Guide: HIMatrix Programmable Logic Controller (PLC) F30 & F3	1	04/06/2022	03/09/2022
FF29	Faulting Guide: HIMatrix Manually Controlled Barrier Level Crossing	1	04/06/2022	03/09/2022

END

Standard and control document briefing note

Ref: NR/L3/SIG/11231	**Issue:** 19
Title: Signalling Maintenance Testing Handbook	
Publication date: 02 December 2023	**Compliance Date:** 02 March 2024
Standard/Control Document Owner: Network Technical Head Signalling	
Standard change lead/contact for briefings: Chris Cresswell, Senior Engineer	**Tel:**0770 291 4534

Purpose:

This document contains the index to the Signal Maintenance Testing (NR/SMTH) The SMTH provides a maintenance testing regime for the replacement or installation of signalling equipment that does not affect the application logic of the system or, the controls of the system that have previously been tested to signal works testing.

Scope:

Signalling equipment that is replaced or renewed on a like for like basis under corrective maintenance, temporary design as a result of an incident or engineering works and minor signalling renewals that do not affect the application logic of the system or, the controls of the system that have previously been tested to signal works testing.

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

This is the continuing update to the SMTH to ensure the most update to date is provided and updates from user feedback.

New documents / modules have been added to support new equipment introduced onto NRMI and the content of TI 181 has been incorporated into the body of this standard. Documents / modules have been amended as part of continuous improvement because of changes to equipment, changes in procedures and feedback from end users. A summary table below gives the high-level numbers of documents / modules.

Type of Change	Number of Documents
Amended	35
New	18
Withdrawn	4
Total	**57**

Detail of change

Module	Name	Summary of Changes
Amended		
NRSMTH Part01 Module 04	Competency of Staff	Module updated to support development of industry wide training material in December 2023 as part of the MR2C project.
NRSMTH Part01 Module 09	Testing Sequence	Updated to reflect introduction of e-SMTH
NRSMTH Part01 Module 10.docm	Completion of the SMTH Log sheet	Updated to reflect introduction of e-SMTH
NRSMTH Part01 Module 14	Site and Testing Records	Updated to reflect introduction of e-SMTH
NRSMTH Part04 AX03	Replace a SK30H Rail Contact (AzLM)	Notes and compatibility tables added.
NRSMTH Part04 AX04	Replace a EAK30H Unit (AzLM)	Reference direction test added and title change
NRSMTH Part04 AX05	Replace an EAK30H Board (AzLM)	Notes and compatibility tables added to allow both ISDN and DSL technology
NRSMTH Part04 AX06	Replace a EP/EPCM CPU Card (AzLM)	Removed reference to AzLE and general tidy
NRSMTH Part04 AX07	Replace an ACE Serial/Parallel Card (AzLM)	Updated to support introduction of DSL
NRSMTH Part04 AX08	Remove and Refit Rail Contact (All Azl & AzLM)	Updated for redundant heads, reference direction test added, reference to AzLE removed, general tidy.
NRSMTH Part04 AX09.docm	Replace an EAK30K Unit (AzLM)	Updated for DSL, reference direction test added, wording clarified to allow to be used in Birmingham New Street, New Compatibility Table added for EAK boards
NRSMTH Part04 AX10	Replace an Rail Contact Adaptor (RCA) (AzLM)	General reformat and tidy up
NRSMTH Part04 AX11	Replace a SK30K Rail Contact (AzLM)	Wording updated to allow to be used in Birmingham New Street, Reference Direction Test Added, general tidy up
NRSMTH Part04 AX22	Replace a Siemens AzS 350 U Axle Counter Card (BLEA12)	'Independence Exempt' banner removed.
NRSMTH Part04 AX40	Replace a Frauscher wheel sensor RSR123	Updated includes box and final checks for SATWAS / ATWAS
NRSMTH Part04 AX53	Remove and Refit Frauscher Wheel Sensor RSR123	Updated includes / excludes box and added final checks for SATWAS ATWAS systems
NRSMTH Part04 AX60	Replace a Converter ISDN Ethernet (CIE) (AzLM)	General Formatting and tidy up
NRSMTH Part04 AX61	Replace a Converter ISDN Ethernet (CIE) DC - DC Power Supply (AzLM)	General Formatting tidy up

NRSMTH Part04 AX62	Replace a Single Channel Controller (SCC) CPU Card (AzLM) in a 2oo2 system	Includes and excludes updated so test plan is used for 2oo2 only
NRSMTH Part04 AX63	Replace a Power Data Coupling Unit (PDCU) (AzLM)	Clarifications on when/how to disconnect power
NRSMTH Part04 AX64	Replace a DC - DC Convertor (Power Supply to EAK) (AzLM)	References to AzLE removed and general tidy up
NRSMTH Part04 AX65	Replace an ACE DC - DC Power Card (AzLM) 2oo2 ACE	Includes and excludes updated. Used for 2oo2 only
NRSMTH Part04 AX66	Replace an ISDN V.24 Converter	General formatting and tidy up
NRSMTH Part04 AX70	Replace a Sedlbauer unit (PMC Transformer) (AzLM)	Removed reference to AzLE
NRSMTH Part04 EL02	Replace a Barrelled or Clip in Component	Updated to include renewal of a link in circuit
NRSMTH Part04 IE07	Cambrian ERTMS: Replace a Non-Vital Programmable Device	Updated includes and excludes boxes to reflect current equipment as per request of end users.
NRSMTH Part04 IF01	Replace an Atlas 200 ETCS Network Transmission Gateway LRU	Amended RAGing in C2 and corrected typos
NRSMTH Part04 IF02.docm	Replace an Atlas 200 RBC Computing Subsystem Module	Para 8 added under Gen Heading 'If more than one computing.....' Table 1 Updated (and titled), minor typos corrected.
NRSMTH Part04 IF08	Replace an RBC Maintenance Supervision System (MSS) Sub-Component	Includes/Excludes box updated and added C17 for Console Replacement
NRSMTH Part04 IG17	Replacement of Printed Circuit Cards (PCCs) – SIOM, LAN and DPM Cards (Thameslink Only)	Title change to distinguish between this doc (Thameslink) and new doc (NCL) Part/04 IG22
NRSMTH Part04 MS02	Replace an Invensys Rail Object Controller TPWS, or Points Equipment Panel	Corrected Error in Module Header to read NR/L3/SIG/11231 Signal Maintenance Testing Handbook
NRSMTH Part08 T011	Wrong Side Failure Test Guide: Automatic Warning System (AWS)	Amended with updated checks
NRSMTH Part08 T037	Wrong Side Failure Test Guide: Colour Light Signal – Obscured by Obstruction	Updated document to support transition of TI181 into BAU
NRSMTH Part08 T038	Wrong Side Failure Test Guide: Mechanical Signal – Obscured by Obstruction	Document updated to allow transition of TI181 into BAU
NRSMTH Part09 U007	Tests Following an Alleged Signal Passed at Danger (SPAD)	Document updated to allow transition of TI181 into BAU
New		
NRSMTH Part02 Form 21	Signal Failure and Incident Testing: Obscuration Diagram	New form to support transition of TI181 into BAU
NRSMTH Part04 AX73	Replace a Single Channel Controller (SCC) CPU Card (AzLM) in a 2oo3 system	Removed reference to AzLE
NRSMTH Part04 AX74	Replace an ACE DC - DC Power Card (AzLM) 2oo3 ACE	New document to support new hardware configuration 2oo3
NRSMTH Part04 EL54	Replace a Remote Disconnection Device (RDD)	New Test Plan
NRSMTH Part04 IG18	Replace an NCL RBC System – RBC Processor Mk2	New Document to support new equipment (NCL RBC).
NRSMTH Part04 IG19	Replace an NCL RBC System - RBC Processor Mk2 Card	New Document to support new equipment (NCL RBC).
NRSMTH Part04 IG20	Replace an NCL RBC System – TCC	New Document to support new equipment (NCL RBC).
NRSMTH Part04 IG21	Replace an NCL RBC System – ISDN Board	New Document to support new equipment (NCL RBC).
NRSMTH Part04 IG22	Replacement of Printed Circuit Cards (PCCs) – SIOM, LAN and DPM Cards (NCL Only)	New Document to support new equipment (NCL RBC).
NRSMTH Part04 IG23	Replace an NCL RBC System- 48V DC Power Supply	New Document to support new equipment (NCL RBC).
NRSMTH Part04 IG24	Replace an NCL RBC System- 230V AC 2U 10 Way PDU Strip	New Document to support new equipment (NCL RBC).
NRSMTH Part04 IG25	Replace an NCL RBC System- Future 2500 Series E Fan Module	New Document to support new equipment (NCL RBC).
NRSMTH Part04 PC81	Replace a Unistar HR Machine	New Document to support introduction of Unistar
NRSMTH Part04 PC82	Replace a Unistar HR Pump Unit	New Document to support introduction of Unistar
NRSMTH Part04 TC09	Replace ZKL3000-RC	New Test Plan
NRSMTH Part05 Module S22	Management of Obscured Signals	New Document to support transition of TI181 into BAU
NRSMTH Part08 T042	Wrong Side Failure Test Guide: Automatic Warning System (AWS)	New Document Wrong Side Failure Test Guide for Temporary AWS Associated with Speed Restrictions
NRSMTH Part08 T044	Wrong Side Failure Test Guide: NCL ERTMS Irregular Movement Authority	New Document to support new equipment (NCL RBC).
Withdrawn		
NRSMTH Part04 AX67	Replace a Modem Card(AzLE)	Document review of all AzLM document as part of B'ham Newstreet 2oo3 introduction - withdrawn as AzLE not on Network

NRSMTH Part04 AX68	Replace a Section Card (AzLE)	Document review of all AzLM document as part of B'ham Newstreet 2oo3 introduction - withdrawn as AzLE not on Network
NRSMTH Part04 AX71	Replace an ACE Power Supply Card (AzLE)	Document review of all AzLM document as part of B'ham Newstreet 2oo3 introduction - withdrawn as AzLE not on Network
NRSMTH Part04 AX72	Replace an ACE Detection Point Power Supply Card (AzLE)	Document review of all AzLM document as part of B'ham Newstreet 2oo3 introduction - withdrawn as AzLE not on Network

Affected documents

Reference	Issue	Impact	Document type
NR/L3/SIG/11231	18	Superseded	Standard
NR/SMTH/Part 01	8	Superseded	Module
NR/SMTH/Part 02	12	Superseded	Module
NR/SMTH/Part 04	17	Superseded	Module
NR/SMTH/Part 05	18	Superseded	Module
NR/SMTH/Part 08	3	Superseded	Module
NR/SMTH/Part 09	2	Superseded	Module
TI 181	-	Withdrawn	Emergency change

Briefing requirements:

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.

Briefing *(O-Overview/ D-Detailed)*	Post	Function	Responsible for cascade briefing? Y/N
O	Chief Control, Comm & Signalling Engineer	Technical Authority	Y
O	Network Technical Head Switches & Crossings	Technical Authority	Y
D	Head of System Authority	Technical Authority	Y
D	Regional Engineer [Signalling & Telecoms]	Regions (Eastern)	Y
D	Regional Asset Manager [Signalling]	Regions (Scotland)	Y
D	Regional Engineer [Signalling & Telecoms]	Regions (NW & C)	Y
D	Regional Head of Engineering & Asset Management [Sig, Ct & Tel]	Regions (Western & Wales)	Y
D	Regional Head of Engineering [Signalling & Telecoms]	Regions (Southern)	Y
D	Workforce Development Specialist	Route Services	N
Briefing *(O-Overview/ D-Detailed)*	**Role**	**Function**	**Responsible for cascade briefing? Y/N**
D	Route Engineer (Signalling)	Regions	Y
D	Asset Engineer	Regions	N
D	Signal Sighting Engineer	Regions	N
D	SINCS Engineer	Regions	N
D	Signal & Telecoms Maintenance Engineer	Regions (Maintenance)	Y
D	Section Manager (Signals)	Regions (Maintenance)	Y
D	Signalling Technical Support Staff	Regions (Maintenance)	N
D	S&T Maintenance Test Engineer	Regions (Maintenance)	N
D	Signals Team Leader	Regions (Maintenance)	N
D	Technician (Signalling)	Regions (Maintenance)	N
D	Operative (Signalling)	Regions (Maintenance)	N
D	Works Delivery Manager (Signals)	Regions (Works Delivery)	Y
D	Works Delivery Supervisor (Signals)	Regions (Works Delivery)	N
D	Technician	Regions (Works Delivery)	N

D	Operative	Regions (Works Delivery)	N
O	Test and Commissioning Engineer	Route Services	N

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

Ref:	**NR/SMTH/Part/01**
Issue:	09
Date:	02 December 2023
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NR/L3/SIG/11231

NR/SMTH/Part/01

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END

1. Background

On the morning of 12th December 1988, a crowded passenger train crashed into the rear of another train that had stopped at a signal just south of Clapham Junction railway station in London. The second train was derailed and subsequently sideswiped an empty train travelling in the opposite direction.

Figure 1 – South of Clapham Junction, 12th December 1988

A total of 35 people died in the collision, while 484 were injured.

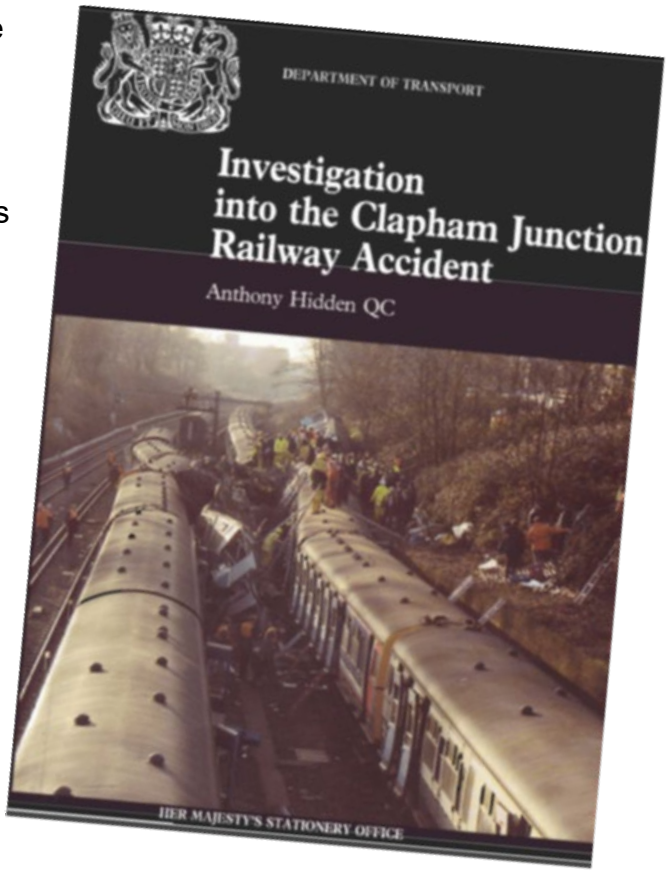
The collision was the result of a signal failure caused by a wiring fault; this fault meant that the protecting signal could not show a red danger aspect when the track circuit immediately in front of the signal was occupied.

New wiring had been installed as part of a re-signalling scheme, but the old wiring had been left in place and not adequately secured.

Following a 56-day independent public inquiry chaired by Sir Anthony Hidden QC, a report was issued which was heavily critical of working methods used during the re-signalling scheme.

The Senior Technician responsible for the flawed work had not been told that his working practices were wrong, and his work had not been inspected by an independent person.

A total of 93 recommendations were made in the report, these covered sweeping changes in installation methods, tighter control over design offices, independent testing of work, the recruitment of sufficient numbers of suitably qualified people, better training, and an end to excessive working.



British Rail's response was to gather together all the best and brightest engineers in the Signal Engineering Department, along with their local and regional practises, their goal to produce the first "National Maintenance Standard" which would lay down mandatory procedures and processes to be used in Maintenance Testing.

And so "The Signal Maintenance Testing Handbook (SMTH)" amongst other documents was born.

END

1. Changes in Ethos since the Introduction of the SMTH

1.1 When the Signal Maintenance Testing Handbook was first introduced it was not considered necessary for:

a) A Maintenance Test Plan to list every task required to perform the work or list checks purely associated with reliability.

b) Non safety critical equipment, or parts of it, to have an associated Maintenance Test Plan.

1.2 Over the years, the rationale behind these statements has changed as the number of asset types/technology has dramatically increased. When added to the increase in mean time between failures and the extended maintenance frequencies, this has led to the maintainer having reduced familiarity with the equipment on their area.

The reduced familiarity has led to “user requests” for:

a) Test plans that are related to reliability.

b) Test Plans for non-safety critical equipment.

c) Test plans for equipment that are owned by other disciplines but maintained by Signalling Technicians.

2. Principles of SMTH

2.1 A flowchart detailing which testing process (SMTH, SITH or SWTH) shall be used and can be found in NR/GI/T001 (Testing – General).

2.2 Maintenance testing allows for safe testing of equipment under varied circumstances such as:

a) Like for like equipment replacement as part of preventative and corrective maintenance where pre-planning cannot be undertaken or

b) Like for like pre-planned minor renewals.

2.3 Maintenance testing is based on the principle that the equipment was fully tested at commissioning and has been working correctly.

The design may therefore be taken to be correct and the work shall not require a change to diagrams unless permitted in the maintenance test plan required as a result of correlation.

3. Working on Equipment

3.1 Working on equipment that is "in service" is acceptable provided the correct protections are in place.

NOTE: *Rule Rook HB19 gives details of the protection arrangements.*

3.2 If disconnections are required as described in NR/GI/B002 (Disconnections), these shall be planned and designed by a Maintenance Tester and shall be checked by an independent Maintenance Tester.

Further information on disconnection, insulation, releasing, isolation, reset, restoration, diversion and monitoring is covered in NR/L3/SIG/10064 (General Instructions to Staff Working on S&T Equipment).

3.3 Signalling circuits in cables shared with telecommunications functions should be identified and tested in accordance with NR/GI/E041 (Signalling Circuits in Telecommunication Systems).

4. Objectives of Maintenance Testing

4.1 The objective of maintenance testing is to prove that the signalling equipment is safely returned to service.

4.2 The Test Plans contain all the vital steps in a logical order. This is necessary to confirm safe working of equipment and to validate that no necessary steps are overlooked.

4.3 Equipment covered by maintenance testing shall be tested in accordance with the maintenance test plans, unless an equivalent or better alternative is approved by the S&TME.

4.4 The approval process shall include a risk assessment and be required to demonstrate that the proposed alternative does not reduce the safety risk.

The requirements for a maintenance test plan are given in NR/SMTH/Part 01/Module/05 (Test Plan Requirements).

5. Independence

5.1 Maintenance testing can be used to achieve independent verification of installation work.

5.2 All Test plans require independence when testing, unless indicated as "Independence Exempt"

5.3 The Maintenance Tester shall be independent of the installer.

5.4 The Maintenance Tester is responsible for checking that the equipment is restored to use in a safe condition. The Maintenance Tester shall not carry out or direct (but can assist) the work which is to be subsequently verified by themselves.

END

1. When Testing moves between Signal Maintenance Testing and Signal Intermediate Testing

1.1 If any of the following criteria are exceeded, then the work shall be classed as extensive and simultaneous and **shall not** be undertaken as maintenance testing:

a) If the number of staff required on any one shift exceeds three teams of three people.

b) If the disconnection work exceeds one shift. Maximum of 12 hours.

c) If the reconnection work exceeds one shift. Maximum of 12 hours.

d) If there are more than thirty tail cable disconnections. In areas fitted with plug and play this number can be increased to fifty.

e) A maximum of two-point machines per team. In areas fitted with plug and play this number can be increased to four per team.

f) A maximum of two signal head replacements (all types) per team. In areas fitted with plug and play this number can be increased to six per team.

g) Excluding rapid response incident, the planned replacement of a lineside multi-core cable affecting signalling equipment on more than two lines that are in service.

1.2 The Engineer in charge of the work (typically the S&TME or Project Engineer) can apply to the Route Engineer (Signalling), Principal Route Engineer (Signalling) or equivalent, for permission to work outside of these criteria.

1.3 The dispensation shall be given in writing. Before giving permission, the Route Engineer (Signalling), Principal Route Engineer (Signalling) or equivalent, shall be assured that the associated risks are controlled.

The evaluation of risk shall take the following into account, as a minimum:

a) The exact nature and scope of the work – details.

b) Local circumstances.

c) Criticality of the affected equipment.

d) Density of service.

e) Other operational issues that are ongoing, but not related to the SMTH issue.

f) Consequences of the SMTH work not going to plan.

g) Possible operational “work arounds”.

h) Quality and competency of staff who undertake the work.

i) Quality and competency of staff who supervise the work.

1.4 If dispensation is refused the Testing process transfers to the Signal Intermediate Testing or Signal Works Testing, see NI/GI/T001 (Testing - General).

1.5 The Route Engineer (Signalling), Principal Route Engineer (Signalling) or equivalent shall be accountable for the final decision to authorise any request for permission to work outside the criteria.

END

1. Responsibilities

1.1 Signal & Telecoms Maintenance Engineer - (S&TME)

Is responsible for confirming that all staff under their control hold valid competencies and authorities to work, before undertaking maintenance testing activities.

1.2 Section Manager (Signals) – (SM(S)) or Renewals Manager

Designates the Maintenance Tester before work starts.

If more than one group of SMTH Testers are working together then the Lead Maintenance Tester shall also be designated.

Determines the extent of the work, confirms that the work can be undertaken using the SMTH and decides which maintenance test plans are required.

Shall produce Maintenance Test Plan Lists (NR/SMTH/Part02/Form/02) whenever more than one Maintenance Test Plan is required to carry out a task.

1.3 Team Leader

The Team Leader (or the Person in Charge of the Work in the absence of the Team Leader) is responsible for designating who will act as the Maintenance Tester/s, and Lead Maintenance Tester, if they not already been designated by the SM(S) or Renewals Manager.

Before any work takes place, that is likely to require any level of maintenance testing, all members of the team shall be advised who the Maintenance Tester/s is/are. There shall be no doubt who this person is before the work commences.

1.4 Lead Maintenance Tester / Maintenance Tester

Lead Maintenance Tester / Maintenance Tester shall be in overall charge of the testing.

If a Test Plan List has been produced:

a) Confirm the extent of the work and

b) Confirm that the work can be undertaken using the Maintenance Test Plans indicated.

If a Test Plan list has not been produced:

a) Determine the extent of the work.

b) Confirm that the work can be undertaken using the Maintenance Testing.

c) Decide which maintenance test plans are required to carry out the testing.

2. Roles and Responsibilities

2.1 The SMTH contains certain roles and job titles pertaining to maintenance within Network Rail. For other functions within Network Rail and Contractors/Suppliers who carried out SMTH work, the roles and responsibilities contained within the SMTH shall be mapped across to these organisations.

END

1. Competence of the Individual Carrying Out the Work (also known as the Installer)

1.1 The individual carrying out the work shall hold the necessary competencies as indicated below:

a) The removal of the item being replaced and fitting of the replacement item.

Where the replacement does not require configuration or set up by the Installer and can be undertaken using site diagrams, then as a minimum the person shall hold basic signalling competencies.

NOTE: *Basic signalling courses such as SEM1 and SEM2 provide a level of competency that allows the installation of simple signalling equipment to be undertaken using existing wiring diagrams. This includes replacement of wires, cables, terminal blocks, free wired and plug-in components.*

b) Where integral component replacement tasks are required to be undertaken (e.g., replacement of lock and detector assembly) or where the replacement requires equipment to be set up or configured by the Installer, the Installer shall be competent to undertake the work independently from the Tester.

c) Where diagram amendments are required to be undertaken (e.g., as a result of a cable diversion) the Installer shall be competent to undertake the work independently from the Tester.

2. Competence of the Signal Maintenance Tester

2.1 The Signal Maintenance Tester shall hold the necessary competencies for the equipment being replaced and tested.

2.2 The Signal Maintenance Tester shall be responsible for:

a) Carrying out the defined checks during both the before and after phases of the testing.

b) Recording any notes that are required during the maintenance test plan process.

c) Carrying out the defined tests during both the before and after phases of the testing.

d) Completing and returning the Log Sheet, the Maintenance Test Plan List (if provided) and all other mandatory testing documentation to the SM(S).

e) Completing the Record Card (if provided).

f) Checking any amendments to diagrams and reporting these alterations to the SM(S).

3. Levels of Competence for Signal Maintenance Testers

When undertaking Signal Maintenance Testing activities, the role and responsibilities of the Signal Maintenance Tester are determined by the activity being undertaken. An individual undertaking the duties of a Signal Maintenance Tester can be categorised as (see also Figure 1):

a) Individual that Requires Training

An Individual who has been selected for development, as part of a development action plan, to become a Signal Maintenance Tester and has not yet successfully completed the Initial Training Event. The Individual is not permitted to complete any Signal Maintenance Testing Activity in the role of Tester.

b) Signal Maintenance Tester in Action Learning (Trained Requires Supervision)

A Signal Maintenance Tester in Action Learning has successfully completed the Initial Signal Maintenance Testing Training Event and has not successfully completed a Signal Maintenance Testing Renewal Event for the relevant testing activity being undertaken. A Signal Maintenance Tester in Action Learning is not permitted to return equipment to service after Signal Maintenance Testing Activity and requires the presence of a Competent and Experienced Signal Maintenance Tester.

c) Competent Signal Maintenance Tester (Competent)

A Competent Signal Maintenance Tester has successfully completed a Signal Maintenance Testing Renewal Event for the relevant testing activity being undertaken. A Competent Signal Maintenance Tester can undertake Signal Maintenance Testing unaided and return equipment to service after Signal Maintenance Testing activities.

d) Competent and Experienced Signal Maintenance Tester (Competent and Experienced)

A Competent and Experienced Signal Maintenance Tester has met the requirements of a Competent Signal Maintenance Tester. They are nominated by their Line Manager, have a minimum of 36 months experience holding the relevant Signal Maintenance Testing competence and exhibit good non-technical skills and behaviours.

A Competent and Experienced Signal Maintenance Tester can undertake Signal Maintenance Testing unaided, return equipment to service after Signal Maintenance Testing activities and act as a nominated Competent and Experienced Signal Maintenance Tester that is responsible for the testing activities being undertaken by a Signal Maintenance Tester who is in Action Learning.

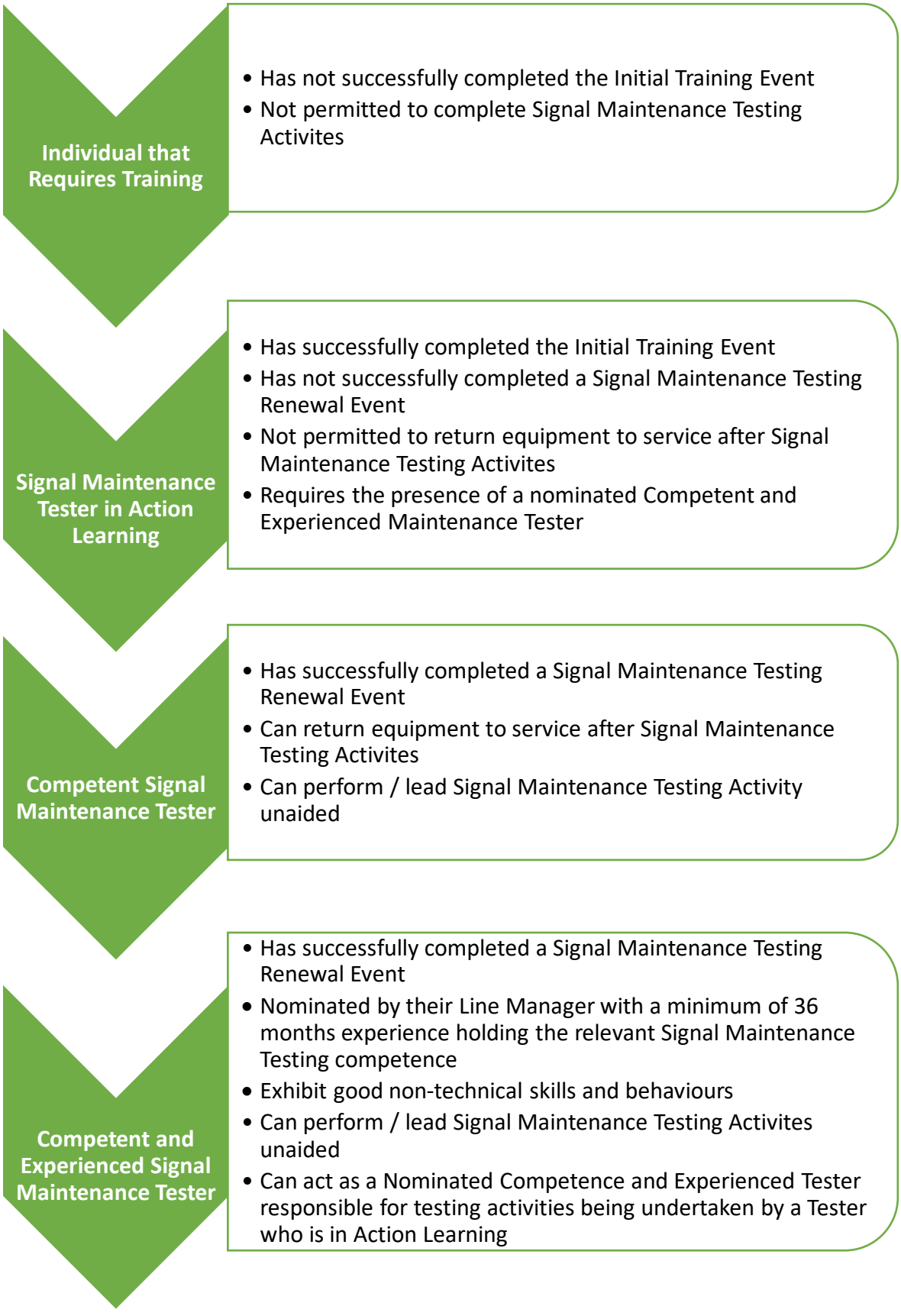


Figure 1: Competence Levels of a Signal Maintenance Tester

4. Authority to work of a Signal Maintenance Tester

4.1 Signal Maintenance Testers shall be issued an authority to work by their employer that clearly details what competencies they hold.

NOTE: *Network Rail use NR/L2/SIG/50035/07 – Competence and Training for the competence framework; CCS Signal Maintenance Testing for the structure of SMTH competence for Network Rail staff. Other Employers may choose to use the same structure. Further information on authority to work requirements can be found in NR/L2/CTM/201 – Competence Management.*

5. IRSE Licensing requirements for a Signal Maintenance Tester

5.1 The Signal Maintenance Tester shall meet the requirements of NR/L2/SIG/10160 – Specification for Application of the IRSE Licensing Scheme.

NOTE: *A competent SMTH tester will normally hold a valid IRSE licence in a relevant category.*

6. Development of an Individual that Requires Training for Signal Maintenance Testing

6.1 The Individual that requires training for Signal Maintenance Testing shall be developed using an Initial Training Event approved by the Network Rail Network Technical Head Signalling.

NOTE: *The approval of Training Events is currently managed through the Signalling Capability Development Group. Further details of Signal Maintenance Testing development can be found in NR/L2/SIG/50035/07 - Competence and Training for the competence framework; CCS Signal Maintenance Testing.*

7. Signal Maintenance Tester in Action Learning

7.1 A period of Action Learning shall be required for Signal Maintenance Testers where they:

a) Are newly qualified.

b) Have been deemed Not Yet Competent as an outcome of a Signal Maintenance Testing Renewal Event.

7.2 The initial period of Action Learning shall be up to 6 months.

NOTE: *Action Learning should be completed within 6 months and supported with a development action plan. If Action Learning is not completed within the initial 6 months, this period can be extended for a further 6 months.*

7.3 If Action Learning has not been completed within 12 months, the line manager shall arrange for the individual's competence to be withdrawn.

NOTE: *Network Rail uses NR/L3/CTM/306 – Skills Assessment Scheme for competence assurance. Action learning is in addition to the mentorship requirements detailed in NR/L2/SIG/10160 – Specification for Application of the IRSE Licensing Scheme.*

7.4 Signal Maintenance Testing that is undertaken by a Signal Maintenance Tester in Action Learning shall be completed in the presence and to the satisfaction of a nominated Competent and Experienced Signal Maintenance Tester.

NOTE: *Individuals selected as Competence and Experienced may develop other Signal Maintenance Testers and can have a large influence on the Signal Maintenance Tester that is in formal Action Learning. The Nominated Signal Maintenance Tester does not have to be the same individual for each Tester in Action Learning.*

7.5 Where paper SMTH log sheets are being used, the SMTH log sheet should be completed by the Signal Maintenance Tester in Action Learning and countersigned by the nominated Competent and Experienced Signal Maintenance Tester.

Where an e-SMTH Log Sheet is being used the nominated Competent and Experienced Tester should complete the e-SMTH Log Sheet and insert the name of the Signal Maintenance Tester in Action Learning in the comments.

7.6 A Signal Maintenance Tester in Action Learning shall only move to a Competent Signal Maintenance Tester and work without supervision after successful completion of a Signal Maintenance Testing Renewal Event approved by the Network Rail Network Technical Head Signalling.

NOTE: *The approval of competency Renewal Events is currently managed through the Signalling Capability Development Group. Further details of Signal Maintenance Testing development can be found in NR/L2/SIG/50035/07 - Competence and Training for the competence framework; CCS Signal Maintenance Testing.*

NOTE 2: *The assessment for renewing a Signal Maintenance Tester competence is used for the Signal Maintenance Tester in Action Learning with the expectation that an individual has to meet the same minimum level of competence required to practice Signal Maintenance Testing.*

Upon Successful completion of a Signal Maintenance Testing Renewal Event, the Signal Maintenance Tester in Action Learning will become a Competent Signal Maintenance Tester. The full competence validity period should begin from day of successful completion.

8. Competent Signal Maintenance Tester

8.1 A Signal Maintenance Testing competence validity period shall not exceed 36 months from the date of the Signal Maintenance Testing Renewal Event for the relevant Signal Maintenance Testing Competence.

8.2 The Signal Maintenance Tester shall have their competence renewed using a Signal Maintenance Testing Renewal Event approved by the Network Rail Network Technical Head Signalling.

NOTE: *The approval of competency Renewal Events is currently managed through the Signalling Capability Development Group. Further details of Signal Maintenance Testing development can be found in NR/L2/SIG/50035/07 - Competence and Training for the competence framework; CCS Signal Maintenance Testing.*

8.3 If the Signal Maintenance Testing Renewal Event decision is 'Not yet Competent', the individual shall undergo a period of formal Action Learning supported by a development action plan.

8.4 If the renewal assessment decision is 'Not Competent', the individual shall be treated as an individual that requires training.

NOTE: *The Structure of the Network Rail approved Signal Maintenance Testing Renewal Event is aligned to NR/L2/SIG/50035/07– Competence and Training for the competence framework; CCS Signal Maintenance Testing. Other Employers may choose to use the same structure for easy mapping into their own Competence Management Systems.*

9. Competent and Experienced Signal Maintenance Tester

9.1 A Competent and Experienced Signal Maintenance Tester shall meet the same requirements of the Competent Signal Maintenance Tester and:

a) Be nominated by their Line Manager.

b) Have a minimum of 36 months experience holding the relevant Signal Maintenance Testing competence.

c) exhibit good non-technical skills and behaviours.

9.2 A competent and Experienced Signal Maintenance Tester can act as a nominated Competence and Experience Signal Maintenance Tester and assist with the development of a Signal Maintenance Tester in Action Learning.

NOTE: *Nominated Competent and Experienced Signal Maintenance Testers can observe multiple Testers in Action Learning.*

9.3 The nominated Competent and Experienced Signal Maintenance Tester shall be responsible for the testing that has been undertaken by the individual that is under formal Action Learning.

NOTE: *This includes the satisfactory completion of any testing documentation.*

If the nominated Competent and Experienced Signal Maintenance Tester, who is observing a Tester in Action Learning, changes during the activity this should be treated as a 'Handover Where Testing Cannot Be Completed' between the two nominated Competent and Experienced Signal Maintenance Testers as defined in NR/SMTH/Part01/Module/09 (Testing Sequence) – Clause 6.

END

1. Maintenance Test Plans

1.1 Maintenance Test Plans are the primary test documents. Maintenance Testing activities shall not be undertaken without reference to these documents.

1.2 A Maintenance Test Plan consists of numbered steps in a logical sequence.

1.3 Maintenance Test Plans are pre-determined test specifications, which comprise checklists of the minimum safety tests to check the safe operation of replaced signalling or telecommunications equipment where the work has operational safety implications.

1.4 The test sequence should be followed, it is permissible to complete the steps out of sequence if the situation requires. However, the Tester shall confirm before testing finishes that all the steps have been completed.

1.5 Maintenance Test Plans are divided into two sections, covering tests needed BEFORE INSTALLATION WORK and those required AFTER INSTALLATION WORK.

NOTE: *On occasion, to assist with the smooth completion of a Test Plan, a third section called "DURING INSTALLATION WORK" is inserted between the Before and After sections of a test plan.*

1.6 A Maintenance Test Plan need not list every task required to perform the work.

1.7 New Maintenance Test Plans, when required, should be produced using the closest, existing Maintenance Test Plan as a guide and independently checked before use.

1.8 A Maintenance Test Plan is not required for adjustment activities where electrical circuits are designed to be adjusted, e.g. transformer tappings, track circuit feed set or resistor block strapping, or wire wound resistors with a tapping ring.

Check that adjustment straps are correctly terminated, and no stray connections are possible.

1.9 Terms or words used in a Maintenance Test Plan, which describe defined tests in Part 03, are to be written in block capitals (e.g. WIRE COUNT).

1.10 Tests or checking sequences which are already defined in the Signalling Maintenance Specifications (NR/SMS under NR/L3/SIG/10663) shall be referenced from this handbook when required.

1.11 Each Maintenance Test Plan is normally indexed by use of an equipment index.

1.12 Some Maintenance Test Plans have hyperlinks within the text these are provided to assist navigation around the documents.

1.13 Maintenance Test Plans are not required for mechanical adjustments or checking that equipment is left secure, e.g., bolts tightened, or pins correctly fitted.

1.14 During any other work, including fault diagnosis, which involves disconnections or substitutions, the relevant Maintenance Test Plans shall be used.

2. Additional Testing Requirements Caused by Replacement or Alteration of an Item of Equipment

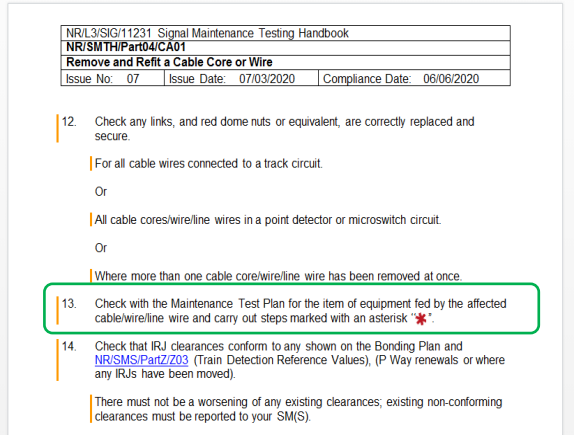
2.1 In some cases, the replacement or alteration of an item of equipment could have consequences on a second item of equipment.

2.2 A Tester shall confirm that any associated equipment has not been affected by the work carried out during the original replacement.

2.3 To assist with this requirement any Maintenance Test Plans that requires this additional confirmation, includes a step which re-directs the tester to an additional test plan/s.

2.4 An example of this would be the replacement of a cable to an LED GPL. When the Tester reaches Step13 of SMTH Part04 CA01, they are instructed to refer to the test plan for an item fed from the replaced cable (circled in green in Figure 1) and carry out the test steps marked with a red asterisk ✱ in the left-hand margin.

The Tester would move to the new Test Plan for the Replacement of Ground Position Light Signal (SMTH Part04 SG15) and carry out test steps 18 and 20 indicated by the asterisks and circled in blue in Figure 2.



NR/L3/SIG/11231 Signal Maintenance Testing Handbook
NR/SMTH/Part04/CA01
Remove and Refit a Cable Core or Wire
Issue No: 07 | Issue Date: 07/03/2020 | Compliance Date: 06/06/2020

12. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.

For all cable wires connected to a track circuit.

Or

All cable cores/wire/line wires in a point detector or microswitch circuit.

Or

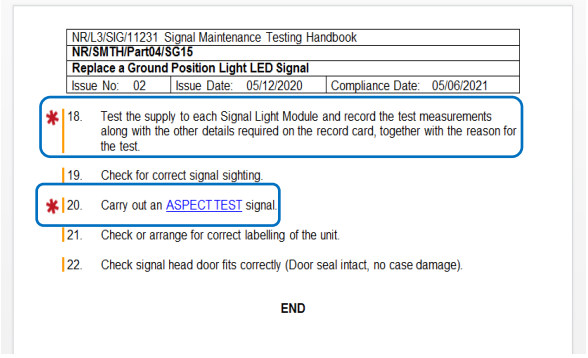
Where more than one cable core/wire/line wire has been removed at once.

13. Check with the Maintenance Test Plan for the item of equipment fed by the affected cable/wire/line wire and carry out steps marked with an asterisk "✱".

14. Check that IRJ clearances conform to any shown on the Bonding Plan and NR/SMS/Part7/Z03 (Train Detection Reference Values), (P Way renewals or where any IRJs have been moved).

There must not be a worsening of any existing clearances; existing non-conforming clearances must be reported to your SM(S).

Figure 1 – Test Plan CA01



NR/L3/SIG/11231 Signal Maintenance Testing Handbook
NR/SMTH/Part04/SG15
Replace a Ground Position Light LED Signal
Issue No: 02 | Issue Date: 05/12/2020 | Compliance Date: 05/06/2021

✱ 18. Test the supply to each Signal Light Module and record the test measurements along with the other details required on the record card, together with the reason for the test.

19. Check for correct signal sighting.

✱ 20. Carry out an ASPECT TEST signal.

21. Check or arrange for correct labelling of the unit.

22. Check signal head door fits correctly (Door seal intact, no case damage).

END

Figure 2 – Test Plan SG15

2.5 On completion of the additional test steps Tester shall return to the original Test Plan.

2.6 Step 2.3 shall be carried out for each item fed or affected by the original replacement.

END

1. Independence Exempt.

1.1 Maintenance testing can be used to achieve independent verification of installation work and the Maintenance Tester shall be independent of the Installer.

1.2 The requirements for a test plan to be “Independence Exempt” are as follows:

a) Straight forward equipment replacement, such as plug in components.

b) No configuration or setup is required.

c) The work is simple in nature, non-complex.

d) Common mode mistakes are extremely unlikely and low risk.

1.3 If all these requirements are met, the test plan shall be endorsed ‘Independence Exempt’.

1.4 If there is any doubt, the test plan shall not be marked as “Independence Exempt”.

1.5 A Test Plan that is “Independence Exempt” is indicated by a banner on the first page, see Figure 1.

*****Independence Exempt*****

Figure 1 - Independence Exempt Banner

1.1 An Independence Exempt Test Plan allows the “Before Installation” and “After Installation” tasks to be carried out without the need for the work to be checked by an independent Tester.

1.2 To carry out an Independence Exempt Test Plan the person carrying out the task shall be a qualified SMTH Tester.

1.3 The completion of an SMTH Log sheet is required.

END

1. General

1.1 Maintenance Testing shall be used to test equipment replaced into a previously working and commissioned system during preventative and corrective maintenance activities and minor renewals.

1.2 The replacement shall be like-for-like and any new item shall be equivalent to the original item which it replaces.

1.3 The following specific alterations to equipment can be tested using SMTH:

a) Cable or wire found cut, separated from its connection or with a length missing.

b) Other previously working equipment found physically missing or separated from its normal position.

c) Temporary diversion of a cable wire for corrective maintenance activities only.

1.4 Maintenance Test Plan Lists (NR/SMTH/Part02/Form/02) shall be used whenever more than one Maintenance Test Plan is required to carry out a task.

1.5 Temporary alterations/reinstatement of equipment is covered by Signal Intermediate Testing Handbook.

1.6 Emergency renewals following an incident shall be undertaken using the correct Test Plan with authorisation from the S&TME or the Route Engineer (Signalling) / Principal Route Engineer (Signalling) or equivalent.

2. Telecommunications Systems

2.1 Work on communications systems carrying safety related data required for railway operations shall be undertaken in accordance with NR/GI/E041 (Signalling Circuits in Telecommunication Systems).

2.2 For work on operational telecommunications equipment, see NR/SMTH/Part/06 (Test Plans for Telecoms, DOO and RETB).

NOTE: *Full details are given in NR/L2/TEL/31001 (Telecommunications Maintenance Testing & Failure Investigation (TMT&FIP).*

3. Signalling Maintenance Diagrams

3.1 Test diagrams and engineering details are not provided for SMTH work, and instead the existing infrastructure maintenance records shall be used as the reference documents.

3.2 If the infrastructure maintenance records are missing, inform your SM(S) who will direct you on how to proceed.

3.3 Further information on Signalling Maintenance Diagrams can be found in NR/SMS/PartA/A11 (Maintenance Diagrams) and NR/L3/SIG/SG0162.

END

1. Introduction

1.1 This module details the SMTH Testing for equipment that is a like for like replacement but are not part of reactive corrective maintenance activities and should be pre-planned.

2. Pre-Planned Like for Like Replacements

2.1 Equipment that is being replaced before failure or life expired, which are being replace as like for like in a pre-planned manner such as:

a) Relay re-servicing.

b) Mechanical treadle replacements.

c) Installing and changeover of a top nutted cable.

2.2 Equipment that has failed but could not be replaced immediately on a like for like basis, due to such reasons as track access or the time taken to acquire the component, for example:

a) The replacement of a point machine.

b) Signal head.

c) Lineside or signalling tail cable.

2.3 The SM(S) shall be responsible for planning the work.

3. Pre-Installation Work

3.1 Installation work carried out off-site in advance of site work shall be Maintenance Tested.

3.2 The extent of the Maintenance Testing completed shall be recorded. The record of the off-site testing shall be included with the technical information details described in clause 6.1. The record shall clearly indicate the item of equipment it applies to, i.e. by serial number or another unique identifier.

Details of the process required to undertake these activities are in Clause 6.

4. Test Plans

4.1 The Maintenance Test Plans in SMTH Part04 shall be used if they are applicable for the activities carried out as pre-planned work.

5. Maintenance Test Plan Lists

5.1 Maintenance Test Plan Lists (NR/SMTH/Part02/Form/02) shall be used whenever more than one Maintenance Test Plan is required to carry out a task.

6. Planning the Work

6.1 Pre-planned work involving SMTH shall be planned in accordance with the Infrastructure Maintenance Planning Handbook (NR/L3/MTC/PL0175). If the work is undertaken by contractors, the planning process used shall be comparable to that used by Network Rail.

7. Additional Responsibilities of the (SM(S) or Renewals Manager (Signals) or equivalent

7.1 The following additional information might be required as part of the Work:

a) Wiring diagrams.

b) Signalling plans.

c) Where point systems are involved, a relevant extract of the site plan (locking sketch) showing the normal lie of the points. Permutation charts are to be provided as part of the testing.

d) Certificates of conformity or pre-testing.

e) Details of any off-site maintenance testing undertaken (completed or partially completed test plans).

f) Identity of replacement equipment (e.g. make and model number, serial number or another unique identifier).

g) Where more than one asset of the same type is being replaced, identify the position (location) of the equipment being substituted.

This list is not exhaustive and other relevant items are to be added if they are appropriate for the work and maintenance testing.

7.2 The SM(S) / Renewals Manager (Signals) or equivalent, shall brief the requirements of the planned work to the Maintenance Tester in overall charge of the work, and all other staff who are going to be involved in the work, prior to it being undertaken.

7.3 The Responsibilities of the S&TME, SM(S), Team Leader, Lead Maintenance Tester / Maintenance Tester and other members of the team is covered in NR/SMTH/Part01/Module/03.

8. Undertaking the Work

8.1 The work shall be carried out as planned; the Maintenance Tester shall stop all work and inform the SM(S) or Renewals Manager (Signals) or equivalent if the work plan and/or associated technical information are missing, incorrect or incomplete.

9. Changes to the Maintenance Testing

9.1 The Maintenance Tester shall amend the details of the test plans undertaken if the requirements for testing vary from those detailed in the work planning.

9.2 Changes to the person(s) undertaking the work or the Maintenance Tester shall be recorded.

9.3 These changes shall be recorded by the Maintenance Tester and returned as part of the work planning details to the relevant SM(S) or Renewals Manager (Signals) or equivalent.

Details shall include:

a) The reason for the variance.

b) The new maintenance test plans used (if amended).

c) The new person(s) undertaking the work or Maintenance Tester (if amended).

d) Any other relevant information.

10. Completion of Work

10.1 On completion of the work, the Maintenance Tester shall review all the details of the actual maintenance testing undertaken and log any variances from the original plan.

10.2 The Maintenance Tester shall return the completed maintenance testing details to the SM(S) or Renewals Manager (Signals) or equivalent.

10.3 The SM(S) or Renewals Manager (Signals) or equivalent shall check the maintenance testing details.

10.4 If the maintenance testing actually undertaken is considered inadequate or any variances details have changed the scope or perspective of the maintenance testing, the SM(S) or Renewals Manager (Signals) or equivalent shall immediately arrange for the maintenance testing to be undertaken again by another competent Maintenance Tester, independent of the original Maintenance Tester.

10.5 If the situation dictates it, the S&TME shall authorise the tested item to be signed out of use until they are assured that maintenance testing has been successfully carried out.

11. Storage of Maintenance Testing details for Pre-Planned Work

The SM(S) or Renewals Manager (Signals) or equivalent shall be responsible for the safe storage of completed paper maintenance testing documents for pre-planned work.

END

1. Testing Sequence

1.1 The relevant Test Plan shall be selected and carried out in sequence:

a) 'Before Installation' tests, checks or preliminary work.

b) The replacement or diversion work itself.

c) 'After Installation' tests or checks.

2. Errors

2.1 Any errors found during the “Before Installation Work” shall be reported to the SM(S).

2.2 Any errors found during the “After Installation Work” testing shall be corrected by the person doing the work.

2.3 The correction shall be rechecked by the Maintenance Tester along with anything that could have been affected by the remedial work.

3. Replacement of Equipment that is found to be Missing

3.1 A standard SMTH Part04 Test Plan shall be used, and the SMTH Log Sheet endorsed “Item Missing”.

NOTE: *Missing Equipment Test Plans have been withdrawn, and the missing step added to the relevant Test Plan.*

3.2 To qualify for replacement as missing equipment the following criteria shall be met:

a) The missing equipment shall have been present and working, prior to its damage or removal.

b) Confirm that the equipment is meant to be in service and has not been removed for a genuine reason.

c) Check the location/equipment room for newly installed stage work wiring, as the removal of the item could be related to an on-going signalling renewal.

d) Documentation is available to allow the “correct type” to be identified.

e) Complete and accurate diagrams are available, and the work shall not require any change to diagrams.

f) For equipment that requires to be placed in a critical position, such as axle counters, treadles etc, check that the documentation is available which identifies the correct line, alignment, position and orientation of the equipment to be replaced.

3.3 If the criteria in 3.2 cannot be met or the Tester has any concerns, advice on how to proceed shall be sort from the SM(S).

3.4 Cables associated with any missing equipment shall be tested before being re-terminated on the replacement equipment, this is to confirm they are undamaged and safe to re-use.

4. Amendments

4.1 If the available diagrams have previously been amended by hand, e.g. with a temporary diversion, details shall be noted on the SMTH Log Sheet as part of the record of test.

5. SMTH Log Sheets and Wire Count Check Sheets

5.1 SMTH Log Sheets shall be fully completed on site as shown in SMTH/Part01/Module/10 (Completion of the SMTH Log Sheet).

5.2 A Wire Count check sheet (see NR/SMTH/Part/02) shall be completed on every occasion that a Test Plan requires a wire count to be undertaken.

5.3 Where the SMTH Tester is unable to complete all applicable testing steps, escalation to the SM(S) is required before allowing equipment to enter service. This shall be noted on the completed SMTH Log Sheet.

5.4 In the event of the SMTH Log Sheet being completed for failure attendance, the relevant infrastructure control shall also be included on the e-mail so that it can be added to the FMS entry.

5.5 If a maintenance test plan is deficient in anyway, details shall be noted as part of the record of test and any additional tests carried out before the equipment is returned to service.

5.6 Any shortfalls or corrections shall be reported to the SM(S) as soon as possible. The SM(S) shall arrange to have the equipment retested if a maintenance test plan is deficient.

6. Handover Where Testing Cannot Be Completed

6.1 If a test plan is partially completed by a Tester, it may be handed over to a continuing Tester to complete. Completed steps shall be recorded on a SMTH Log Sheet, incomplete steps shall be marked as incomplete. A copy of the SMTH Log Sheet shall be forwarded to the continuing Tester. If using a paper SMTH Log Sheet, the incomplete steps shall be lined out.

6.2 A clear understanding shall be reached between first Tester and the second Tester, as to the exact tests/steps completed at the point of hand over.

6.3 The continuing Tester shall record steps they complete on a new SMTH Log Sheet, steps completed by other Tester(s) shall be marked as completed by others. If using a paper SMTH Log Sheet, steps completed by others shall be lined out.

6.4 Tests documented as completed need not be repeated but any which are not listed as complete shall be assumed not done. Both records of test shall be submitted to the SM(S) after completion.

7. Testing for Correct Operation

7.1 On completion of the required testing defined in the maintenance test plan(s) the part of the signalling system affected by the work shall be checked to prove correct operation.

This check can, for example, involve watching a train pass through a signalled route and observing that the track circuits occupy and clear in the correct sequence; signals are restored to danger, etc. It can involve observing that points move in correspondence with the Signaller's controls.

7.2 If equipment cannot be safely restored to service, then the provisions of Rule Book Handbook 19 shall be applied to the failed equipment.

8. On Completion of Testing

8.1 Before the equipment is returned to service, the work and all testing shall be completed, and an SMTH Log Sheet produced, unless exempted in the maintenance test plan.

8.2 Any test instrumentation or straps provided for testing shall be completely disconnected from the commissioned system, except where permitted by NR/GI/U033 (Use of Monitoring and Test Equipment) and NR/GI/U034 (Management and Control of Temporary Straps).

8.3 On completion of the maintenance testing work, the Maintenance Tester shall check that the installation / equipment is left in a secure condition and that arrangements have been made for the prompt removal from site of any displaced equipment. Where manual handling is practicable, this removal shall be immediate.

8.4 On completion of the work and prior to leaving site, the Tester shall submit the completed SMTH Log Sheet and wire count check sheets to the SM(S). If using paper SMTH Log Sheets and Wire Count check sheets a photo/scan shall be sent to a designated Route e-mail address.

The designated route email addresses are:

- SMTH-Log-Slips-Anglia@networkrail.co.uk
- SMTH-Log-Slips-East-Coast@networkrail.co.uk
- SMTH-Log-Slips-East-Midlands@networkrail.co.uk
- SMTH-Log-Slips-North-and-East@networkrail.co.uk
- SMTH-Log-Slips-NW&C-Central@networkrail.co.uk
- SMTH-Log-Slips-NW&C-NorthWest@networkrail.co.uk
- SMTH-Log-Slips-NW&C-WCS@networkrail.co.uk
- SMTH-Log-Slips-Scotland@networkrail.co.uk
- SMTH-Log-Slips-Kent@networkrail.co.uk
- SMTH-Log-Slips-NR-High-Speed@networkrail.co.uk
- SMTH-Log-Slips-Sussex@networkrail.co.uk
- SMTH-Log-Slips-Wessex@networkrail.co.uk
- SMTH-Log-Slips-Wales@networkrail.co.uk
- SMTH-Log-Slips-Western@networkrail.co.uk

8.5 In the event of the SMTH Log Sheet being completed for failure attendance, the relevant infrastructure control shall also be included on the e-mail so that it can be added to the FMS entry.

8.6 The Team Leader (person in charge of the work) shall check the SMTH Log Sheets have been submitted prior to leaving site.

8.7 If using paper SMTH Log Sheets and other supporting paperwork, hard copies shall be returned to the SM(S) on return to depot.

8.8 Where the SMTH tester is unable to complete all applicable testing steps, escalation to the SM(S) is required before allowing equipment to enter service. This shall be noted on the completed SMTH Log Sheet.

9. Final Checks before Returning to Service

9.1 The Signaller shall be requested to restore any signalling functions operated for testing, e.g. cancel routes and normalise levers.

9.2 Where applicable, the system shall be restored to its normal state in accordance with NR/GI/B003 (Releases and Restoration) i.e. with no stored conditions, before it is permitted to re-enter service.

END

1. When is a SMTH Log Sheet not required?

1.1 There are occasions for simple tasks when the completion of an SMTH Log Sheet is not required. These are shown by the banner in Figure 1.

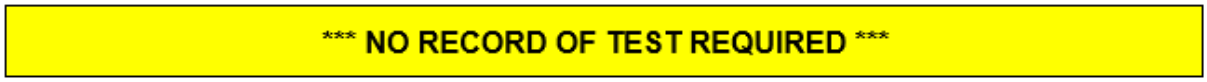


Figure 1 – Banner of No Test Required

2. SMTH Log Sheet Requirements

2.1 When Maintenance Test Plans are used a SMTH Log Sheet shall be completed by the Tester whilst carrying out the work.

2.2 The information shown in Table 1 shall be recorded as a minimum:

Key	Requirement
1	The date of the work.
2	The time of rectification or completion.
3	Any fault number or N/A if not required.
4	The site of work.
5	A summary of affected equipment (ID/serial numbers).
6	Basic details of the work (summary).
7	The first SMTH Maintenance Test Plan used.
8	The second SMTH Maintenance Test Plan used.
9	The name of the person or persons doing the work.
10	The name of the person carrying out the testing.
11	Any relevant Notes shall be recorded here these could include: • Any links slipped during the work which require recording. • Any details of handover to/from another team (time, date, names). • Any testing steps required which have not or cannot be carried out. Any suggested Maintenance Test Plan deficiency and any additional testing carried out as a result. • Any amendments to diagram. • Any temporary strapping / diversions Any problems encountered during the work or testing.
12	The Section Manager should initial and date in this area when a paper SMTH Log Sheet has been reviewed.

Table 1 – SMTH Log Sheet Requirements

3. e-SMTH Log Sheets

NOTE: *e-SMTH Log Sheets are completed within the e-SMTH Mobile App.*

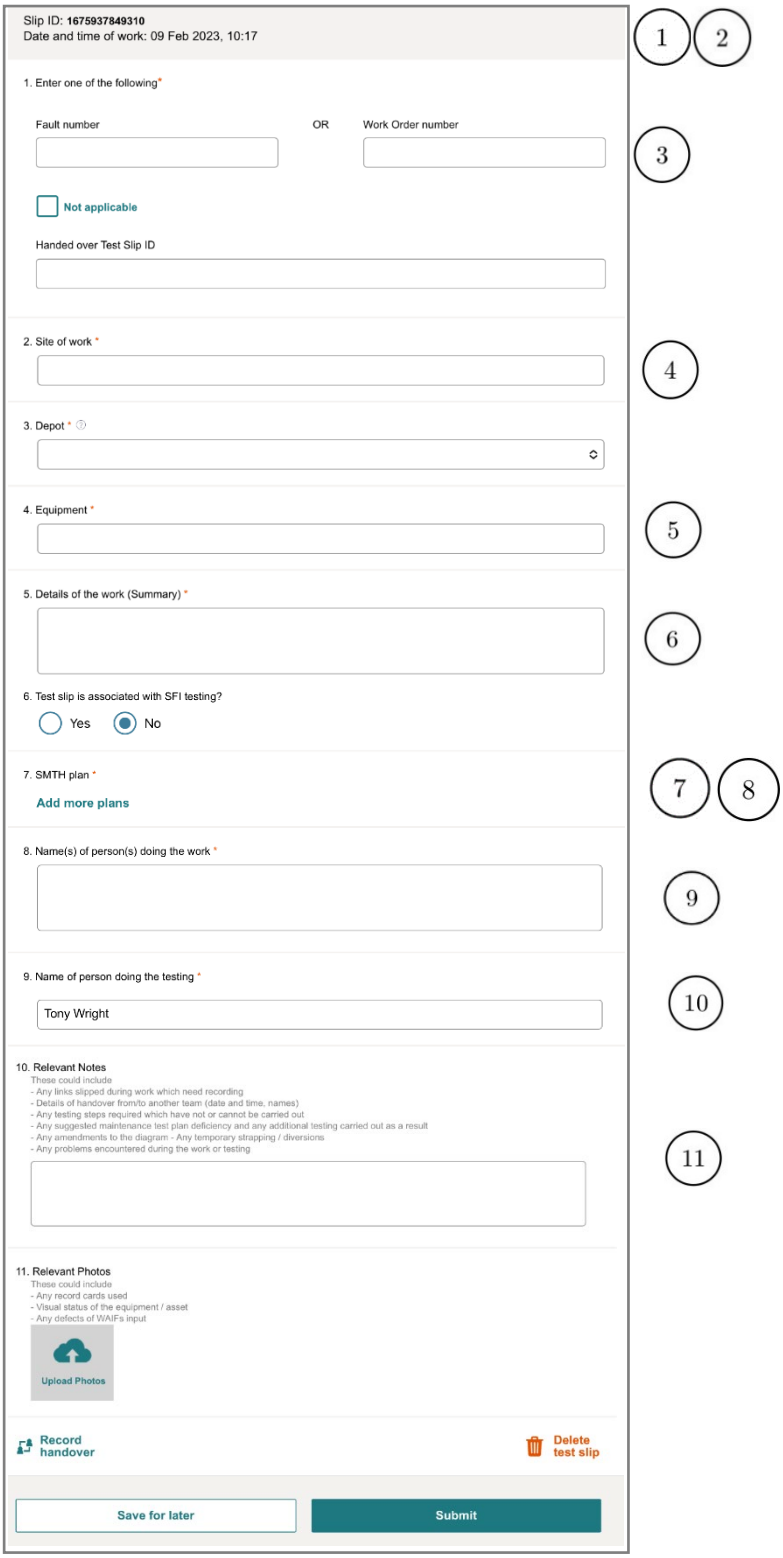


Figure 2 - e-SMTH Log Sheet mapped to Section 2 – SMTH Log Sheet Requirements

4. Recording e-SMTH Test Plan steps

4.1 Add appropriate Test Plan(s) to the SMTH Log Sheet.

Multiple Test Plans can be attached to one SMTH Log Sheet.

4.2 All Test Plans on the same SMTH Log Sheet shall be for the same piece of equipment.

NOTE 1: *Serial numbers are captured within each Test Plan.*

4.3 Record the outcome for each Test Plan step undertaken.

a) If the Test Plan step is fully completed select a ‘tick’.

b) If the Test Plan step cannot be fully completed select a ‘cross’ and record a comment to indicate why the step was not completed.

c) If the Test Plan step is not applicable select ‘N/A’.

4.4 If a Test Plan step requires a Defined Test, i.e. WIRE COUNT, complete the necessary forms within the Test Plan step.

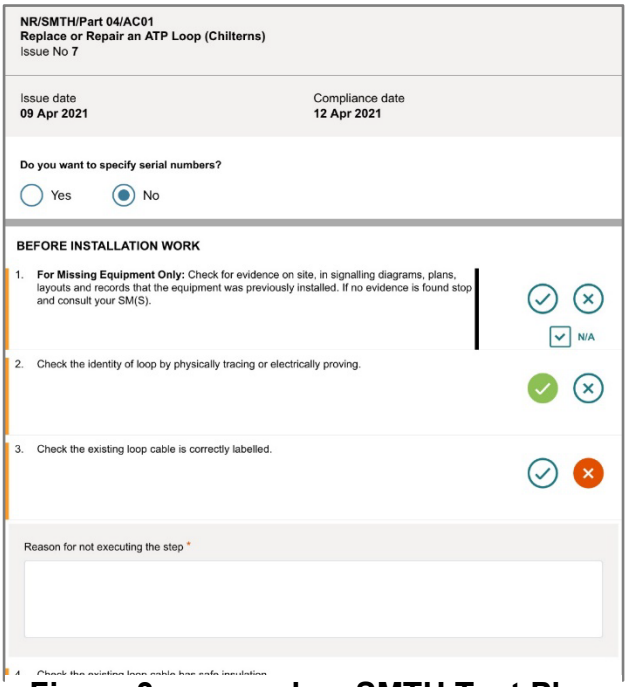
4.5 Partially completed Test Plans can be handed over to another Tester for completion.

4.6 Mark all Test Plan steps to be handed over.

4.7 Submit SMTH Log Sheets for review.

4.8 All submitted SMTH Log Sheets are retained in line with the company records policy for the lifetime of the equipment.

NOTE 2: *Manager review of SMTH Log Sheets is managed within the e-SMTH Portal.*


NR/SMTH/Part 04/AC01
Replace or Repair an ATP Loop (Chilterns)
Issue No 7

Issue date
09 Apr 2021

Compliance date
12 Apr 2021

Do you want to specify serial numbers?

Yes No

BEFORE INSTALLATION WORK

1. For Missing Equipment Only: Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S). N/A
2. Check the identity of loop by physically tracing or electrically proving.
3. Check the existing loop cable is correctly labelled.

Reason for not executing the step *

Figure 3 – example e-SMTH Test Plan

5. Paper SMTH Log Sheets

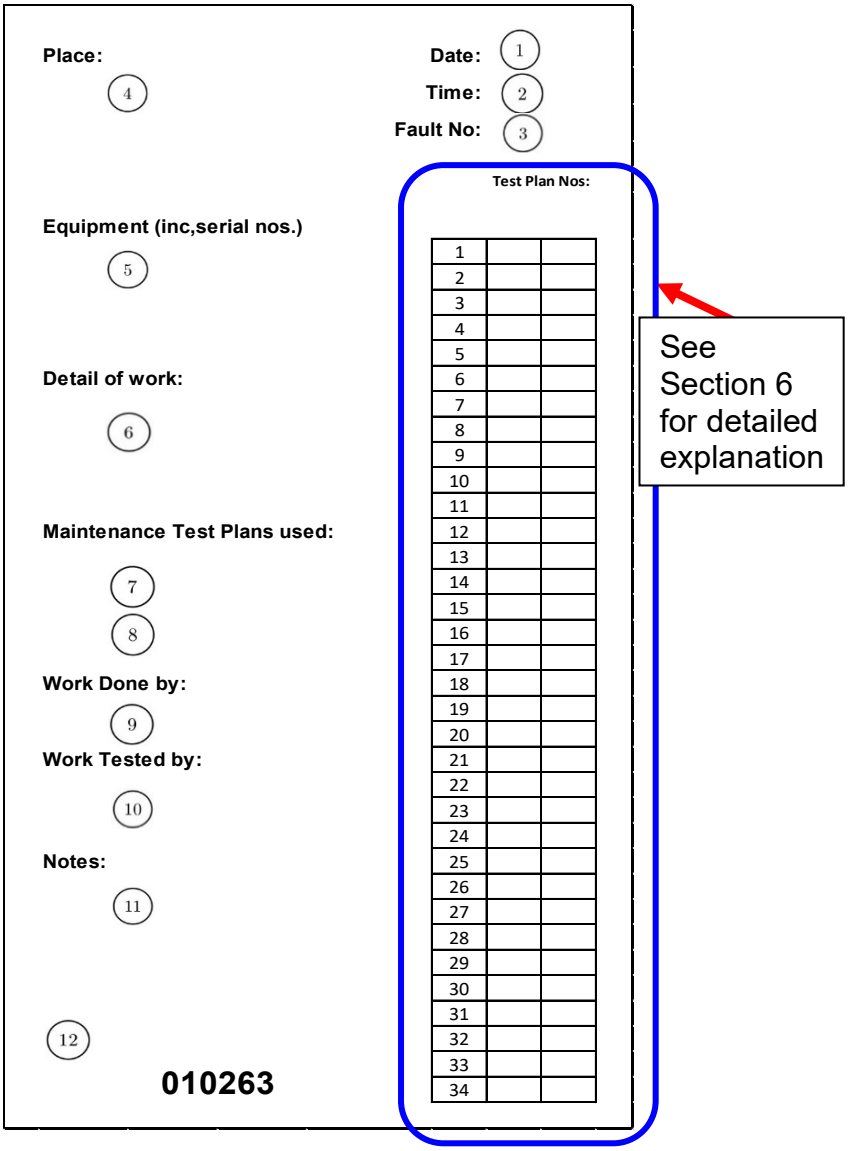


Figure 4 – Paper SMTH Log Sheet Mapped to Section 2 – SMTH Log Sheet Requirements

5.1 One identical copy of each paper SMTH Log Sheet shall be submitted to the Manager and another identical copy retained by the Maintenance Tester.

Test records shall be retained in accordance with company records policy for the lifetime of the equipment.

6. Recording Paper SMTH Test Plan steps

NOTE 1: *The purpose of the check box matrix on the paper SMTH Log Sheet is to record the Test Plan(s) steps which have been completed.*

NOTE 2: *The matrix is shown in Table 2.*

Key	Requirement
(13)	*This column is a list of the Test Plan steps.*
(14)	*The first Test Plan being used shall be recorded here.*
(15)	*If a second Test Plan is being used this shall be recorded here.*

Table 2 – Tick Box Requirements

6.1 Record the Test Plan reference at the top of the left-hand blank column, marked '14' in Table 2.

6.2 Record the outcome for each Test Plan step undertaken in the box corresponding to the Test Plan step number in the Test Plan:

a) If the Test Plan step is completed 'tick' the corresponding box.

b) If the Test Plan step cannot be fully completed the box shall be left blank and reported to the Manager with an explanation as to why it was not completed.

NOTE 3: *The box is left blank so that it can be completed if the Manager determines the step is required.*

c) If the Test Plan step is not applicable, then write 'N/A' in the corresponding box.

6.3 If only using one Test Plan, draw a line from top to bottom of the right-hand column to indicate only one Test Plan is in use.

6.4 If using a second Test Plan, record its reference at the top of the right-hand blank column, marked '15' in Table 2. Record the outcome for each Test Plan step in the boxes below as for the first Test Plan.

	Test Plan Nos: (14)	(15)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
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31		
32		
33		
34		

Table 3 – Check Box Matrix

6.5 If a Test Plan is partially completed, indicate all steps that have been completed and strike out the others.

6.6 If taking over the testing of a partially completed Test Plan, a new SMTH Log Sheet shall be used. Strike out the steps which have not been completed by the Tester completing the SMTH Log Sheet.

7. Examples of Completed Paper SMTH Log Sheets

NOTE 1: *Figure 5 shows a paper SMTH Log Sheet when used to record a single Test Plan and Figure 6 shows a paper SMTH Log Sheet when used to record two Test Plans.*

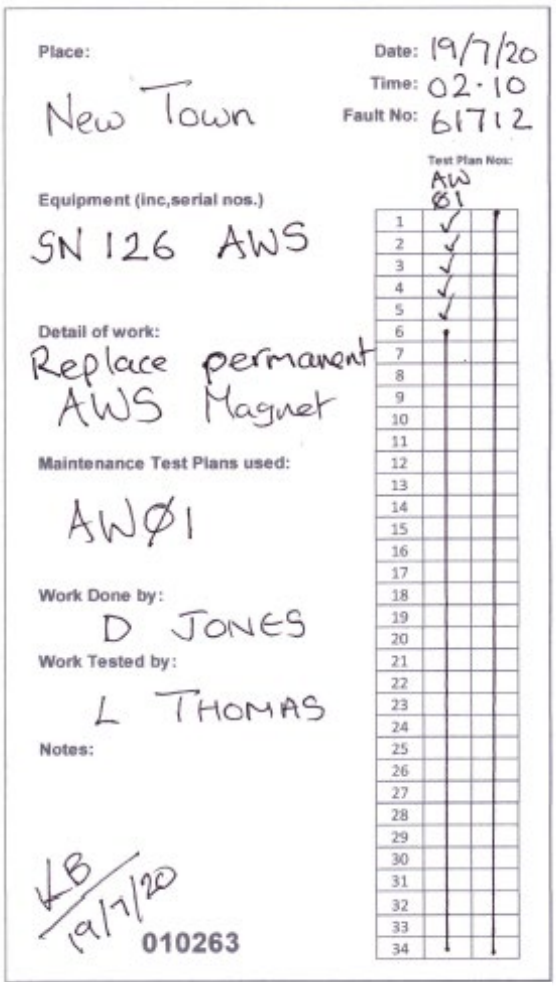


Figure 5 – One Test Plan

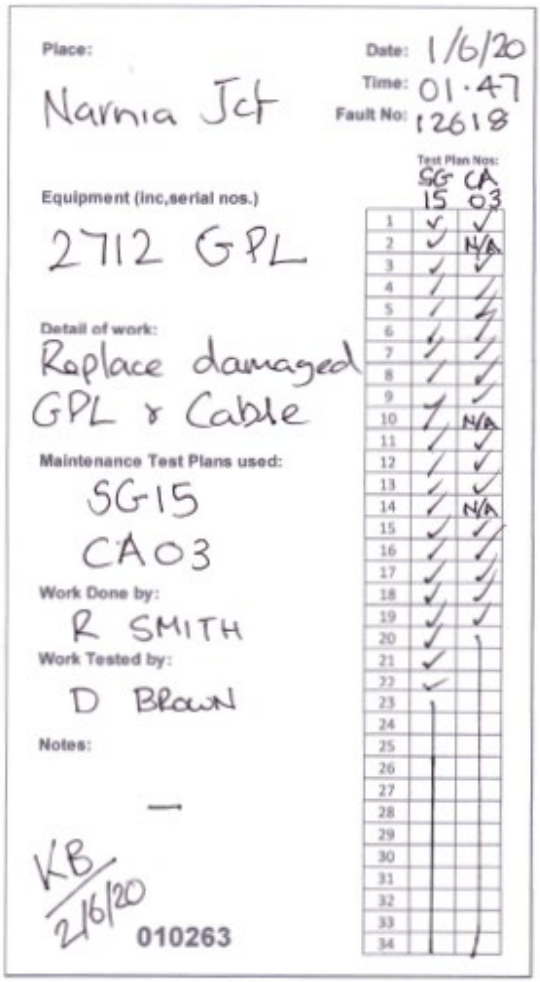


Figure 6 – Two Test Plans

END

1. Testing Where No Maintenance Test Plan Exists

1.1 Where no maintenance test plan exists for the work to be undertaken in Part 04 of the SMTH, a new maintenance test plan shall be produced by the Maintenance Tester.

1.2 The requirements for a Maintenance Test Plan are given in NR/SMTH/Part01/Module05 (Test Plan Requirements).

1.3 Before using the new maintenance test plan, it shall be checked by an independent Maintenance Tester not involved in writing it.

This check should be carried out on site with reference to the equipment concerned except where the person concerned is sufficiently familiar with the equipment.

1.4 If there is any doubt about the testing required, and whether it is maintenance testing, the SM(S) shall be consulted.

1.5 On completion of the work and testing, the new maintenance test plan shall be forwarded as part of the record of test.

1.6 The SM(S) shall arrange to have the equipment retested if the maintenance test plan is deficient.

1.7 The S&TME is responsible for forwarding the new maintenance test plan to signalengineers@networkrail.co.uk.

END

1. Reasons for Diversion

1.1 Circuits can be temporarily diverted in a number of ways. Examples are the diversion of circuits from faulty to spare cores, the reallocation of a faulty relay contact and the emergency repositioning of an item of equipment.

1.2 Maintenance Test Plans are provided to divert a faulty cable core and to reallocate a relay contact.

2. Diversion of Faulty Cable Cores

2.1 If it is necessary to divert a cable core, it shall be assumed that the cable has been damaged in some way. An open circuit core might be the only detected problem, but the cause could be a nail which is still shorting two other conductors together.

2.2 Existing wiring which is diverted shall be clearly labelled. If new wires need to be run, they shall be of single multi-stranded core (9/.030 to BR spec 872) red wire and remain clearly visible and labelled.

2.3 The spare cable core used for the diversion, shall be checked to make sure it is not being used for any other purpose and is disconnected at both ends (nor calling at intermediate points).

2.4 The links at both ends of the faulty core shall be removed and a red dome nut placed on the faulty cable core side of the terminal block see Figure 1. This is to prevent the link being accidentally replaced (similar devices have been provided for other types of link such as Wago).

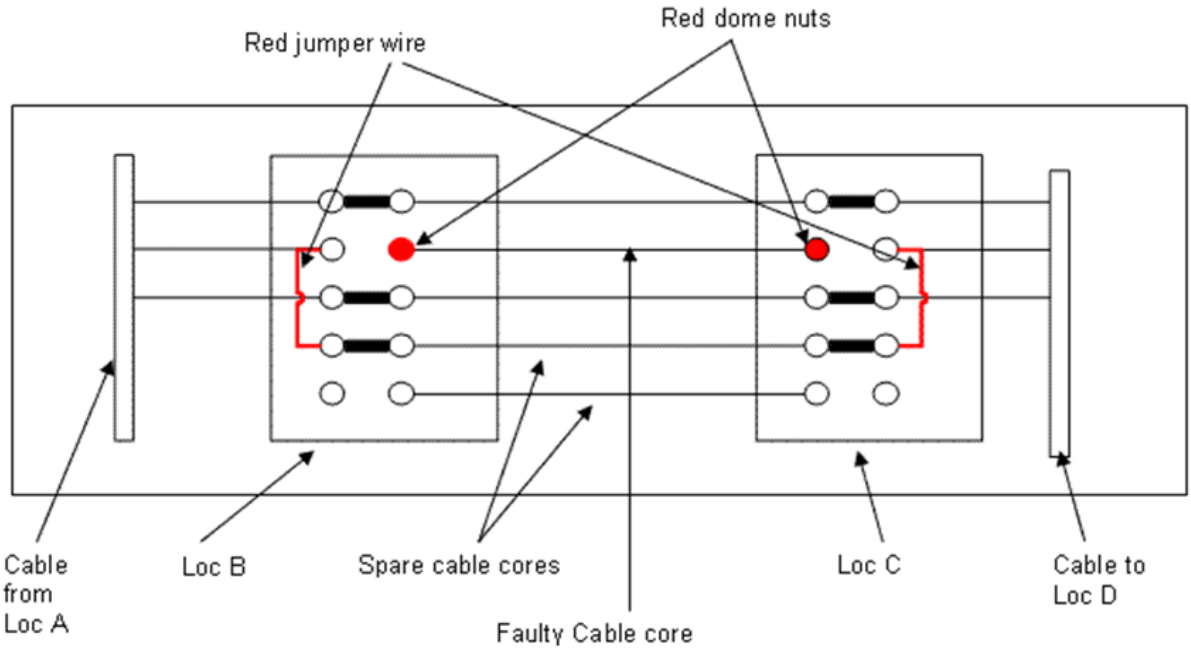


Figure 1 - Schematic drawing of applying a diversion to a fault cable core

Figure 2 - Diversion Applied to a Terminal Block

2.5 If the terminal is a binding post, the faulty core shall be removed and insulated to prevent contact with any other terminal or working circuits.

2.6 Any alternative cable cores used (either within an existing cable or a specially run temporary cable) shall be labelled at each termination point in the diversion.

2.7 All affected location diagram copies shall be amended in red, signed and dated by the Signalling Technician undertaking the work and checked by the Maintenance Tester. The SM(S) shall be advised as soon as possible. For cable core diversion this shall include diagrams in each location where the original and any alternative cable are terminated.

If the location diagram is printed on “Laminated Paper”, it is acceptable for these details to be written on a sticky white label then applied to the location diagram.

This label shall not obscure any non-related details on the location diagram.

NOTE: *Used sticky label can then be removed following the repair work without the need to order additional diagrams. If an alteration is to be made permanent, then replacement diagrams should be ordered via the SM(S).*

2.8 A cable core diversion shall not bypass more than one cable at a time. It shall only be applied to the terminal posts at each end of the faulty core so that intermediate controls are not by passed.

2.9 The SM(S) shall maintain a record of spare core usage, faulty cores, cross core jumpering and associated dates. The faulty cable insulation values measured at the time of diversion shall be retained for future reference.

2.10 Maintenance Test Plan NR/SMTH/Part04/CA05 (Divert a Faulty Cable Core) allows the full INSULATION TEST and CONTINUITY TEST of the existing cable to be deferred where serious traffic delay or increased safety risk is likely.

2.11 A minimum test of all spare cores or 10% of cable capacity (whichever is greater) is required.

The test results are to be checked against the minimum insulation requirement in NR/SMS/PartZ/Z05 (Cable – Reference Values). Any failure to meet these insulation requirements shall be actioned before any decision to proceed with a deferral.

2.12 In all cases, the decision to defer testing shall be made primarily on the basis of safety. Before agreeing to a deferral, the SM(S) shall access factors such as the importance for safety of the other circuits in that cable, and whether the damage has been found.

2.13 If the minimum test is satisfactory, the diversion work shall be carried out and the full INSULATION TEST and CONTINUITY TEST can be deferred for:

a) 72 hours when the cable has no existing faulty cores.

b) 48 hours when the cable already contains one or more existing faulty cores which are out of use (function diverted).

3. Temporary Labelling of Diverted Cores and Records

3.1 Part A of the label shown in Figure 3 shall be completed and secured to each end of the cable core or the temporary jumper containing the diverted circuit.

After the work has been completed by the Signalling Technician it shall be checked by the Maintenance Tester.

3.2 The Maintenance Tester shall complete and return Part B of the label to the SM(S).

3.3 When the cable has been restored to full working order by repair or replacement, the diverted circuit shall be returned to its original position and Part A of the label returned to the SM(S) endorsed by the Maintenance Tester.

A suitable blank label is provided in NR/SMTH/Part02/Form/01 for copying as required.

3.4 The SM(S) shall be responsible for:

a) Creating a record for the defective cable.

b) Making arrangements for the cable to be tested at the intervals laid down in NR/SMTH/Part01/Module/13 (Procedure for Monitoring a Damaged Cable). The results of these tests shall be kept with the record for the defective cable.

c) Repair of the cable, or if repair is impracticable, escalating the fault to the S&TME to authorise the replacement of the cable.

d) Attaching Part A of the label to the record for the cable.

e) Arranging for new diagrams to be ordered if necessary and arranging that these are placed in the relevant locations.

Cable Core Temporary Label — Network Rail

PART A	
Circuit	
Strap From	
Strap To	
Date	
Signature	
Name	
Company	

Cable Core Temporary Label — Network Rail

PART B	
Strap Information	
Location	
Situation	
Strap From	
Strap To	
Reason	
Signature	
Name	
Company	

Figure 3 - Example of a Cable Core Temporary Label

4. Diversion of a Circuit to an Alternative Relay Contact

4.1 Where a replacement relay is not available, it might be necessary to temporarily re-allocate the circuit through another contact of that relay. NR/SMTH/Part04/EL13 (Re-allocate a Contact) exists for this work.

4.2 Diagrams shall be suitably amended, signed and dated in red by the Signalling Technician doing the work and checked by the Maintenance Tester. The SM(S) shall keep a record of all such re-allocations.

5. Emergency Repositioning of Equipment

5.1 Where equipment size constraints or other emergency conditions apply, equipment can be placed in a different position to that shown on the diagram.

5.2 Repositioning of equipment shall be carried out in the same way as circuit diversion, with consideration of electrical isolation from other equipment or wires and the security of fixings.

5.3 Relevant labelling and diagram amendments shall be made, and the SM(S) advised.

6. The Use of Circuits Unaffected by the Cable Damage

6.1 As long as other circuits continue to use cores in the damaged cable (although the circuits might be unaffected by the cable damage), there is a risk that there will be a subsequent failure (which could be wrong side) caused by further deterioration of the cable.

6.2 This risk shall be controlled. NR/SMTH/Part01/Module13 (Procedure for Monitoring a Damaged Cable) gives a procedure for controlling the risk.

6.3 On final rectification and replacement of all associated red wiring, the SM(S) shall arrange for revised final record copies.

7. Permanent Adoption of Temporary Alterations

7.1 Any proposals to retain the equipment, core or contact in its new position (effectively becoming permanent) shall be advised to the S&TME.

7.2 Where the alteration becomes permanent, the SM(S) shall arrange for any red wiring to be replaced and the issue of new record copies.

7.3 Where coloured wiring has been installed for monitoring purposes the S&TME may permit retention subject to the wiring being installed to a standard which allows for its permanent adoption.

8. Rectification

8.1 The S&TME shall check that all temporary diversions, repositioned equipment and temporarily re-allocated relay contacts are permanently rectified, and any red wiring replaced.

8.2 Where a temporary alteration is required to become permanent the S&TME shall be advised.

8.3 At rectification the SM(S) shall confirm that the diagram alteration is cancelled, and new record copies obtained or if the alteration was recorded on stick on labels then these have been removed.

8.4 If repositioned equipment remains in its temporary position for more than one month the SM(S), shall arrange to obtain new record copies marked ‘temporary position’.

8.5 If the temporary diversion remains in use for more than one month the SM(S), shall arrange to obtain new record copies marked ‘temporary wiring’.

8.6 Ongoing test provision for damaged cables shall be agreed with the S&TME taking account of the risks, cable condition and timescale for the cable renewal.

END

1. Process

Initial and Subsequent Tests

1.1 A full INSULATION TEST of the faulty cable shall be arranged by the SM(S) at the end of the first month. The Maintenance Tester shall carry out the work and return the results to the SM(S).

1.2 The SM(S) shall examine the results recorded and compare them with the values noted at the time of diversion. This test shall be repeated at the end of the second and third months of diversion.

1.3 Environmental conditions can have an effect on obtained values (e.g. damp and wet conditions). This should be taken into consideration when planning the tests.

2. Review of Obtained Results

2.1 If each of these three, monthly retests indicate an acceptable insulation value, and does not show progressive deterioration, the SM(S) may authorise a change of the retest frequency. The frequency shall not exceed 12 months.

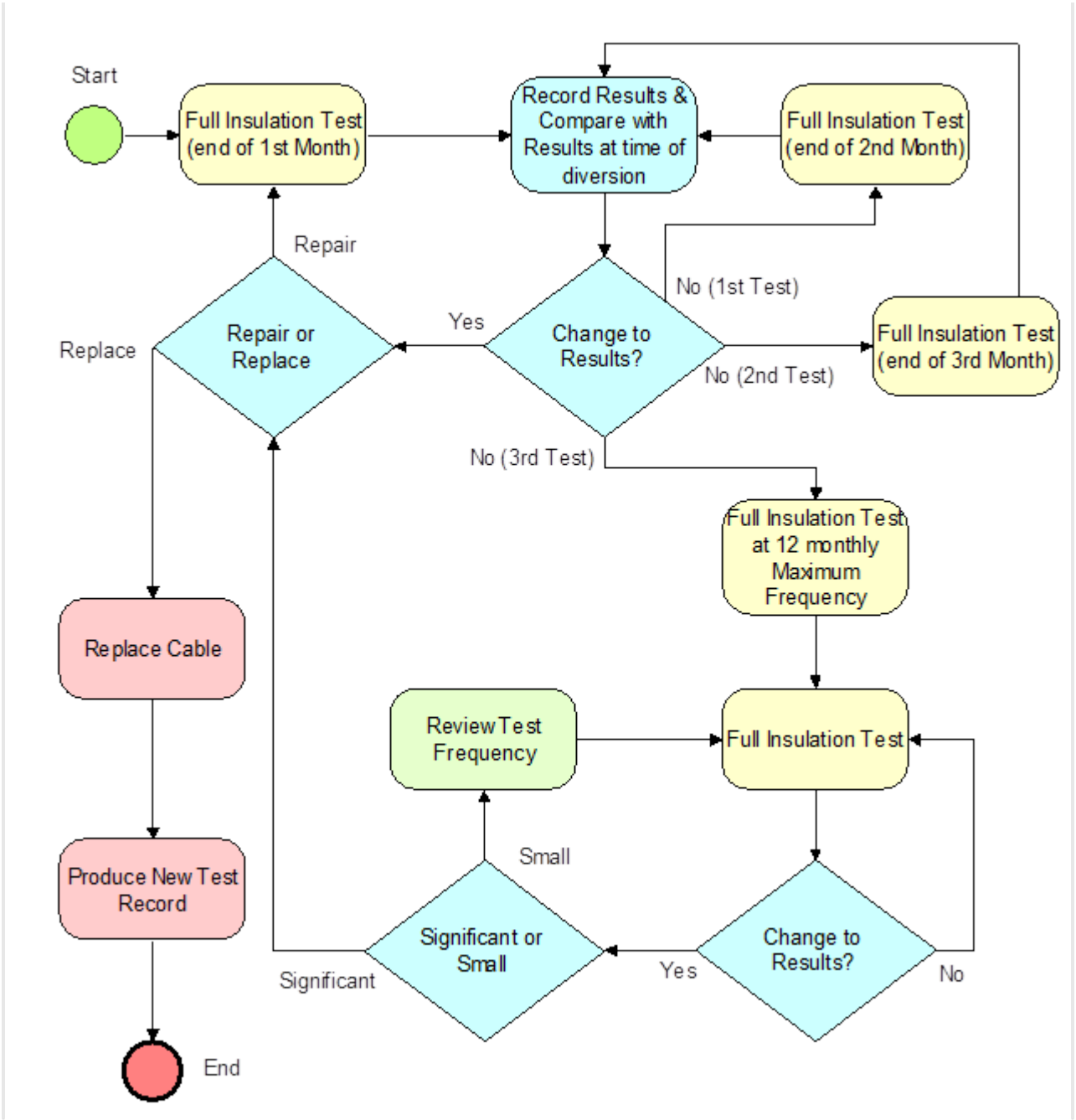
2.2 If at any time these tests indicate that cable insulation values have fallen below an acceptable value, or there is evidence of significant deterioration, the cause shall be investigated, and repairs undertaken without delay.

3. Continuation of Result Monitoring

3.1 The SM(S) shall continue to compare test results and use the information to assess the risk and determine whether annual or more frequent retesting is required.

3.2 The maximum interval between retests shall be 12 months. The circumstances shall be reviewed with the S&TME at a mutually agreed frequency not exceeding 12 months.

4. Process Flowchart for Monitoring a Damaged Cable



END

1. Testing - General

1.1 Maintenance Testing is based on the assumption that equipment is correctly wired and correctly documented before work commences.

1.2 Complete and accurate site records shall be available at each installation. A completed SMTH Log Sheet shall be provided by the Maintenance Tester for each replacement or alteration unless exempted in the maintenance test plan. The requirements for test records are given in NR/SMTH/Part01/Module/10 (Completion of the SMTH Log Sheet).

2. Testing with Site Records

2.1 The installation shall be checked by the Maintenance Tester against the diagrams before work is started and again after work is complete, to check that the installation is correct.

3. Testing where Site Records have been Amended

3.1 If, when needed for fault rectification or renewal work, diagrams are available but have an unsigned and undated amendment which affects that work, the work shall **STOP**.

3.2 Advice shall be sought from the SM(S). This also applies to any diagrams found marked ‘Installation Copy’.

The following action shall be taken:

a) If the diagram shows amendments, it shall be checked to the wiring on site.

If the diagrams are clear and in agreement with the wiring, the SM(S) can allow work to continue.

Arrangements shall be made to obtain revised diagrams. If revised diagrams cannot be supplied, the S&TME shall be advised and arrangements made to reduce any risks to as low as reasonably practicable. In both cases a note shall be included with the record of test.

b) If the diagrams are unclear, or if a discrepancy with the wiring is found, the SM(S) shall arrange for the discrepancy to be resolved and determine the method for the work to be completed.

Design assistance to produce any revised diagrams shall be arranged.

3.3 Diagram amendments reported that are unrelated to the work, shall be dealt with using the local procedures for arranging revised diagrams.

4. Testing where Site Records Differ from Wiring

4.1 If a difference is discovered between the wiring being worked on and the diagram, the work shall **STOP**. Advice shall be sought from the SM(S).

4.2 The action to be taken shall depend on the extent of the difference. In all cases, where the diagrams are related to the work in hand a note shall be included with the record of test, and arrangements made to obtain revised diagrams:

a) If the difference only involves the looping arrangement or contact / terminal allocation detail and is otherwise electrically identical, the SM(S) can permit the work to proceed.

The diagram shall be suitably amended, signed and dated in red.

If the location diagram is printed on “Laminated Paper” It is acceptable for these details to be written on a sticky white label applied to the location diagrams.

This label shall not obscure any non-related details on the location diagram.

NOTE: *Used sticky label can then be removed following the repair work without the need to order additional diagrams.*

If an alteration is to be made permanent, then replacement diagrams shall be ordered.

b) If any other discrepancy is found, the SM(S) shall arrange for the discrepancy to be resolved and determine the method for the work to be completed.

Design assistance to produce any revised diagrams shall be arranged.

4.3 Diagram discrepancies reported that are unrelated to the work, shall be dealt with using the local procedures for arranging revised diagrams.

5. Testing where there are No Site Records

5.1 If site records are missing, the work shall **STOP**. Advice shall be sought from the SM(S).

5.2 The action to be taken shall depend on the work being done. Where work is permitted to continue, as outlined below, the maintenance test plan(s) shall be used. In all cases, a note shall be included with the record of test and arrangements made to obtain revised diagrams:

a) If the equipment being changed is a pin-coded plug-in component, the SM(S) can allow the work to proceed omitting any requirement to check to the wiring diagram.

b) If the component is a simple piece of equipment not involving control circuitry, the equipment can be changed on the authority of the SM(S) who assess the experience of the staff doing the work and testing.

A sketch drawing shall be produced showing the wiring connected to the equipment which shall then be used in lieu of the original diagram.

The sketch shall be left on site, signed and dated in red. Transformers and lamp holders are typical of the equipment that can be dealt with in this way.

c) If the equipment involves control circuitry, additional testing resource shall be involved in the change.

Design assistance to produce any revised diagrams shall be arranged.

The work shall be tested using NR/L2/SIG/30014 (NR/SWTH).

6. Test Records

6.1 At the earliest opportunity the SM(S), Works Delivery Manager, or nominated deputy shall carry out a 100% check of completed SMTH Log Sheets to verify accuracy and completeness.

6.2 Once this check has been completed, the SMTH Log Sheet shall be authorised. If using paper SMTH Log Sheets the checker shall initial and date the SMTH Log Sheet.

6.3 Faulting and Maintenance SM(S)'s or their nominated deputies shall complete a daily check of the fault management system to confirm they have received 100% of SMTH Log Sheets for their area of responsibility.

6.4 These checks shall determine that the correct maintenance test plans have been used and that enough detail has been recorded. Deficiencies shall be followed up by the corrective action such as monitoring or retraining.

7. Version Control of Site Records

7.1 If there is reason to doubt that the site records are the latest version, ask your SM(S) to confirm the status with the National Records Group.

END

1. Use of the Balise - Certificate of Conformity

1.1 When a Balise needs to be replaced and the programming of the Balise is carried out in advance, then a Balise Certificate of Conformity (CoC) shall be completed by the person programming the Balise.

The text in red in Figure 1 gives details of the entries required on the CoC.

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part02/Form/04		
Balise – Certificate of Conformity (CoC)		
Issue No: 02	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Positioning Form Number	*Insert the number of the associated positioning form*	Version	*Insert the version of the positioning form*
Balise Data File Number	*Insert the name of the data file used*	Version	*Insert version of data file*
Balise Serial Number			
Balise Group ID (BG)	*Insert the balise group ID*	Location of Balise	*Geographic location Miles and yds, Kilometres and Meters or GPS must state method used*
Position in BG	*Insert the position in BG*	ELR	*ELR*
Balise Label ID	*Record the balise label ID*	Line Name	*Up Fast/ DN Slow*
Application code	*APCO/ASDO/TASS/ETCS*	Direction of BG Normal or Reverse	*Direction the balise group is read in N or R*
Installation record Check list - Insert a tick if correct (To be completed by programmer)		**Installation record check list – Insert tick if correct (for use by installer)**	
Balise correctly Labelled	*Tick/NA/strike through*	Balise correctly labelled	*Tick/NA/strike through*
Label included for bracket	*Tick/NA/strike through*	Label included for bracket	*Tick/NA/strike through*
Label included for cable (if applicable)	*Tick/NA/strike through*	Label included for cable (if applicable)	*Tick/NA/strike through*
Positioning Record Included	*Tick/NA/strike through*	Positioning Record Included	*Tick/NA/strike through*
Positioning record number matches the number recorded above.	*Tick/NA/strike through*	Positioning record number matches the number recorded above.	*Tick/NA/strike through*
Name of programmer		Name of Installer	
Name of Verifier		Name of Tester	

Figure 1 – Example of a Certificate of Conformity

1.2 After programming, the completed CoC shall be attached to the Balise.

1.3 The completed CoC shall then be verified by the Tester against both the replacement Balise and the Balise Positioning Form before installation.

1.4 If any discrepancies are noted, work shall stop, and the SM(S) shall be informed.

1.5 On completion of the work the CoC shall be returned to the (SM)S with the SMTH Log Sheets.

A Blank Balise - Certificate of Conformity can be found at NR/SMTH/Part02/Form/04 (Balise - Certificate of Conformity).

END

ACTION DEFINITIONS

Term	Definition
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).
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/Part03/Check/A05 (Defined Check: Check for correct isolation).
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.
Rectify	Make good any faults discovered and/or adjustments required.
Record	Enter the obtained measurement readings or observations on a suitable record card or in a site logbook.
Remove/Refit	Disconnecting and refitting existing component or equipment.
Replace	Replace an existing component or equipment “like for like” as detailed in NR/SMTH/Part01/Module07 (Maintenance Testing - Like for Like Replacement).
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 its specification.

END

Ref:	**NR/SMTH/Part/02**
Issue:	13
Date:	02 December 2023
Compliance date:	02 March 2024

NR/L3/SIG/11231

NR/SMTH/Part/02

Published and Issued by Network Rail, 2nd Floor, One Eversholt Street, London, NW1 2DN.

INDEX

END

Cable Core Temporary Label NR/SMTH/Part02/Form/01	
PART A	
Circuit	
Strap From	
Strap To	
Date	
Signature	
Name	
Company	

Cable Core Temporary Label NR/SMTH/Part02/Form/01	
PART B	
Strap Information	
Location	
Situation	
Strap From	
Strap To	
Reason	
Signature	
Name	
Company	

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part02/Form/02		
Maintenance Test Plan List (including G130 Test Plans)		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

PLACE / PROJECT / STAGE: _____

MAINTENANCE TEST PLAN LIST NUMBER: _____ **CONTROLLING SIGNAL BOX(ES):** _____

	Name	Company	Position / Role	Signature	Date
PREPARED BY:					
CHECKED BY:					
APPROVED BY:			Responsible Signal Engineer		

Location / Relay Room	Affected Equipment (Identity and Type)	Work Description	Test Plan Number	Installer	Tester	Tester Identity / Signature	Time / Date

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part02/Form/02		
Maintenance Test Plan List (including G130 Test Plans)		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

PLACE / PROJECT / STAGE: _____

MAINTENANCE TEST PLAN LIST NUMBER: _____ **CONTROLLING SIGNAL BOX(ES):** _____

Test Equipment Type	Serial Number	Test Equipment Type	Serial Number	Test Equipment Type	Serial Number	Test Equipment Type	Serial Number

Activity	Details / Records		(Lead) Tester Identity / Signature	Time / Date
Alteration to the listed work	Details Agreed & Authorised by:			
Disconnections to remain after work. Applied & checked, see NR GI B002. *Copy of RT3187 to be attached*	Equipment List	Disconnection detail if not stated on separate list		
System restored to its normal (quiescent) state.	Straps accounted for (GI U034)			
	Systems reset			
	Sequential controls reset			
All Testing completed	All Test Plan Slips Complete			
	Incomplete tests recorded and protection stated			
Test Plan Record Slips submitted to Signalling Manager/Lead Tester	Records submission method			
Equipment Security	All Doors Secured & Locked			
Signalling offered / entered (delete as required) for Entry into Operational Service	**(Lead) Tester Name:**			
Comments: *(continue on a separate sheet if required)*				

It is the responsibility of the SMTH Tester / G110 Tester / G110 Lead Tester to check that this Test Plan List has all the required signatures. If the Test Plan does not have all the signatures, then the final SMTH Tester / G110 Tester / G110 Lead Tester must complete / arrange for the testing to be completed or arrange protection.

Positioning Form Number		Version	
Balise Data File Number		Version	
Balise Serial Number			
Balise Group ID (BG)		Location of Balise	
Position in BG		ELR	
Balise Label ID		Line Name	
Application Code		Direction of BG Normal or Reverse	
Installation record check list - Insert a tick if correct (To be completed by Programmer)		**Installation record check list – Insert a tick if correct (for use by Installer)**	
Balise Correctly Labelled		Balise Correctly Labelled	
Label Included for Bracket		Label Included for Bracket	
Label Included for Cable (If Applicable)		Label Included for Cable (If Applicable)	
Positioning Record Included		Positioning Record Included	
Positioning Record Number Matches the Number Recorded Above		Positioning Record Number Matches the Number Recorded Above	
Name of Programmer		Name of Installer	
Name of Verifier		Name of Tester	

END

Signal Box:		**Loc/Equip. Room:**	
Point No:		**Date:**	
Comments:			

No.	**End 01**	**Tick**
01	0	

END

Signal Box:		**Loc/Equip. Room:**	
Point No:		**Date:**	
Comments:			

No.	**End 01**	**End 02**	**Tick**
01	0	0	
02	0	1	
03	1	0	

END

Signal Box:		**Loc/Equip. Room:**	
Point No:		**Date:**	
Comments:			

No.	End 01	End 02	End 03	Tick
01	0	0	0	
02	0	0	1	
03	0	1	0	
04	0	1	1	
05	1	0	0	
06	1	0	1	
07	1	1	0	

END

Signal Box:		**Loc/Equip. Room:**	
Point No:		**Date:**	
Comments:			

No.	End 01	End 02	End 03	End 04	Tick
01	0	0	0	0	
02	0	0	0	1	
03	0	0	1	0	
04	0	0	1	1	
05	0	1	0	0	
06	0	1	0	1	
07	0	1	1	0	
08	0	1	1	1	
09	1	0	0	0	
10	1	0	0	1	
11	1	0	1	0	
12	1	0	1	1	
13	1	1	0	0	
14	1	1	0	1	
15	1	1	1	0	

END

Signal Box:		**Loc/Equip. Room:**	
Point No:		**Date:**	
Comments:			

No.	End 01	End 02	End 03	End 04	End 05	Tick
01	0	0	0	0	0	
02	0	0	0	0	1	
03	0	0	0	1	0	
04	0	0	0	1	1	
05	0	0	1	0	0	
06	0	0	1	0	1	
07	0	0	1	1	0	
08	0	0	1	1	1	
09	0	1	0	0	0	
10	0	1	0	0	1	
11	0	1	0	1	0	
12	0	1	0	1	1	
13	0	1	1	0	0	
14	0	1	1	0	1	
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16	0	1	1	1	1	
17	1	0	0	0	0	
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29	1	1	1	0	0	
30	1	1	1	0	1	
31	1	1	1	1	0	

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part02/Form/11		
Point Permutation Chart: Six Point Ends		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Signal Box:		**Loc/Equip. Room:**	
Point No:		**Date:**	
Comments:			

No.	End 01	End 02	End 03	End 04	End 05	End 06	Tick
01	0	0	0	0	0	0	
02	0	0	0	0	0	1	
03	0	0	0	0	1	0	
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31	0	1	1	1	1	0	
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No.	End 01	End 02	End 03	End 04	End 05	End 06	Tick
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34	1	0	0	0	0	1	
35	1	0	0	0	1	0	
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55	1	1	0	1	1	0	
56	1	1	0	1	1	1	
57	1	1	1	0	0	0	
58	1	1	1	0	0	1	
59	1	1	1	0	1	0	
60	1	1	1	0	1	1	
61	1	1	1	1	0	0	
62	1	1	1	1	0	1	
63	1	1	1	1	1	0	

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part02/Form/12		
Train Protection Warning System (TPWS) Failure Report Form		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

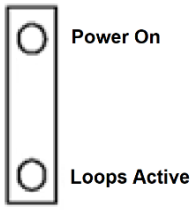
	TPWS FAILURE REPORT FORM	**Thales Form Ser. No.** **Thales Use Only**

Contact Name:		Contact Tel:	
Company:		Email:	
Address:		Date:	

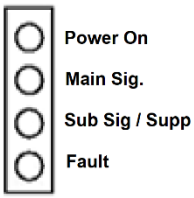
Site Details								
Site Common Name:								
Signal / PSR / Buffer Stops Name:								
Site Ref / ELR								
Failed Function:	**TSS - ND**		**TSS - OD**		**OSS - ND**		**OSS - OD**	

Please indicate which lights were on when found

Initial Findings		
Was fault indicated to the Signaller?	Y	N
Was fault found during maintenance service?	Y	N
Cable length from TPWS to OS Arming Loops		M
Cable length from TPWS to OS Trigger Loops		M



SIM



OSM / TSM
(please circle one)

Weather Conditions (During Investigation)					
Cold		Mild		Hot	
Raining		Overcast		Dry	
Was there condensation in TPWS enclosure?				Y	N

Baseplate or Trackside Enclosure			
Serial No.		Part No.	

S/N	
P/N	

S/N	
P/N	

Test	**Last Recorded Value**	**Current Value**	**Units**
Supply Voltage			Vrms
Main signal input voltage when signal at red			Vrms
Sub signal input voltage when lit (if installed)			Vrms
Overspeed Arming loop voltage at terminal rail			Vrms
Overspeed Arming loop frequency at terminal rail			kHz
Overspeed Arming loop signal strength from loop			mVrms
Overspeed Trigger loop voltage at terminal rail			Vrms
Overspeed Trigger loop frequency at terminal rail			kHz
Overspeed Trigger loop signal strength from loop			mVrms
Train Stop Arming loop voltage at terminal rail			Vrms
Train Stop Arming loop frequency at terminal rail			kHz
Train Stop Arming loop signal strength from loop			mVrms
Train Stop Trigger loop voltage at terminal rail			Vrms
Train Stop Trigger loop frequency at terminal rail			kHz
Train Stop Trigger loop signal strength from loop			mVrms

Fault Code from Fault Flow Chart:		**FRAME Report No:**	

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part02/Form/13		
Wrongside Failure or Incident Check Sheets		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Wrong Side Failure or Incident
Excludes:	Intermittent or obscure failures

General

These check sheets shall be used in conjunction with the Wrong Side Failure Test Guides in NR/SMTH/Part/08 of this standard. This form is generic for failure and incident testing on all equipment types, information shall be filled in as directed in the Wrong Side Failure Test Guides notes.

Test plan / certificates SFI/01-01 to SFI/01-13 are to be used for all signalling wrong side failures and serious incidents **except** signal / level crossing lamps and damaged / defective telephones.

All signal boxes, equipment/relay rooms, trackside apparatus cases, and sites where investigations have been identified shall be entered on each test plan / certificate.

If extra sheets are required for a particular step, the number should be recorded above.

SFI/01-01	**MASTER TEST PLAN / INDEX**

Test Plan Produced By (Level 1)	
Checked by (Level 2 or 3)	

Place	
Signal Box	
Date	
Time	
FMS No.	
Test Guide No.	
Weather Conditions	
Details of Incident / Failure	

Certificates (General)		**No. of Sheets**	**Name**	**Signature**	**Date**
SFI/01- 02	Authority Levels				

Certificates (Level 1)		**No. of Sheets**	**Name**	**Signature**	**Date**
SFI/01-03	Equipment Identity				
SFI/01-04	Additional Information				
SFI/01-05	Non Destructive Tests				
SFI/01-06	Destructive Tests				
SFI/01-07	Other Considerations				
SFI/01-08	Records & Notes				
SFI/01-09	Cable Test Plan				
SFI/01-10	Additional Testing				

Certificates (Level 2)		**No. of Sheets**	**Name**	**Signature**	**Date**
SFI/01-11	Information Checklist				
SFI/01-12	Level 2 Report				

Certificates (Level 3)		**No. of Sheets**	**Name**	**Signature**	**Date**
SFI/01- 13	Level 3 Report				

SFI/01- 02	**AUTHORITY LEVELS**

FMS No.		**Test Guide No**		**Sheet of**	

Enter details of all testers and authorised persons who have signed / initialled the test certificates, escalated testing levels, and offered equipment back to service.

Level 1			
Grade/Position	Name	Signature	Initials

Level 2			
Grade/Position	Name	Signature	Initials

Level 3			
Grade/Position	Name	Signature	Initials

Details of Person Offering Equipment for Return to Service				
Name	SFI Level	Date	Time	Signature

SFI/01- 03	**EQUIPMENT IDENTIFICATION**

FMS No		**Test Guide No**		**Sheet of**	

List all relevant equipment and sites visited during the investigation. Initial each 'Test(s) Completed' box on completion of the test. Where an item is not applicable to the investigation put a cross though that box, do **not** leave it blank.

Equipment Identity	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Signal Box Name(s)							
Test(s) Complete							
Equipment Room Name(s)/Number(s)							
Test(s) Complete							
Apparatus Case Number(s)							
Test(s) Complete							
Track Circuit Number(s)							
Test(s) Complete							
Signal Number(s)							
Test(s) Complete							
Route Indicator Identity							
Test(s) Complete							
Point Number(s)							
Test(s) Complete							
AWS Number(s)							
Test(s) Complete							
TPWS Number(s)							
Test(s) Complete							

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part02/Form/13		
Wrongside Failure or Incident Check Sheets		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Equipment Identity	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Level Crossing Name(s)							
Test(s) Complete							
Cable Identities							
Test(s) Complete							
Miscellaneous Equipment #1							
Test(s) Complete							
Miscellaneous Equipment #2							
Test(s) Complete							

Miscellaneous Equipment #1 Identity	
Miscellaneous Equipment #2 Identity	

Signal Aspect Sequence Test							
Signal From							
Signal To							
Test Complete							

Signals shall not be disconnected to protect the portion of line affected by the failure or incident unless requested by Network Rail operations staff and then only if this request is additionally authorised by the SFI Level 2 person.
S&T staff shall advise the Signaller of the protection required to confirm that the risks associated with the reported WSF or incident are minimised.
List as follows the signals that are to be maintained at danger by the Signaller to protect the portion of line affected by the failure or incident.

Signals Maintained at Danger by the Signaller				

Signaller Advised at:							
Signal Box		Time		Date		By (Initials)	

SFI/01-04	**ADDITIONAL INFORMATION**

FMS No		**Test Guide No**		**Sheet of**	

List applicable details of additional information that might be of use to other persons involved with the investigation of the failure/incident (if none or not applicable, state so in the box).

Signallers Name	
Drivers Name & Depot	
Train Type & Reporting Number	
Train Operating Company	
Details of any other Train Movements	
Other Witness Name(s) and contact Details	
Details of Non Standard Operations Procedures	
Details of any Ongoing Engineering Work	
Details of any Ongoing Signalling Work	
Any Other Details that might have Relevance (e.g. temporary cable core diversions, relay contact diversions, rodent infestation etc)	

Site Sketch

SFI/01-05	**NON DESTRUCTIVE TESTS**

FMS No		**Test Guide No**		**Sheet of**	

Initial each box on completion of the applicable step. If a step is not applicable to the investigation, enter 'N/A' in that box. Boxes shall not be left blank.
Where applicable, enter the relevant response to a specific item on sheet SFI/01-09.

Step	**Location or Equipment Identities**					
N01						
N02						
N03						
N04						
N05						
N06						
N07						
N08						
N09						
N10						
N11						
N12						
N13						
N14						
N15						
N16						
N17						
N18						
N19						
N20						
N21						
N22						
N23						
N24						
N25						
N26						
N27						
N28						
N29						

Step	**Location or Equipment Identities**					
N30						
N31						
N32						
N33						
N34						
N35						
N36						
N37						
N38						
N39						
N40						
N41						
N42						
N43						
N44						
N45						
N46						
N47						
N48						
N49						
N50						
N51						
N52						

Level 2 Authorisation to Proceed to Destructive Tests					
Name		Date		Time	

SFI/01-06	**DESTRUCTIVE TESTS**

FMS No		**Test Guide No**		**Sheet of**	

Initial each box on completion of the applicable step. If a step is not applicable to the investigation, enter 'N/A' in that box. Boxes shall not be left blank.
Where applicable, enter the relevant response to a specific item on sheet SFI 08

Step	**Location or Equipment Identity**					
D01						
D02						
D03						
D04						
D05						
D06						
D07						
D08						
D09						
D10						
D11						
D12						
D13						
D14						
D15						
D16						
D17						
D18						
D19						
D20						
D21						
D22						
D23						
D24						
D25						
D26						
D27						
D28						
D29						
D30						

SFI/01-07	**OTHER CONSIDERATIONS**

FMS No		**Test Guide No**		**Sheet of**	

Initial each box on completion of the applicable step. If a step is not applicable to the investigation, enter 'N/A' in that box. Boxes shall not be left blank.
Where applicable, enter the relevant response to a specific item on sheet SFI/01-08

Step	**Location or Equipment Identity**					
O01						
O02						
O03						
O04						
O05						
O06						
O07						
O08						
O09						
O10						

SFI/01-08	**RECORDS & NOTES**

FMS No		**Test Guide No**		**Sheet of**	

Record all items identified in the guide steps where records are required (e.g. voltages, values etc). Items of equipment that have been replaced and/or sent away for specialist investigation should also be identified. Also, record all information where the guide step asks you to 'Note'. Any additional information you think might assist with the review of the failure/incident should also be noted here.

Step	**Note**

SFI/01-09	**CABLE TEST PLAN**

FMS No		**Test Guide No**		**Sheet of**	

Initial and date the relevant section on completion of the cable test.
Each cable section shall be treated as an 'affected length'
Results shall be recorded on record card NR/SMS/T054/RC/01.

Cable Type	Cable Identity	Start (From)	Finish (To)	Initials	Date

Comments

Notes:

Cable type should state if tail or lineside.
Cable identity should state cable number (if any) or number of cores.

SFI/01-10	**ADDITIONAL TESTING**

FMS No		**Test Guide No**		**Sheet of**	

Where a situation requires additional testing over and above the steps in this test plan, or additional steps have been requested by an SFI level 2/3 or other authorised person (e.g. HSE) details of these should be recorded below.

Additional Testing

Name	**Signature**	**Date**

SFI/01-11	**INFORMATION / DATA / REPORTS CHECKLIST**

FMS No		**Test Guide No**		**Sheet of**	

Note that some failures/incidents might not require all the reports etc listed, if not required write 'N/A' in the box.

The relevant SMTH log sheets should also be included in these reports.

Information / Data / Report Type	**Requested**		**Received**	
	Date	**Initials**	**Date**	**Initials**
Signallers Report				
Drivers Report				
Guards Report				
Signal Box Shift Manager Report				
Network Rail Daily Log				
Apparatus Case/Equipment Room Record Card				
Busbar Record Cards				
Track Circuit Record Cards				
Signal Lamp Voltage Record Card				
FPL Record Card				
British Transport Police Report				
Witness Statement(s)				
Data Logger Media (Instead Type)				
Data Logger Media (PC Type)				
SSI Logger Media				
IECC Logger Media				
Telephone Voice Recorder Media				
DOO Recorder Media				

Additional Reports / Comments on Reports, Data or Information

SFI/01-12	**LEVEL 2 REPORT**

Fault No		**Test Guide No**		**Sheet of**	

Fault Details	
Place	
Signal Box	
Date	
Time	
Weather Conditions	

Summary of Fault or Problem Found

Name	**Signature**	**Date**

SFI/01-13	**LEVEL 3 REPORT**

FMS No		**Test Guide No**		**Sheet of**	

Fault Details	
Place	
Signal Box	
Date	
Time	
Weather Conditions	

Report Review

Recommendations

Name	**Signature**	**Date**

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part02/Form/14		
Intermittent/Obscure Failure Check Sheets		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Intermittent or obscure failures
Excludes:	Wrongside failure or incident

General

These check sheets shall be used in conjunction with the Intermittent or Obscure Failure Guides (NR/SMTH/Part09) of this standard. This form is generic for failure and incident testing on all equipment types, information shall be filled in as directed in the Intermittent or Obscure Failure Guides chosen.

SFI/02-01	**MASTER TEST PLAN / INDEX**

Test Plan Produced By	
Grade	
Team	

Place	
Signal Box	
Date	
Time	
FMS No.	
Test Guide No.	
Weather Conditions	
Details of Failure	

Sheets		**No. of Sheets**	**Name**	**Signature**	**Date**
SFI/02-02	Equipment Identity				
SFI/02-03	Additional Information				
SFI/02-04	Guide Steps				
SFI/02-05	Records & Notes				

SFI/02-02	**EQUIPMENT IDENTIFICATION**

FMS No		**Test Guide No**		**Sheet of**	

List all relevant equipment and sites visited during the investigation. Initial each 'Test(s) Completed' box on completion of the test. Where an item is not applicable to the investigation put a cross though that box, do not leave it blank.

Equipment Identity	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Signal Box Name(s)							
Test(s) Complete							
Equipment Room Name(s)/Number(s)							
Test(s) Complete							
Apparatus Case Number(s)							
Test(s) Complete							
Track Circuit Number(s)							
Test(s) Complete							
Signal Number(s)							
Test(s) Complete							
Route Indicator Identity							
Test(s) Complete							
Point Number(s)							
Test(s) Complete							
AWS Number(s)							
Test(s) Complete							
TPWS Number(s)							
Test(s) Complete							

Equipment Identity	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Level Crossing Name(s)							
Test(s) Complete							
Cable Identities							
Test(s) Complete							
Miscellaneous Equipment #1							
Test(s) Complete							
Miscellaneous Equipment #2							
Test(s) Complete							

Miscellaneous Equipment #1 Identity	
Miscellaneous Equipment #2 Identity	

SFI/02-03	**ADDITIONAL INFORMATION**

FMS No		**Test Guide No**		**Sheet of**	

List applicable details of additional information that might be of use to other persons involved with the analysis of the failure (if none or not applicable, state so in the box).

Signallers Name	
Drivers Name & Depot	
Train Type & Reporting Number	
Train Operating Company	
Details of any other Train Movements	
Other Witness Name(s) and contact Details	
Details of Non Standard Operations Procedures	
Details of any Ongoing Engineering Work	
Details of any Ongoing Signalling Work	
Any Other Details that might have relevance (e.g. temporary cable core diversions, relay contact diversions, rodent infestation etc)	

Site Sketch

SFI/02-04	**GUIDE STEPS**

FMS No		**Test Guide No**		**Sheet of**	

Initial each box on completion of the applicable step. If a step is not applicable to the investigation, enter 'N/A' in that box. Boxes must not be left blank.
Where applicable, enter the relevant response to a specific item on sheet SFI/02-05.

Step	**Location or Equipment Identity**					
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						
13						
14						
15						
16						
17						
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Step	**Location or Equipment Identity**					
30						
31						
32						
33						
34						
35						
36						
37						
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43						
44						
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61						
62						
63						
64						
65						

Step	**Location or Equipment Identity**					
66						
67						
68						
69						

SFI/02-05	**RECORDS & NOTES**

FMS No		**Test Guide No**		**Sheet of**	

Record all items identified in the guide steps where records are required (e.g. voltages, values etc). Items of equipment that have been replaced and/or sent away for specialist investigation should also be identified. Also, record all information where the guide step asks you to 'Note'. Any additional information you think might assist with the review of the failure/incident should also be noted here.

Step	**Note**

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part02/Form/15		
Wire Count Grid Sheet - Bus Bar and Terminal Wire		
Issue No. 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Signal Box:		**Loc / Equip. Room:**	
Bus Bar / Terminal ID:			
Date:		**SMTH Log Sheet No:**	
Name:		**Signature**	

Terminal	Termination	Analysis	Diagram
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

Terminal	Termination	Analysis	Diagram
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			

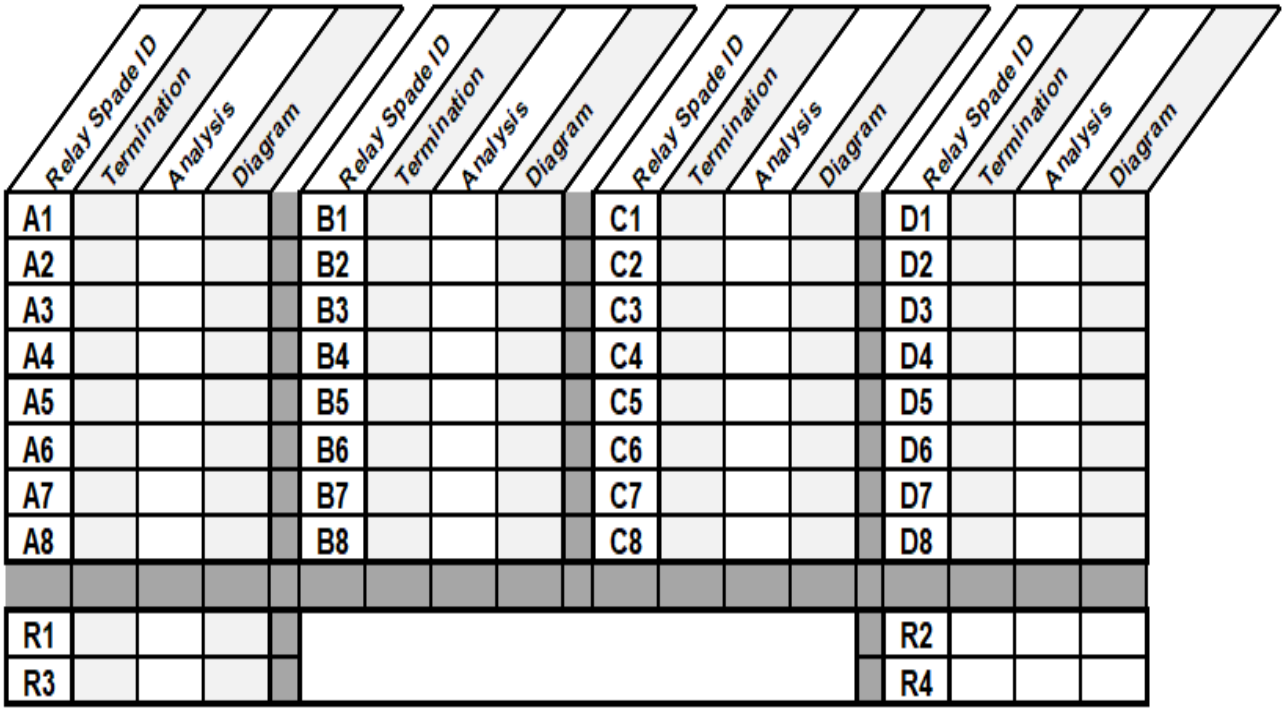
Completion Guidance:

Column Heading	Action required
Terminal	Comfirm terminal number.
Termination	Observe the number of wires/cable cores connected on the termination point and record this figure.
Analysis	Check the cable analysis and record the number of wires/cable cores shown as being connected to the termination point.
Diagram	Check the diagrams and record the number of wires/cable cores shown as being connected to the termination point.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part02/Form/16		
Wire Count Grid Sheet – BR930 Series Relay Base		
Issue No. 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Signal Box:		**Loc/Equip. Room:**	
Relay:		**Position:**	
Function Left:		**Function Right:**	
Date:		**SMTH Log Sheet No:**	
Name:		**Signature**	



Completion Guidance:

Column Heading	Action required
Relay Spade ID	Confirm the numbering.
Termination	Observe the number of wires/cable cores connected on the termination point and record this figure.
Analysis	Check the cable analysis and record the number of wires/cable cores shown as being connected to the termination point.
Diagram	Check the diagrams and record the number of wires/cable cores shown as being connected to the termination point.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part02/Form/17		
Wire Count Grid Sheet – Cable Core		
Issue No. 03	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Signal Box:		**Loc/Equip. Room:**	
Cable ID:		**Row/Link ID:**	
Cable From:		**Cable to:**	
Cable size:		**Cable type:**	
Date:		**SMTH Log Sheet No:**	
Name:		**Signature**	

	Left-hand side				Right-hand side			
Terminal	Core Number	Termination	Analysis	Diagram	Core Number	Termination	Analysis	Diagram
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
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24											
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31											
32											
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35											
36											
37											
38											
39											
40											
41											
42											
43											
44											
45											
46											
47											
48											

Completion Guidance:

Column Heading	Action required
Terminal	Confirm the terminal number.
Core Number	Record the cable core number.
Termination	Observe the number of wires/cable cores connected on the termination point and record this figure
Analysis	Check the cable analysis and record the number of wires/cable cores shown as being connected to the termination point.
Diagram	Check the diagrams and record the number of wires/cable cores shown as being connected to the termination point.

END

Signal Box:		**Loc/Equip. Room:**	
Cable ID:		**Equipment ID:**	
Cable From:		**Cable To:**	
Date:		**SMTH Log Sheet No:**	
Name:		**Signature**	

Key **B= Base** **A = Analysis** **P = Prints**

END

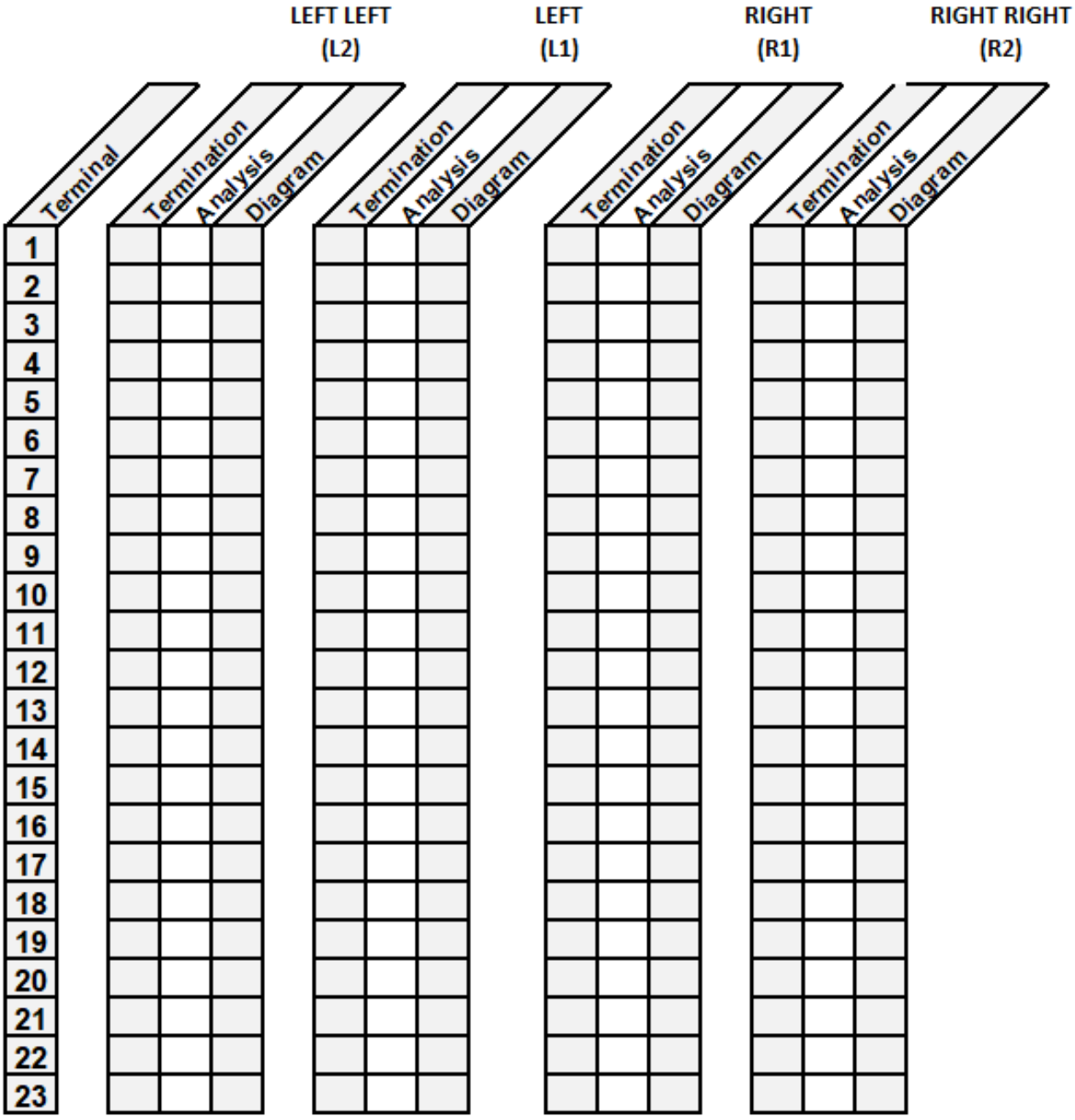
Cable ID:		**Cable Size:**		**Cable From:**		**Cable To:**		**Date:**	

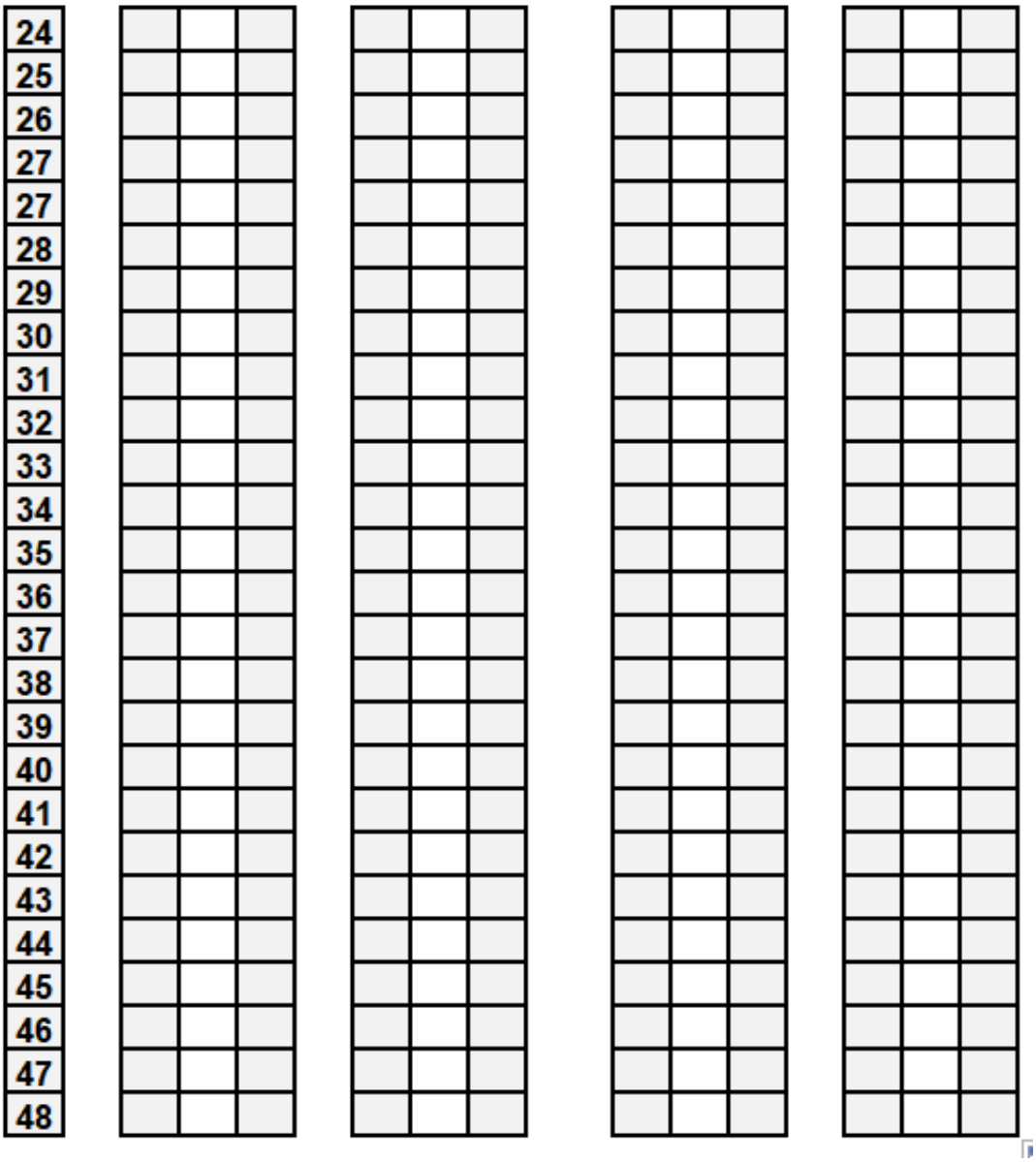
Cable Core	First Function*	Location of First Function	Polarity at First Function	First Fuse, Link or Terminal	Location of First Fuse, Link or Terminal	Controlling Device	Location of Controlling Device	Final Function	Location of Final Function
			+ve:						
			-ve:						
			+ve:						
			-ve:						
			+ve:						
			-ve:						
			+ve:						
			-ve:						
			+ve:						
			-ve:						
			+ve:						
			-ve:						
			+ve:						
			-ve:						
			+ve:						
			-ve:						
			+ve:						
			-ve:						
			+ve:						
			-ve:						

**Note. For polarity change circuits there may be two Final Functions*

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part02/Form/20		
Wire Count Grid Sheet – WAGO Terminals		
Issue No. 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Signal Box:		**Loc/Equip. Room:**	
Cable ID:		**Row/Link ID:**	
Cable From:		**Cable to:**	
Cable size:		**Cable type:**	
Date:		**SMTH Log Sheet No:**	
Name:		**Signature**	





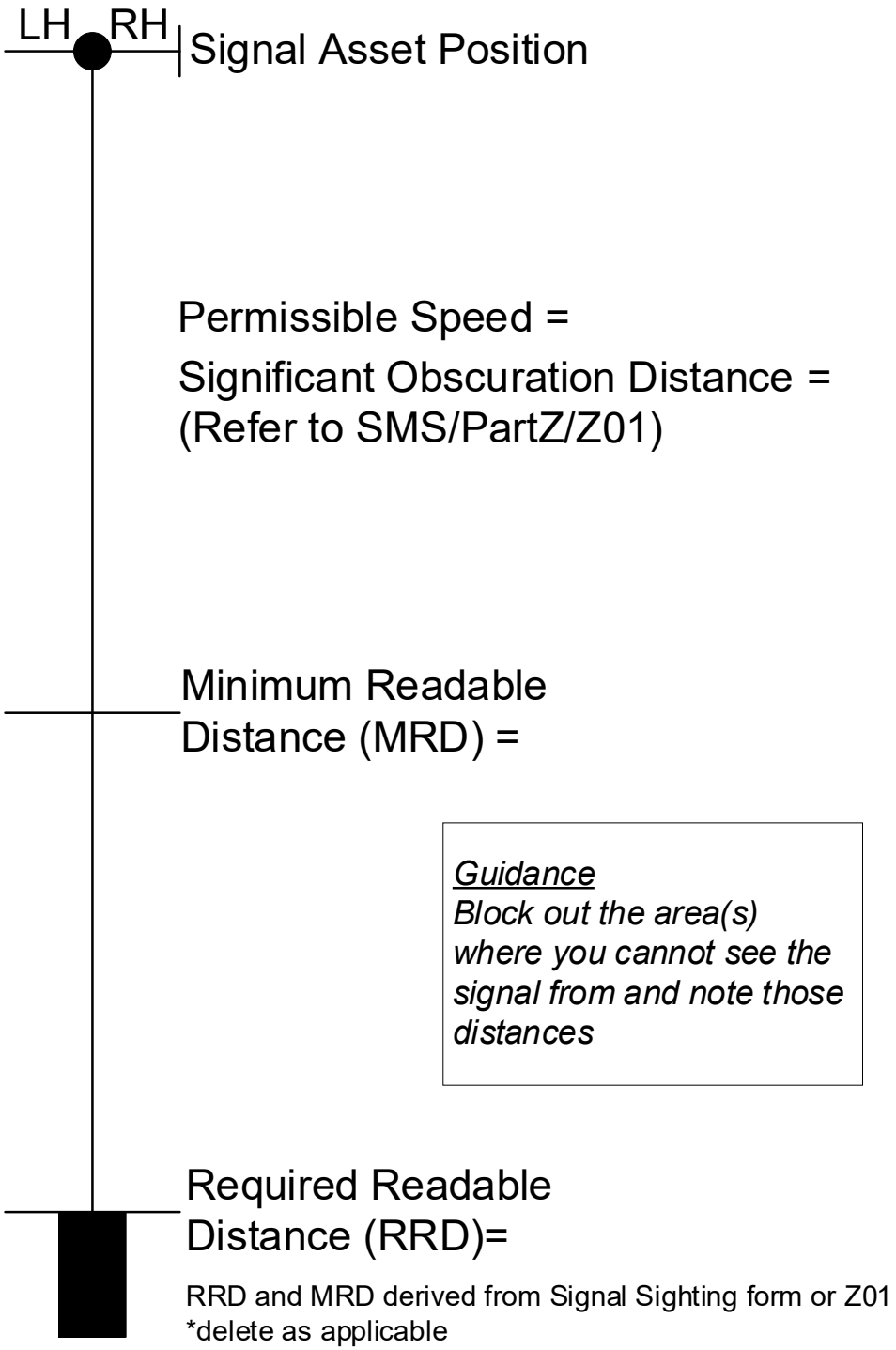
Completion Guidance:

Column Heading	Action required
Terminal	Confirm the terminal number.
Termination	Observe the number of wires/cable cores connected on the termination point and record this figure.
Analysis	Check the cable analysis and record the number of wires/cable cores shown as being connected to the termination point.
Diagram	Check the diagrams and record the number of wires/cable cores shown as being connected to the termination point.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part02/Form/21		
Signal Failure and Incident Testing: Obscuration Diagram		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Signal Identity:		**Signal Box or Control Point:**	
Line:		**Direction:**	
Name:		**Date/Time:**	



RRD and MRD derived from Signal Sighting form or Z01
*delete as applicable

Ref:	**NR/SMTH/Part/03**
Issue:	12
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NR/L3/SIG/11231

NR/SMTH/Part/03

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Test B19	Defined Test: FREDDY Test
Test B24	Defined Test: SSI Trackside Functional Module Test
Test B25	Defined Test: Mechanical Locking Function Test

END

1. Introduction

1.1 Maintenance Test Plans use the checks and tests which are defined in this Handbook.

2. Defined Checks

2.1 The following topics are covered:

a) **Correct Type -** Checking replacement equipment is of the correct type.

b) **Damage -** Checking replacement equipment is not damaged.

c) **Safe Insulation-** Checking that wiring insulation is safe.

d) **Correct Installation -** Checking replacement equipment is correctly installed.

e) **Correct Isolation -** Checking equipment is electrically isolated during work.

f) **Correct Labelling -** Checking for correct labelling.

g) **Correlation Check -** Correlation checking to verify that the equipment/wiring agrees with the site drawings.

3. Defined Tests

3.1 The following topics are covered:

a) **Wire Count -** To visually check that the correct number of wires or conductors are connected to each terminating point as shown on the wiring diagrams and any analysis.

b) **Continuity Test -** To check that the integrity of continuity and correspondence of individual wires or cable cores.

c) **Insulation Test -** To check that a cable, wire, spare core or other equipment meets the required insulation criteria.

d) **Cable Function Test -** To check that each circuit in a cable functions correctly after work on that cable.

e) **Earth Tests (DC and AC) -** To check that equipment and power supplies (non-earthed) are earth free.

f) **Aspect Test -** To check that only the correct signal aspect is displayed.

g) **Point Detection and Correspondence Test –**

I. To check that all the detection contacts are effective.

II. To check that the required correspondence is achieved between the point end, their controls and indications.

h) **Block Tests (various) -** To check that correct operation of specified block equipment.

i) **Mechanical Locking Function Test -** To check that that each mechanical lever is locked in its correct position.

j) **FREDDY Test –** To check the FREDDY functions correctly after work on the equipment.

k) **SSI Trackside Functional Module Test –** This test is to check that the TFM outputs operate correctly after a reset following the loss of the output interface.

l) **Mechanical Locking Function Test -** This test checks the operating lever conform the mechanical locking table**.**

END

1. Purpose

1.1 Confirms new or replacement equipment is inspected to check that the type is correct.

NOTE 1: *The content of checks is not exhaustive and other equipment specific installation checks might be required as specified in the Test Plans.*

2. Checks

2.1 Check the replacement item of equipment which has been selected for installation is a “like for like” replacement for the item.

2.2 Check that any configurable wiring or straps internal to the replacement item are correct.

2.3 Check the voltage, frequency, current, power ratings are correct.

2.4 Check the British Rail, Railway Group Standard, Network Rail or other specification number should be the same as the original item or directly compatible with it.

2.5 Check modification states for compatibility.

2.6 Check the size of the replacement item will fit in the available space. If any rewiring or repositioning of the equipment is necessary, the work shall be treated as a temporary diversion of circuits.

3. Relays

3.1 The contact arrangement, pin code and coil resistance of the replacement shall be checked against the item being replaced.

3.2 Check the relay prior to use for damage which might render the relay unusable. Any relay that has been dropped shall be returned for full servicing, it shall under no circumstances be placed into service

3.3 Check replacement relay has been functionally tested if the service date is in excess of three years.

NOTE 1: *Relays can be stored for up to 3 years before action is required prior to inserting them into operational use. Where relays have been stored for over 3 years and up to 10 years, a functional test shall be performed. Relays stored for 10 years or more require a full test to specification or to be sent for servicing.*

NOTE 2: *Plug-in relays can be checked using a relay test set before being made available for use. The test set should prove that contacts open and close correctly and prove polarity characteristics at working voltage. It should be noted that relay*

coil resistances can vary between different manufacturers' designs for the same type of relay, particularly for BR930 series relays.

3.4 Check "shelf type relays with detachable tops (Remax) Verification of correct type is extremely important when replacing.

3.5 The labelling of the replacement item shall be checked including any dates. Certain terminals or contacts might be labelled differently to the original item.

3.6 Check labelling is clear, not misleading and not conflicting with the diagram, it should be considered operationally equivalent.

3.7 If there is any risk of confusion or the diagram conflicts with the equipment, then the work shall be treated in the same way as a temporary diversion of circuits.

END

1. Purpose

1.1 When a replacement item of equipment is installed it is to be examined for physical damage before installation.

2. Checks

2.1 Check for obvious mechanical damage, dents, scrapes, cracks or misalignments.

2.2 Check moving mechanical parts do not bind and move freely.

2.3 Check for signs of excessive contamination by rust, grease, verdigris, or moisture, infestation by insects or rodents, or any signs of metallic contamination.

2.4 Check for any damage to external protective coatings.

2.5 Check for signs of water ingress or damage.

2.6 Check for any signs of metallic contamination.

3. Relays

3.1 Relays shall be examined, and any found with the following conditions shall not be put into service but either returned for servicing or scrapped:

a) Flaking plating on relay internal framework and components.

b) Prototype relays or relays of suspect origin.

c) Ill-fitting or warped/yellowing, damaged/cracked or loose covers.

d) Damaged or broken adjustment cards.

e) Presence of foreign bodies inside relay.

f) Presence of Silver Sulphide contamination.

g) Defective or missing seals.

h) Severe contamination, water, heat damage, physical damage (other than cosmetic).

i) Misalignment or mechanical damage which might have occurred in transit.

j) For BR 930 style relays manufactured by GEC, AEI-GS, AEI-GRS, GRS, or SGE, check that lifting card retainers are fitted.

END

1. Introduction

1.1 This check is to confirm the condition of wiring associated with new or replaced equipment.

2. Checks

2.1 Check wiring to be disconnected from an item of equipment or link, for damage and the condition of the insulation, particularly around crimps.

2.2 Check new wiring for damage and the condition of the insulation, particularly the area around crimps.

2.3 Check adjacent wiring, likely to be disturbed by the work, for damage and the condition of the insulation, particularly the area around the crimps.

If the insulation is found to be defective your SM(S) shall be advised.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part03/Check A04		
Defined Check: Check for Correct Installation		
Issue No. 07	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

1. Purpose

1.1 When a replacement item of equipment is installed it shall be examined to check that it is correctly positioned and orientated.

2. Checks

2.1 Check the equipment is fixed securely as designed using any screws, bolts, pins, clips etc provided. The base, mounting or route shall also be secure.

2.2 Check the equipment meets the requirements of the standard structure gauge as per NR/L3/SIG/10064 – General Instructions for Staff Working on S&T Equipment - C001 (Clearances for S&T Equipment).

2.3 Check that the correct crimp and crimp tool have been used.

2.4 Check the wire end and insulation are secure in the crimp and with no conductor strands visible.

2.5 Check any terminal protection such as terminal shrouds, are correctly fitted.

2.6 Check that any equipment connections are properly terminated, and that no stray electrical connection or mechanical snagging is possible.

2.7 Check wires and cables are secured to minimise disturbance and prevent damage or trapping during routine access to the equipment room, apparatus case or route.

END

1. Purpose

1.1 To confirm that equipment is isolated correctly and safely.

2. Methods of Isolation

2.1 When an existing item of equipment is required to be electrically isolated from working circuitry, there are three acceptable methods. Where the item to be replaced is a cable or wire, both ends shall be isolated. If there is any doubt, more than one method of isolation shall be carried out. The three methods of isolation are:

a) Disconnection at a plugboard.

b) Removal of a cable core/wire.

c) Slipping links/removing fuses/MCB's.

3. Disconnection at a Plugboard

3.1 All necessary checks and tests are contained within the Test Plan.

4. Removal and Refitting of a Cable Core / Wire

4.1 Where removing and refitting a cable core/wire is part of the process of replacing an item of equipment, all necessary checks and tests are contained within the Test Plan.

4.2 Where the removal and refitting of a cable core/wire for isolation purposes is carried out at a point in the circuit remote from the item of equipment to be replaced, Maintenance Test Plan NR/SMTH/Part04/CA01 (Remove and Refit an Existing Cable Core or Wire) shall be used and recorded on a log sheet.

4.3 In either case the Maintenance Tester shall check that any disconnected wires are temporarily insulated, see NR/GI/E052 (Insulation of Unterminated Wire). The method of temporary insulation used shall be robust and not be compromised by the work to change the item of equipment.

For example:

a) Pulling wires through small cable entries.

b) The danger of inadvertent operation of equipment during replacement/testing.

c) The risk of sparking causing explosion.

5. Slipping Links / Removing Fuses / MCB's

5.1 Procedures for links slipped during the work or testing are described in NR/GI/B002. (Disconnections). Fuses / MCB's removed for isolation purposes shall be dealt with in the same way as links slipped during the work.

END

1. Purpose

1.1 To confirm that equipment is correctly labelled.

1.2 The labelling can relate to any of the following:

- The labelling of equipment to determine its function, e.g., relay label on a rack: “34 HR”.
- The labelling of wires and cables terminated, or for termination on, fitted or replacement equipment or links.
- The provision of additional labels.
- The stamping of locking components for fitment or replacement into the correct position in a mechanical locking frame.

2. All Labelling

2.1 Replace or make arrangements for, the replacement of any missing labels. Provide temporary if possible.

2.2 Check the labelling arrangements and style are consistent between existing and new labels, as far as practicable.

2.3 Check the equipment naming nomenclature and convention is consistent between existing, new and replacement equipment.

2.4 Check equipment labelling is such that each item of equipment can be readily identified.

2.5 Check all labels provide clear and unambiguous information.

2.6 Check all labels are clearly visible and secure.

2.7 Check label fixings are such that, as far as practicable, the label shall remain in situ if the equipment is removed, i.e., it is not held in place with the equipment fixing bolt, screw, etc.

3. Equipment Labelling

3.1 Certain terminals or contacts might be labelled differently to the original item.

3.2 Where no label exists, arrangements shall be made to fit one at the earliest opportunity.

4. Cable and Wire Labelling

4.1 Check wires and cable cores are correctly marked at each termination point in accordance with the diagrams.

4.2 Check cable core numbers are clearly visible.

4.3 Temporary labels shall not damage either wires or equipment. They shall be removed on completion of the work or on rectification of a temporary diversion to avoid confusion. The essential feature is that everyone likely to be involved in the work or testing shall understand the labelling system adopted.

4.4 A process for the temporary labelling of diverted cable cores is given in NR/SMTH/Part01/Module/12 (The Diversion of a Circuit/Relay Contact or Emergency Equipment Relocation).

END

1. Purpose

1.1 Correlation is the comparison of an existing signalling system with the current design records to check that the two are in agreement.

1.2 There are two types of correlation. Where major and complex projects are to be undertaken, which will eventually be Works Tested, a comprehensive correlation will be required. SMTH testers might undertake this correlation but will need to work to a defined correlation copy of the wiring diagrams. This type of correlation will be specifically called up in the Method Statement for the work. For work which will be Maintenance Tested, the process will be abbreviated.

1.3 The process of correlation goes beyond that of WIRE COUNT because it requires:

a) A set of drawings stamped 'CORRELATION COPY'.

b) Physical tracing or electrical proving of circuitry/cables to confirm that they run to where the diagrams state.

c) Verification of equipment profiles, types and labelling.

d) Tick marks to record the scope of each check.

1.4 The equipment shall be checked to the diagrams to avoid any chance of differences to the diagram being missed.

1.5 Correlation requires two members of staff, one of whom shall check the equipment and the second shall mark the diagrams.

1.6 Avoid disturbing fragile or degraded wiring.

BEFORE STARTING WORK

2. Full Correlation

2.1 Check that wiring diagrams are stamped ‘Correlation Copy’, and the correct circuitry is identified for correlation.

2.2 Check that the Correlation Copy and Maintenance Copy are the same issue.

2.3 Carry out an EARTH TEST (DC) or EARTH TEST (AC) as required.

3. SMTH Correlation

3.1 Check that the correct circuit is identified for correlation.

3.2 Check that a diagram is available to correlate the circuit against.

NOTE: *A simple correlation can be made against the maintenance copy of the drawings. If the work is more complicated, a photocopy of the relevant drawing can be used. The photocopy should be kept with the NR/SMTH test record on completion of testing.*

3.3 Check the photocopy and the maintenance copy are the same issue number.

3.4 When working in location case or equipment rooms carry out an EARTH TEST (DC) or EARTH TEST (AC) is required. For other equipment it is optional but recommended.

4. Correlation Checks

4.1 Carry out the procedure listed below, in relation to the equipment that requires correlation, marking the diagrams in accordance with NR/L2/SIG/30014/C310.

Further details are given in NR/L2/SIG/11201/Mod A2-20.

5. Equipment Rooms, Signal Boxes and Location Cases

5.1 Check of relay and equipment racks (where applicable) to include:

a) Profile check front and rear (including spaces).

b) Equipment check (including ratings, mod states and, where applicable, adjustment, e.g. for timers and capacitors).

c) Check for correct labelling.

5.2 WIRE COUNT the installation to wiring diagrams.

5.3 WIRE COUNT the installation to contact analysis (where available).

6. Point Machines, Signal Heads & Trackside Equipment

6.1 Equipment check to include:

a) Type of equipment.

b) Position of equipment/type of mounting.

c) Check for correct labelling.

6.2 Prove tail cables. Tail cables shall be physically traced. If this is not possible, they shall be electrically proved.

6.3 WIRE COUNT the installation to wiring diagrams.

7. Lineside Cables

7.1 Check at both ends of the cable, to include:

a) Correct cable identification.

b) Cores correctly terminated on links / binding posts.

7.2 WIRE COUNT Installation to wiring diagrams.

8. Track Circuit Bonding

8.1 Check the whole track circuit, to include:

a) Position and type of TC bonds.

b) Disconnection boxes (where applicable).

c) Check for correct labelling (where applicable).

8.2 Prove tail cables. Tail cables shall be physically traced. If this is not possible, they shall be electrically proved.

8.3 Carry out a WIRE COUNT to the bonding diagrams.

8.4 Check position of insulated rail joints to the bonding diagrams.

8.5 Check that IRJ clearances conform to any shown on the Bonding Plan and to NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

9. Lever Locks, Circuit Controllers and Associated Equipment

9.1 Equipment checks to include:

a) Equipment type.

b) Lock type and position.

c) Lever band configuration.

d) Check for correct labelling.

9.2 WIRE COUNT the installation to wiring diagrams.

9.3 WIRE COUNT the installation to contact analysis (where available).

10. Mechanical Locking

This check of component position and connections to the Mechanical Locking Chart is required before and after disarrangement of interlocking for the purpose of replacement or cleaning, when components designed to hold the locking in place are to be removed. The application of this check is, itself, likely to cause a disarrangement of interlocking.

10.1 Check every component, type, side of cut and shape are in agreement with the Locking Chart, following each connection to other components. The check shall always be performed by inspecting the equipment and checking it to the diagrams to confirm no equipment or connection is missed.

It is necessary to record the correlation of each component and connection. The diagram shall be marked to show agreement BEFORE installation work and in a different style to indicate agreement AFTER installation work.

It is not be essential to have an unmarked diagram before starting a correlation check but there shall be room for additional marks which shall be made in a different colour to previous marks.

NOTE: *The Mechanical Locking Chart can also be known as a Dog Chart, Locking Diagram, or Tappet Diagram.*

DISCREPANCIES

11. Full Correlation

11.1 If any discrepancies are found between the wiring diagrams and equipment, the wires shall be traced through and the circuit drawn out in the prescribed manner.

11.2 Arrangements shall be made for an independent person to review any discrepancies for any safety implications (e.g., any conceptual design changes).

11.3 Any amendments to diagrams that are required shall be recorded on correlation log sheets (see NR/L2/SIG/11201/Mod A2-20.) and notified to the SM(S) by the reviewer.

12. SMTH Correlation

12.1 If any discrepancies are found between the wiring diagrams and equipment, the wires shall be traced through. Record any discrepancies. Do not proceed with the post correlation work without authority from the SM(S). Full details of the discrepancies shall be sent to the SM(S).

ON COMPLETION

13. Full Correlation

13.1 EARTH TEST (DC) or EARTH TEST (AC) as required.

13.2 Check all tick marks have been completed and all discrepancies have been marked up.

13.3 Sign and date each correlation diagram and return them to the SM(S).

14. SMTH Correlation

14.1 EARTH TEST (DC) or EARTH TEST (AC) .

END

Includes:	Single wires, Terminated Multicore cables and Plug-in type cables (including Fibre Optic cables)
Excludes:	Any other cable connection

1. Purpose

This is a visual examination to check that the correct number of wires, or conductors are connected to each terminating point as shown on the wiring diagrams and any analysis.

2. Methodology

The wire count shall be carried out with all wires terminated. This include any vertical links and bus bars.

If the conductors are cable cores, the cable core numbers shall also be checked for agreement with the diagram.

It is not necessary to wire count moulded cables only the wires on equipment terminals.

NOTE: *Particular attention should be paid to the labelling and reconnection of moulded cables.*

3. Test

a) All wire counts shall be recorded using a wire count grid sheet.

b) Check every termination point on the affected equipment has the correct number of wires, conductors or cables connected to it as shown on the wiring diagrams and any analysis.

A wire count shall always be carried out by inspecting the equipment and checking it to the diagram. Check that no wires or cables on the equipment are missing.

c) Whilst making a wire count check that spades/terminals are not loosened, wires are not broken and that there are no loose nuts, washers, off-cuts of wire or other superfluous metal objects in the vicinity of working circuits.

d) If, during the 'Before' section of a Maintenance Test Plan, the wire count reveals an error, then STOP and advise your SM(S).

e) If, during the 'After' section of a Maintenance Test Plan, the wire count reveals an error, then the work shall be corrected and independently retested.

f) The ticking of the maintenance wiring diagrams for auditing purposes is not necessary. If a job is pre planned a copy of the diagrams can be provide for ticking purposes by the SM(S).

(The wire count grid sheet is suitable for this purpose. An example of a completed grid sheet is shown in Figure1.

A suitable blank wire count grid sheet is provided in NR/SMTH/Part/02 for copying as required).

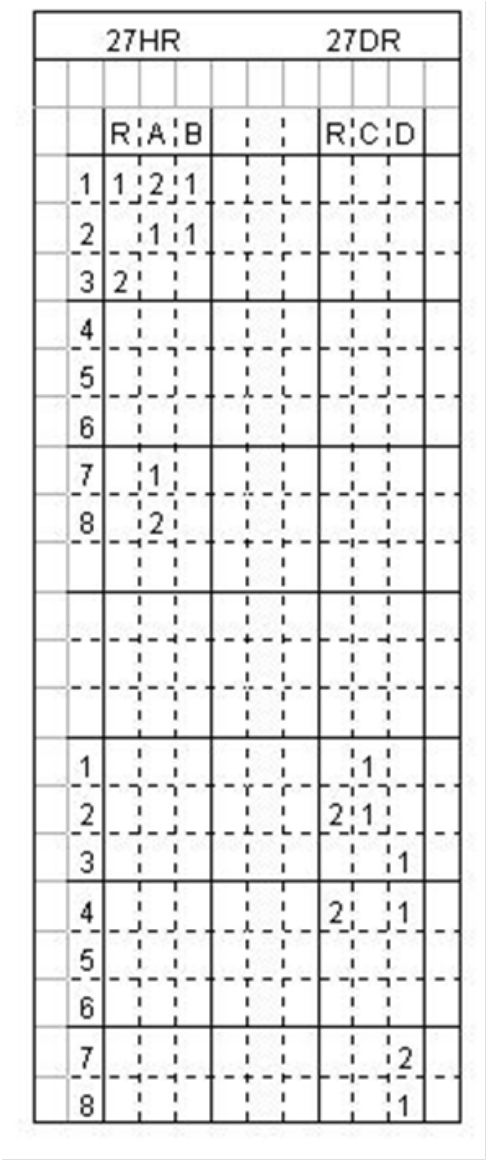


Figure 1 - Example of a Filled in Wire Count Grid Sheet

END

1. Purpose

This test is to check the continuity and correspondence of each individual wire/cable core. Where practicable the test shall be carried out with all wires terminated and all relay connectors locked in their bases, but with all relays, fuses and links removed.

2. Test

a. Test for correct polarity/correspondence of a two core cable using a DC source (e.g. battery) connected to one end of the cable and a voltmeter applied to the other. **(TWO CORE CABLES ONLY)**

b. Test for continuity by connecting a bell/buzzer test set or a multimeter set to ohms/continuity position in turn to both ends of the wire/cable core being tested. Spare cable cores may be used where the ends of the wire/cable core being tested are remote from each other.

c. Repeat for the next wire/cable core.

End

1. Purpose

To check that a cable, wire, spare core or other equipment meets the required insulation criteria. Cables carrying signalling circuits are subject to insulation tests. In certain cases, such as telecoms cables, special control measures might apply.

2. Wiring / Cable Insulation Test

Carry out CONTINUITY TEST first, to check that the whole cable is continuous.

The acceptable safe values of insulation resistance are shown in NR/SMS/Part/Z05 (Cable - Reference Values). This document specifies what to do when the insulation resistance measured has degraded and requires authorisation for circuits to remain in service.

Cables and wires shall be tested at 250V or 1000V with an approved insulation tester depending on the insulation grade see NR/SMS/PartB/Test/054 (Cable Insulation Test)

Carry out the following steps:

a) Test earth by insulation testing between the earth terminal to be used and a separate test earth.

b) CONTINUITY TEST the testing straps to be used.

c) Isolate all conductors of the cable from all circuits.

d) Test insulation between each core and all other cores in the cable connected together using the testing straps.

e) Test insulation between all cores connected together and earth using the testing straps.

3. Equipment Insulation Test

Refer to NR/SMS/PartZ/Z05 Clause 3.1 for details.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 03/Test B04		
Defined Test: Cable Function Test		
Issue No. 05	Issue Date: 05/03/11	Compliance Date: 03/09/11

1. Purpose

This test is to check that each circuit functions correctly after jointing, adding a length of cable or the renewal of a cable or line wire. It also checks for voltages on the circuit capable of falsely energising the circuit function. A particular risk is that the cable being replaced has had one or more crosses between cores at joints (the replacement cable would be substituted omitting the crosses), or the internal wires attached to either end of the cable could have been replaced onto the wrong terminations. Either of these conditions could lead to incorrect functions being operated.

AC equipment with separate local and control coils shall be fed from the same supply. Where this is not the case **STOP** and inform your Section Manager (Signals). **(AC RELAY AREAS ONLY)**

'**FIRST** function' is the first item of equipment after the affected length of cable to be directly operated by the circuit under test, e.g. a relay, motor, indicator, etc.

'**FINAL** function' is the indication at the signalling panel or the equipment on site fed by the circuit(s) under test.

Each circuit in the affected cable shall be tested in the following way (refer to Figure 1)

2. Test

a. Select and Test **EACH** circuit in the affected cable by following the steps below and referring to Figure 1.

b. Insert the links, or connect the internal wires, at each end of the affected length for the circuit to be tested.

c. Arrange for the circuit to be energised.

d. Check correct operation of all AC phase sensitive equipment where local or control coils are fed from a supply via the cable under test.
(AC RELAY AREAS ONLY)

e. Test the circuit at the FIRST function for correct polarity.
(DC CIRCUITS ONLY)

f. Test the circuit at the FIRST function for correct voltage level.

g. Test that no stray voltage is present at the **FIRST** function whilst disconnecting the feed to each leg of the circuit at the first fuse, link or terminal unique to the operation of the **FIRST** function, first separately then at the same time. (A Suitable electronic meter with a 150k ohm shunt attached shall be used.) Reconnect the feed to each leg.
(CABLES CONTAINING ANY SAFETY CRITICAL CIRCUIT)

OR

Test that no stray voltage is present at the **FIRST** function when the circuit is de-energised. (A suitable electronic with a 150k ohm shunt attached shall be used)
(CABLES CONTAINING ONLY NON SAFETY CRITICAL OR REMOTE CONTROL CIRCUITS)

h. Observe that the **FIRST** function corresponds correctly to the operation of one of its controlling contacts/devices (refer to Figure 1).

i. Where the **FINAL** function is different to the **FIRST** function, Observe that the **FINAL** function corresponds correctly to the operation of one of the controlling contacts/devices (refer to Figure 1).
(CASCADED RELAY CIRCUITS ONLY)

j. Repeat all above tests for each remaining circuit.

k. Test that no voltage can be measured between the supplies fed from different ends of the cable.
(MICROCORE CABLES ONLY WITH SEPARATE COMMON RETURN CONDUCTORS)

l. Check that all unused links are removed.

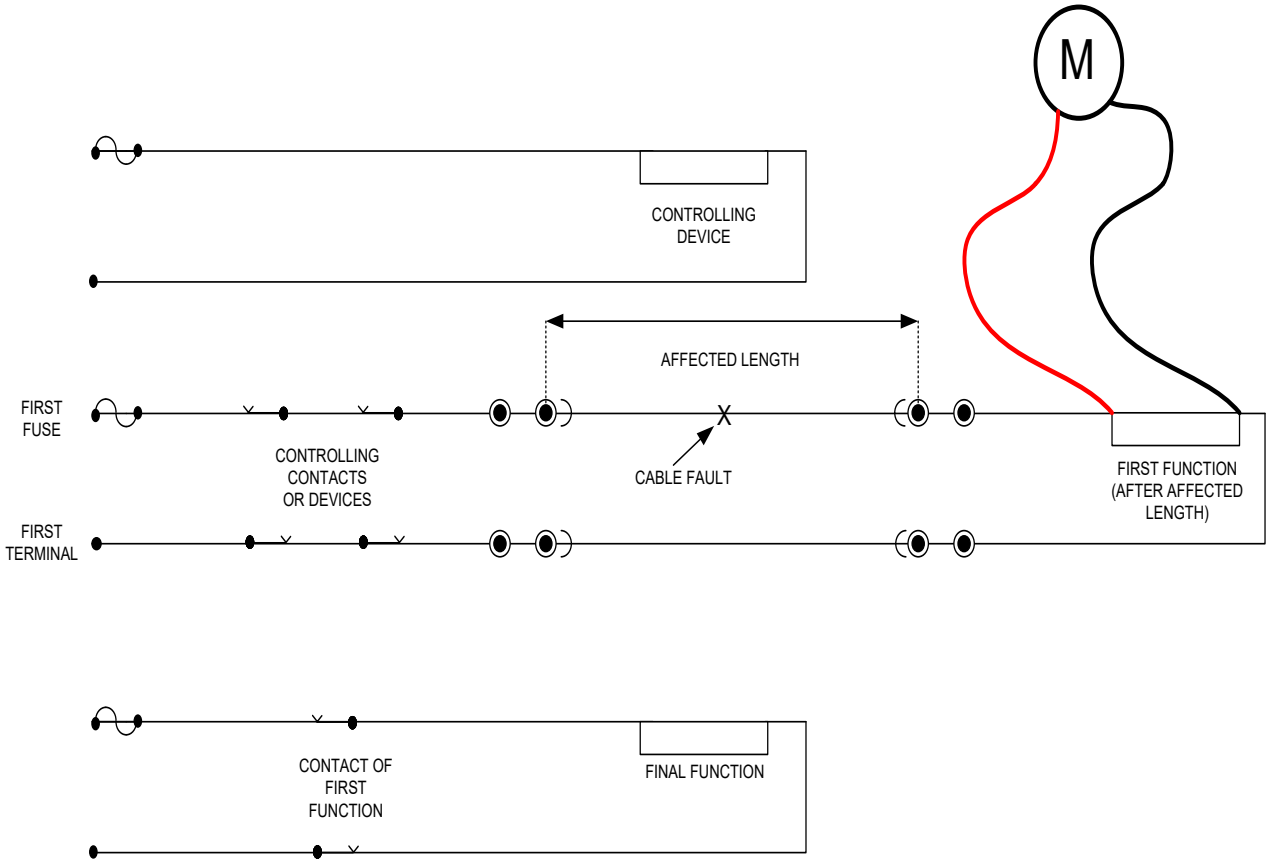


Figure 1: Cable Function Test Schematic

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 03/Test B05		
Defined Test: Earth Test (DC up to a nominal 120V)		
Issue No. 06	Issue Date: 03/03/18	Compliance Date: 31/05/18

1. Purpose

This test is to check that equipment and power supplies (when designed to be) are earth free. It makes sure that circuits cannot be falsely operated from spurious feeds. Any earth present may originate from bus bars or from equipment.

Where an earth fault detector monitors the equipment the test is not required, but the detector shall be checked for correct operation before and after any work.

For point machines, this test shall be undertaken whilst each machine is operating normal and reverse. For level crossings, this test shall be undertaken throughout the operation cycle.

An appropriately calibrated electronic meter with input impedance of at least 1M ohm fitted with a 150k ohm shunt shall be used.

All test measurements shall be recorded on DC Busbar & Earth Test record card (NR/SMS/T051/RC/02), together with the reason for the test.

2. Test

a. Measure the DC voltage between the positive and negative busbars supplying the equipment to be tested. Record the voltage indicated (V).

b. With one meter lead connected to earth and the other to the positive busbar, Record the DC voltage indicated (V1). The polarity of the indication can be ignored.

c. With one meter lead connected to earth and the other to the negative busbar, Record the DC. voltage indicated (V2). The polarity of the indication can be ignored.

d. Disconnect the meter and refer to the reportable, acceptable and safety values listed in NR/SMS/Part/Z07 applicable to the actual busbar voltage (V). If the required busbar voltage is not listed select the nearest busbar voltage shown that is less than the measured voltage.

3. Results

3.1 Less than the Reportable Range

The recorded values of V1, V2 and V1+V2 are less than the reportable range no further action is required. If any earth fault is found with the voltage below the reportable voltage range NR/SMS/Part/Z07, and the trend is worsening significantly from previous results, report to your SM(S) within 24 hours.

3.2 In the Reportable or Maximum Acceptable Range

If the recorded values of V1, V2 and V1+V2 are in the reportable or maximum acceptable range NR/SMS/Part/Z07, the SM(S) shall be advised within 24 hours.
The SM(S) will decide if any further action is required.

3.3 More than the Maximum Acceptable Value

If any of the recorded values of V1, V2 and V1+V2 are greater than the maximum acceptable voltage values NR/SMS/Part/Z07 then the SM(S) shall be advised within 24 hours. The SM(S) will decide if any further action is required.

3.4 More than the Maximum Safety Value

If any of the recorded values of V1, V2 and V1+V2 are more than the maximum safety voltage values immediate action shall be taken. If the fault cannot be cleared the SM (Signals) shall be advised immediately and decide the action to be taken.

4. Rectification of Earth Faults

All earth fault conditions are potentially serious and may be located by methodical disconnections.

When an earth fault outside acceptable limits is found, Rectify the fault as corrective maintenance.

Report to your Section Manager (Signals) the problem and any difficulties rectifying it. Failure to rectify shall be reported to your Section Manager (Signals) for necessary remedial action – the report shall be made preferably immediately and certainly within 24 hours.

Check that any earth faults in the “Reportable Region”, or any worsening trends in earth readings, are rectified or reported in accordance with NR/SMS/EL21 and NR/SMS/EL31.

5. RACI

RACI DETAILS	KEY CONTROL ACTIVITY	Maintenance Tester	Section Manager (Signals)	
Process Task				
3.1		I	I	
3.2		R	AR	
3.3		R	AR	
3.4		R	AR	
end RACI				

RACI is a means of linking process steps to roles as follows:

R **Responsible:** the individual(s) who perform an activity – responsible for action/implementation – although usually only one, R's can be shared.

A **Accountable:** the individual who is ultimately accountable including yes/no decision and power of veto – only one 'A' can be assigned

C **Consulted:** the individual(s) to be consulted prior to a final decision being made or action taken – two-way communication

I **Informed:** the individual(s) who need to be informed after a decision is made or action is taken – one-way communication

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 03/Test B06		
Defined Test: Earth Test (AC up to a nominal 110V)		
Issue No. 05	Issue Date: 05/03/11	Compliance Date: 03/09/11

1. Purpose

This test is to check that equipment and power supplies (when designed to be) are earth free. It makes sure that circuits cannot be falsely operated from spurious feeds. Any earth present may originate from bus bars or from equipment. Where an earth fault detector monitors the equipment these tests are not required, but the detector shall be checked for correct operation before and after any work.

For point machines, this test shall be undertaken whilst each machine is operating normal and reverse.

An appropriately calibrated electronic meter with input impedance of at least 1M ohm shall be used.

Caution: The 150k ohm shunt shall NOT BE USED with the meter when carrying out AC earth tests using the AC busbar earth test adaptor.

All test measurements shall be recorded on AC Busbar & Earth Test record card (NR/SMS/T051/RC/01), together with the reason for the test.

2. Test

a. Connect the meter set to volts DC to the red and one of the black terminals of the AC busbar earth test adaptor (see Figure 1).

b. Connect the green and other black terminal of the AC busbar earth test adaptor together and Measure the battery voltage (VB). Check VB is no less than positive 8V, which shows that the earth test adaptor is working and that the meter is connected the right way round. If VB is less than 8V, the battery shall be changed.

c. Remove the connection between the green and black terminals. Connect the green terminal of the adaptor to earth and the black terminal to either the BX or NX busbar. Record the DC voltage indicated (V1).

d. Reverse the leads to the selected busbar and earth so that the black terminal of the adaptor is connected to earth and the busbar is connected to the green terminal of the adaptor. Record the DC voltage indicated (V2).

e. Disconnect the test circuit and refer to the reportable, acceptable and safety values listed in NR/SMS/Part/Z07 applicable to the actual adaptor battery voltage VB. If the required adaptor battery voltage is not listed select the nearest battery voltage shown that is less than the measured voltage.

3. Results

Calculate V1+V2 and V1–V2 (*)

3.1 Less than the Reportable Range

The recorded values of V1+ V2 and V1-V2 are below the reportable range no further action is required.

3.2 In the Reportable or Maximum Acceptable Range

If the recorded values of V1+V2 and V1-V2 are in the reportable or maximum acceptable range, the Section Manager (Signals) shall be advised preferably immediately and certainly within 24 hours. The Section Manager (signals) shall decide if any further action is required.

3.3 More than the Maximum Acceptable Value

If any of the recorded values of V1+ V2 and V1-V2 are more than the maximum acceptable voltage values then the Section Manager (Signals) shall be advised preferably immediately and immediately within 24 hours. The Section Manager (signals) shall decide if any further action is required.

3.4 More than the Maximum Safety Value

If any of the recorded values of V1+ V2 and V1-V2 are more than the maximum safety voltage values immediate action shall be taken. If the fault cannot be cleared the Section Manager (Signals) shall be advised immediately and decide the action to be taken.

4. Rectification of Earth Faults

All earth fault conditions are potentially serious and may be located by methodical disconnections. When an earth fault outside acceptable limits is found, Rectify the fault as corrective maintenance. Report to your Section Manager (Signals) the problem and any difficulties rectifying it. Failure to rectify shall be reported to your Section Manager (Signals) for necessary remedial action – the report shall be made preferably immediately and certainly within 24 hours. Check that any earth faults in the “Reportable Region”, or any worsening trends in earth readings, are rectified or reported in accordance with NR/SMS/EL21 and NR/SMS/EL31

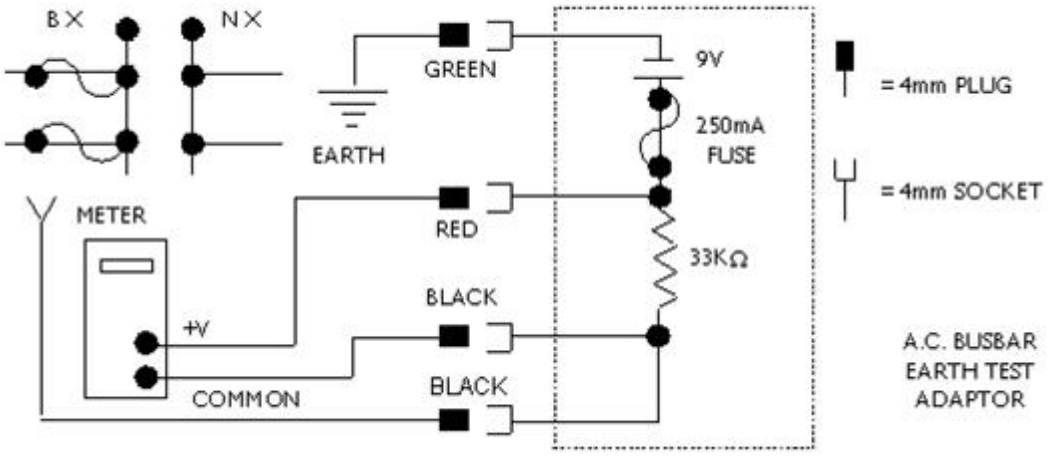


Figure 1: AC Earth Test Circuit

5. RACI

RACI DETAILS	KEY CONTROL ACTIVITY	Maintenance Tester	Section Manager (Signals)	
Process Task				
3.1		I	I	
3.2		R	AR	
3.3		R	AR	
3.4		R	AR	
end RACI				

RACI is a means of linking process steps to roles as follows:

R **Responsible:** the individual(s) who perform an activity – responsible for action/implementation – although usually only one, R's can be shared.

A **Accountable:** the individual who is ultimately accountable including yes/no decision and power of veto – only one 'A' can be assigned

C **Consulted:** the individual(s) to be consulted prior to a final decision being made or action taken – two-way communication

I **Informed:** the individual(s) who need to be informed after a decision is made or action is taken – one-way communication

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 03/Test B07		
Defined Test: Aspect Test		
Issue No. 06	Issue Date: 03/03/18	Compliance Date: 31/05/18

1. Purpose

This test is to check that the correct aspect (including any appropriate indication of route) is displayed.

Check that no other aspects, lamps, or signal lamp module are falsely illuminated during this test.

2. Test

a. Check the correspondence of each aspect control relay (or test correspondence of each SSI telegram) to its associated aspect. Additionally, for an electro-mechanical searchlight signal Test for correct polarity and operation of mechanism.

b. Check the correspondence of each aspect (or test correspondence of each SSI telegram) to its associated signal box indication or aspect repeat relay.

c. Check that all fitted lamp proving circuit(s) operate correctly.

d. Check (if provided) that any fitted filament changeover and first filament failure indication(s) operate correctly.

e. Check (if provided) that the signal post replacement switch returns the signal back to danger from a proceed aspect.

f. Check that adequate sighting is achieved for all aspects and route indications NR/SMS/Test/302.

g. Check that there is no ambiguity or conflict with any other signals.

h. Check that there is no ambiguity or conflict with any extraneous lighting.

End

1. Point Detection and Correspondence Test

This consists of a check followed by three tests. This check and tests need to be carried out in the order they are listed in Table 1:

Order	Check or Test	Definition
01	Point Position Check	This is to make sure of a correct understanding of the lie of the points in their normal and reverse positions
02	Correspondence Test	This is to make sure that the signal box controlling device, e.g. lever, controls and indications correspond with the lie of the points for both normal and reverse positions.
03	Detection Test	This is to make sure that all contacts are in the circuit and effective
04	Out of Correspondence Test	This is to make sure that detection cannot be obtained if one or more ends are not in the correct position.

Table 1 – Test Sequence

2. Carrying Out the Tests

To assess which point ends need to be tested the term ‘affected end’ has been defined:

a) If point equipment has been changed on any point end that point end is the ‘affected end’.

b) If a point detection cable is changed between any point ends those point ends are the ‘affected ends’.

All three tests shall be carried out to all point ends with a common detection circuit which includes the ‘affected end(s)’.

The point permutation chart (contained in NR/SMTH/Part/02) shall be used.

3. Point Position Check

a) Check that the point number of point end to be tested, as shown on the signalling plan, corresponds with the number on the point identification plate.

b) Check that the actual layout of the points relative to adjacent track/points/signals corresponds with that shown on the signalling plan.

c) Check that you have a correct understanding of the lie of the points in their normal and reverse positions, as follows:

d) Check that the normal position of the points (as shown on the signalling plan) agrees with the normal position as indicated by the identification plates on the points.

e) Check that you and the Signaller have a common understanding of the destination route/line for trains travelling over the points in the normal and reverse positions.

4. Correspondence Test

Operate the points normal and reverse in turn and perform the following tests for both positions:

a) Check that the control and detection relays (or voltages, or, in the case of SSI, the control and detection telegrams) correspond with the lie of the points.

b) Check that the position of the Signallers control device for the points and the Signallers' indications correspond with the lie of the points.

5. Detection Test

For ALL ends of the set of points, and ALL supplementary detectors where fitted, break each detection contact three times in succession and check that the correct local detection relay de-energises each time for both normal and reverse positions or test that the correct SSI telegram is given for both normal and reverse positions.

For systems with micro switches operate the micro switches which are not compressed.

For HW point machines, the detection contact springs are arranged in pairs of phosphor bronze contacts.

To undertake the detection breaks, break each spring of the pair once, and one of them for a second time, to achieve the three detection breaks required by this test.

Where the detection contacts are not accessible in the detector, e.g. as in the case with the Hy-Drive System, the 'Detection Test' shall be undertaken by breaking detection once for each supplementary detector position at the outgoing detection links in the associated Location Case.

The point detection test for the HPSS shall be carried out as detailed in NR/SMS/PartB/Test/008 (HPSS Tests) - Supplementary Sensor Integrity and Detection Test.

6. Out of Correspondence Test

Out of correspondence condition means that neither the normal or reverse detection relay is made or that the SSI telegram is indicating "out of correspondence".

During the out of correspondence test, the detection relays or SSI telegrams shall be continuously monitored to check that detection is only made at the correct phase of the tests.

To facilitate the monitoring of the detection relays or telegram, the points shall be operated manually (as required by SMTH) at such a rate that any false operation of relays or telegrams can be observed.

Out of Correspondence shall not be tested between the point operating mechanism and any supplementary detectors fitted to the same end.

Point detection (Steps b) & f) below) shall be checked at the relay or detector concerned (rather than at the signal box indication) or by testing for the correct SSI telegram. In certain cases, it may be tested on the KR circuit.

At certain installations the circuitry can be designed to cut the feed path to the detection circuit when detection is lost for five seconds.

To facilitate testing it can be necessary to maintain the feed to the circuit (WCR, WJR or equivalent) to make sure continued operation for the duration of the test. This is the case, for example, where the points are fitted with a separate controller. Any such requirement should be confirmed by reference to the diagrams, recorded as part of the record of test and restored on completion of the Out of Correspondence test.

The Out of Correspondence test shall be recorded to assist the Maintenance Tester in performing the test. The permutation chart grid sheets are provided for this purpose, see NR/SMTH/Part/02.

a) Normalise all ends. Refer to the first step of the permutation chart.

b) Isolate (only) the ends indicated by a zero (0) on the permutation chart.

c) Ask the Signaller to operate the points to reverse. Check they indicate out of correspondence.

d) Manually operate the isolated end(s) to reverse. Check that reverse detection is only given at full reverse position.

e) Leave the isolated ends isolated. Ask the Signaller to operate the points to normal. Check they indicate out of correspondence.

f) Manually operate the isolated end(s) to normal. Check that normal detection is only given at full normal position.

g) Repeat Steps b) to f) following the next step on the permutation chart until all permutations are complete.

h) Reconnect the isolated point drive(s).

7. Point Permutation Chart Examples

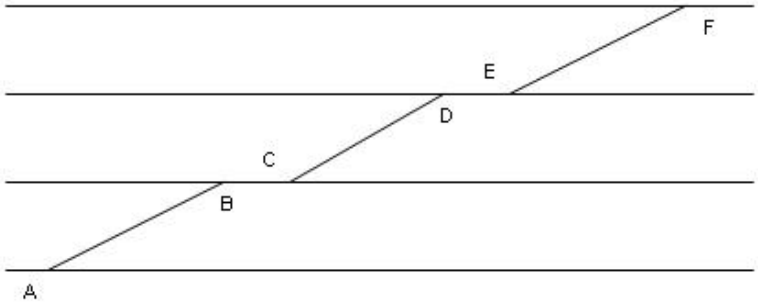


Figure 1 – Shows three separate detection circuits

A & B ends share same detection circuit (common KR or SSI input).

C & D ends share same detection circuit (common KR or SSI input).

E & F ends share same detection circuit (common KR or SSI input).

If A is the affected end, test A to B using the permutation chart for 2 ends.

A completed permutation chart grid sheet for this example would look like this:

No.	End 01	End 02	Tick
	A	B	
01	0	0	✓
02	0	1	✓
03	1	0	✓

Table 2 – Shows a completed grid sheet for one detection circuit

A, B, C, D, E & F share same detection circuit (common KR). If A is the affected end, test A to B to C to D to E to F using the point permutation chart for 6 ends.

END

1. Block Controls Nomenclature

Normal (Line Blocked)

Refers to commutator / indications in the central / vertical position.

Compulsory Train on Line Block (CTOLB)

When the controlling track circuit(s) is occupied, the block will automatically register TRAIN ON LINE regardless of the position of the commutator. To restore the block to either LINE CLEAR or NORMAL (LINE BLOCKED) the controlling track circuit(s) must be clear and the commutator placed at TRAIN ON LINE and then at LINE CLEAR or NORMAL (LINE BLOCKED) as required.

One Acceptance Block (OAB) (also known as Welwyn Block and One Train Block)

The same as CTOLB with the additional requirement that once a LINE CLEAR has been given it is not possible to give a further LINE CLEAR until the controlling track circuit(s) of the home signal has been occupied and cleared and the signal restored, or the signaller has operated a time release. There are currently two types of ONE ACCEPTANCE BLOCK (OAB):

Type 1 Where the TRAIN ON LINE indication remains when the controlling track circuit is cleared.

Type 2 Where the TRAIN ON LINE indication returns to NORMAL (LINE BLOCKED) when the controlling track circuit is cleared.

2. Test

This test is to check for the correct operation of all absolute block equipment in three stages:

Stage 1: Tests the system to prove that no LINE CLEAR can be given with any normal contact broken.

Stage 2: Tests to prove that the controlling track circuit occupied restores the block to TRAIN ON LINE (separate tests for type 1 & type 2 OAB).

Stage 3: Tests to prove that a LINE CLEAR is required to release the starting signal (LINE CLEAR releases ONLY).

The starting point for each stage is with the block restored, if necessary by using the ABSOLUTE BLOCK RECOVERY TEST.

2.1 Stage 1: No LINE CLEAR with any normal contact broken

1. Place the commutator to LINE CLEAR. Check that the block indicator shows LINE CLEAR.
2. Place the commutator to NORMAL then to LINE CLEAR. Check that the block indicator shows NORMAL (LINE BLOCKED) (OAB ONLY).
3. Use the ABSOLUTE BLOCK RECOVERY TEST to restore the block ('OAB' ONLY).

4. Check that LINE CLEAR cannot be given with the first contact in the normal proving circuit broken (see wiring diagrams).
5. Restore the first contact in the normal proving circuit. Check that LINE CLEAR can be given.
6. Repeat steps 03 to 05 for any additional contact in the normal proving circuit.

2.2 Stage 2: Prove controlling track circuit occupied restores the block to TRAIN ON LINE. (CTOLB and OAB type 1 ONLY)

7. Place the commutator to LINE CLEAR. Check the block indicator shows LINE CLEAR.
8. Check the block indicator shows TRAIN ON LINE for the 1st controlling track circuit occupied and cleared (see wiring diagrams).
9. Place the commutator to NORMAL (LINE BLOCKED). Check the block indicator continues to show TRAIN ON LINE.
10. Place the commutator to LINE CLEAR. Check the block indicator continues to show TRAIN ON LINE.
11. Place the commutator to NORMAL (LINE BLOCKED). Check the block indicator continues to show TRAIN ON LINE.
12. Place the commutator to TRAIN ON LINE. Check the block indicator continues to show TRAIN ON LINE.
13. Place the commutator to NORMAL (LINE BLOCKED). Check the block indicator shows NORMAL (LINE BLOCKED).
14. Repeat steps 07 to 13 for any additional controlling track circuit restoring the block first where necessary.
15. Check the block indicator shows TRAIN ON LINE for the 1st controlling track circuit occupied and cleared (see wiring diagrams).
16. Place the commutator to TRAIN ON LINE. Check the block indicator continues to show TRAIN ON LINE.
17. Place the commutator to NORMAL (LINE BLOCKED). Check the block indicator shows NORMAL (LINE BLOCKED).

2.3 Stage 2: Prove controlling track occupied restores the block to TRAIN ON LINE. (OAB TYPE 2 ONLY)

Place the commutator to LINE CLEAR. Check the block indicator shows LINE CLEAR.

18. Check the block indicator shows TRAIN ON LINE for the 1st controlling track circuit occupied and cleared (see wiring diagrams).

19. Place the commutator to NORMAL (LINE BLOCKED). Check the block indicator shows NORMAL (LINE BLOCKED).
20. Check the block indicator shows TRAIN ON LINE for the 1st controlling track circuit occupied (see wiring diagrams).
21. Check the block indicator shows NORMAL (LINE BLOCKED) for the 1st controlling track circuit cleared (see wiring diagrams).
22. Place the commutator to TRAIN ON LINE. Check the block indicator shows TRAIN ON LINE.
23. Check the block indicator shows TRAIN ON LINE for the 1st controlling track circuit occupied.
24. Place the commutator to NORMAL (LINE BLOCKED). Check the block indicator continues to show TRAIN ON LINE.
25. Check the block indicator shows NORMAL (LINE BLOCKED) for the 1st controlling track circuit cleared.
26. Repeat steps 18 to 26 for any additional controlling track circuit restoring the block first where necessary.

2.4 Stage 3: Prove that LINE CLEAR is required to release starting signal (LINE CLEAR RELEASE ONLY)

27. Check that the starting signal can be released while the block indicator is at LINE CLEAR.

Where 'one train' control applies, the track circuit ahead of the starting signal must be occupied and cleared to remove the LINE CLEAR release.

28. Check that the starting signal cannot be released again with the same LINE CLEAR.
29. Check that the starting signal cannot be released while the block indicator is at TRAIN ON LINE and at NORMAL (LINE BLOCKED).
30. Check that the starting signal at the adjacent signal box can be released while the commutator is at LINE CLEAR.
31. Check that the starting signal at the adjacent signal box cannot be released while the commutator is at TRAIN ON LINE and at NORMAL (LINE BLOCKED).
32. Use the ABSOLUTE BLOCK RECOVERY TEST to restore the block.

End

General

When the controlling track circuit(s) or treadle(s) is occupied, the block will automatically register TRAIN IN SECTION regardless of the position of the acceptance switch.

To restore the block the controlling track circuit(s) or treadle(s) of the home signal must have been occupied and cleared and, at the receiving signal box, the acceptance switch placed to NORMAL and the TRAIN ARRIVED plunger operated.

Tokenless Block Controls Test

This test is to check for the correct operation of all BRB tokenless block equipment:

1. Check the block indicator shows NORMAL at both signal boxes.
2. Place the acceptance switch to ACCEPT.
3. Check the block indicator shows NORMAL at both signal boxes.
4. Check that the starting signal cannot be released at both signal boxes.
5. Check the block indicator shows NORMAL at both signal boxes with the first contact in the normal proving circuit broken and the OFFER button operated at the adjacent signal box (see wiring diagrams).
6. Restore the first contact in the normal proving circuit while the OFFER button continues to be operated at the adjacent signal box.
7. Check the block indicator shows TRAIN ACCEPTED at both signal boxes.
8. Check that the starting signal cannot be released.
9. Check that the starting signal can be released at the adjacent signal box.
10. Check the block indicator shows TRAIN IN SECTION at both signal boxes for the first controlling track circuit or treadle occupied and cleared (see wiring diagrams).
11. Recreate the effect of a passing train in the approaching direction.
12. Check the block indicator shows TRAIN IN SECTION at both signal boxes.
13. Operate the TRAIN ARRIVED button. Check the block indicator shows NORMAL at both signal boxes.
14. Repeat steps 2 to 13 for any additional contact in the normal proving circuit and for any additional controlling track circuit or treadle.

15. Place the acceptance switch to NORMAL.

16. Check the block indicator shows NORMAL at both signal boxes.

17. Place the acceptance switch to ACCEPT at the adjacent signal box.

18. Check the block indicator shows NORMAL at both signal boxes.

19. Check that the starting signal cannot be released at both signal boxes.

20. Operate the OFFER button. Check the block indicator shows TRAIN ACCEPTED at both signal boxes.

21. Check that the starting signal cannot be released at the adjacent signal box.

22. Check that the starting signal can be released.

23. Check the block indicator shows TRAIN IN SECTION at both signal boxes for any controlling track circuit or treadle occupied and cleared.

24. Recreate the effect of a passing train to the adjacent signal box.

25. Check the block indicator shows TRAIN IN SECTION at both signal boxes.

26. Operate the TRAIN ARRIVED button at the adjacent signal box. Check the block indicator shows NORMAL at both signal boxes.

Prove block release winder operates correctly (MODIFIED SYSTEMS WITH BLOCK RELEASE WINDER ONLY)

27. Turn the winder until the N disappears. Check that the winder cannot be turned anticlockwise.

28. Check the block indicator shows TRAIN IN SECTION at both signal boxes.

29. Continue to turn winder. Check the block indicators at both signal boxes show TRAIN IN SECTION until the N fully reappears.

NOTE: *This should take a minimum of 30 seconds, if it does not, inform your SM(S).*

30. Check the block indicator shows NORMAL at both signal boxes.

END

1. General

When the controlling track circuits(s) or treadle(s) is occupied, the block will automatically register TRAIN GOING TO regardless of the position of the acceptance switch. To restore the block the controlling track circuit(s) or treadle(s) of the home signal must have been occupied and cleared and, at the receiving signal box, the acceptance switch placed to NORMAL and the ringing key operated.

2. Test

This test is to check for the correct operation of all Open/Sealed cancel type tokenless block equipment.

1. Check the block indicator shows NORMAL at both signal boxes.
2. Place the acceptance switch to REVERSE. Check the block indicator shows NORMAL at both signal boxes.
3. Check that the starting signal cannot be released at both signal boxes.
4. Check the block indicator shows NORMAL at both signal boxes with the first contact in the normal proving circuit broken and the ringing key operated at the adjacent signal box (see wiring diagrams).
5. Restore the first contact in the normal proving circuit while the ringing key continues to be operated at the adjacent signal box.
6. Check the block indicator shows TRAIN COMING FROM.
7. Operate the ringing key. Check the block indicator shows TRAIN GOING TO at the adjacent signal box.
8. Check that the starting signal cannot be released.
9. Check that the starting signal can be released at the adjacent signal box.
10. Operate the ringing key and the OPEN CANCEL button at the adjacent signal box.
11. Check the block indicator shows TRAIN COMING FROM.
12. Place the acceptance switch to NORMAL. Check that the TRAIN COMING FROM indication is extinguished.
13. Operate the ringing key. Check the block indicator shows NORMAL at the adjacent signal box.
14. Operate the ringing key at the adjacent signal box. Check the block indicator shows NORMAL.
15. Occupy and then clear the first controlling track circuit or treadle (see wiring diagrams).
16. Check the block indicator shows TRAIN GOING TO.
17. Check the block indicator shows TRAIN COMING FROM at the adjacent signal box.
18. Operate the ringing key at the adjacent signal box. Check the block indicator shows NORMAL.

19. Repeat steps 02 to 18 for any additional contact in the normal proving circuit and for any additional controlling track circuit or treadle.
20. Place the acceptance switch to REVERSE at the adjacent signal box. Check the block indicator shows NORMAL at both signal boxes.
21. Operate the ringing key. Check the block indicator shows TRAIN COMING FROM at the adjacent signal box.
22. Operate the ringing key at the adjacent signal box. Check the block indicator shows TRAIN GOING TO.
23. Check that the starting signal cannot be released at the adjacent signal box.
24. Check that the starting signal can be released.
25. Operate the ringing key and the OPEN CANCEL button.
26. Check the block indicator shows TRAIN COMING FROM at the adjacent signal box.
27. Place the acceptance switch to NORMAL at the adjacent signal box.
28. Check that the TRAIN COMING FROM indication is extinguished at the adjacent signal box.
29. Operate the ringing key at the adjacent signal box. Check the block indicator shows NORMAL.
30. Operate the ringing key. Check the block indicator shows NORMAL at the adjacent signal box.
31. Place the acceptance switch to REVERSE at the adjacent signal box. Check the block indicator shows NORMAL at both signal boxes.
32. Operate the ringing key. Check the block indicator shows TRAIN COMING FROM at the adjacent signal box.
33. Operate the ringing key at the adjacent signal box. Check the block indicator shows TRAIN GOING TO.
34. Place the acceptance switch to NORMAL at the adjacent signal box.
35. Operate the ringing key and OPEN CANCEL button with the first contact in the normal proving circuit broken (see wiring diagrams).
36. Check the block indicator shows TRAIN COMING FROM at the adjacent signal box.
37. Restore the first contact in the normal proving circuit.
38. Operate the ringing key, whilst operating the SEALED CANCEL button at the adjacent signal box.
39. Check the block indicator shows NORMAL at the adjacent signal box.
40. Operate the ringing key at the adjacent signal box. Check the block indicator shows NORMAL.
41. Repeat steps 34 to 40 for any additional contact in the normal proving circuit (see wiring diagrams).

42. Place the acceptance switch to REVERSE.
43. Operate the ringing key at the adjacent signal box. Check the block indicator shows TRAIN COMING FROM.
44. Operate the ringing key. Check the block indicator shows TRAIN GOING TO at the adjacent signal box.
45. Occupy and then clear the first controlling track circuit or treadle at the adjacent signal box.
46. Operate the SEALED CANCEL button. Check the block indicator shows TRAIN COMING FROM.
47. Continue to operate the SEALED CANCEL button whilst holding in the ringing key at the adjacent signal box.
48. Check the block indicator continues to show TRAIN COMING FROM.
49. Place the acceptance switch to NORMAL.
50. Operate the SEALED CANCEL button, whilst holding in the ringing key at the adjacent signal box. Check the block indicator shows NORMAL.
51. Operate the ringing key. Check the block indicator shows NORMAL at the adjacent signal box.
52. Repeat steps 42 to 51 for any additional controlling track circuit or treadle.
53. Occupy and clear the first controlling track circuit and incoming arm of treadle.
54. Place the acceptance switch to NORMAL
55. Operate the ringing key. Check the block indicator shows NORMAL at the adjacent signal box.
56. Operate the ringing key at the adjacent signal box. Check the block indicator shows NORMAL.
57. Check SEALED CANCEL glasses are replaced at both signal boxes.

End

1. General

The block indicator uses white lights for indications. NORMAL is no light showing.

2. Test

This test is to check for the correct operation of all direction lever tokenless block equipment.

1. Use the TOKENLESS CO-OPERATIVE CANCEL TEST to restore the block.
2. Check that the starting signal cannot be released at both signal boxes.
3. Operate the acceptance lever to REVERSE at both signal boxes at the same time. Check that there are no indications at both signal boxes.
4. Replace the acceptance lever to NORMAL at both signal boxes. Check the block indicator shows NORMAL at both signal boxes.
5. Operate the acceptance lever to REVERSE at the adjacent signal box.
6. Check the block indicator shows TRAIN ACCEPTED.
7. Check the acceptance lever cannot be operated to REVERSE.
8. Use the TOKENLESS CO-OPERATIVE CANCEL TEST to restore the acceptance lever at the adjacent signal box.
9. Check the block indicator shows NORMAL at both signal boxes.
10. Check the acceptance lever cannot be operated REVERSE with the first contact in the normal proving circuit broken (see wiring diagrams).
11. Restore the first contact in the normal proving circuit.
12. Operate the acceptance lever to REVERSE.
13. Check the block indicator shows TRAIN ACCEPTED.
14. Check the acceptance lever at the adjacent signal box cannot be operated to REVERSE.
15. Use the TOKENLESS CO-OPERATIVE CANCEL TEST to restore the acceptance lever.

16. Check the block indicator shows NORMAL.

17. Repeat steps 10 to 16 for any additional contact in the normal proving circuit.

END

1. General

The check sequence in the token testing table is designed for either two or three token instruments.

2. Test

This test is to check that only ONE token can be released from the system at any one time.

a. Check all tokens are electrically locked in the instruments.

If a token is missing from the system (Pilotman, damage) one token may be removed from the system for testing purposes, and the situation recorded as part of the record of test.

If there are insufficient tokens in the system, then spare tokens may be added to the system for testing purposes, and the situation recorded as part of the record of test.

b. Carry out token tests as shown in the following token testing table. (For two instruments carry out tests 01 to 11, for three instruments carry out tests 01 to 28).

A token can only be withdrawn electrically when there is an even number of tokens in the system.

Token Block Controls Test Table

Test	Instrument 01	Instrument 02	Instrument 03
01	WE	G	-
02	0	G	-
03	G	0	-
04	R	-	-
05	G	WE	-
06	G	0	-
07	0	G	-
08	-	R	-
09	WM	WM	-
10	**REPEAT TESTS 1 TO 8**		
11	R	R	-
12	G	G	WE
13	G	G	0

Test	Instrument 01	Instrument 02	Instrument 03
14	0	G	0
15	G	0	0
16	-	-	R
17	G	WE	0
18	G	G	0
19	-	R	-
20	WE	G	0
21	G	G	0
22	R		0
23	WM	-	WM
24	**REPEAT TESTS 12 TO 22**		
25	R	-	R
26	-	WM	WM
27	**REPEAT TESTS 12 TO 22**		
28	-	R	R

Abbreviation	Meaning
0	Unable to withdraw token
R	Replace token
WE	Withdraw token electrically
WM	Withdraw token manually
G	Give release

End

General

1. Test

This test is to check that only ONE tablet can be released from the system at any one time.

a) Check all tablets are electrically locked in the instruments.

b) Carry out tablet tests as shown in the following tablet testing table.

Test	Instrument 01	Instrument 02
01	WE	G
02	0	G
03	G	0
04	R	-
05	G	WE
06	G	0
07	0	G
08	-	R

Table 1 - Tablet Block Controls Test Table

Abbreviation	Meaning
0	Unable to withdraw token
R	Replace token
WE	Withdraw token electrically
G	Give release

Table 2 – Token Test Abbreviations

END

1. General

The check sequence in the token testing table is designed for either two or three token instruments. Note that step b. applies to all installations apart from the Whitby branch and step c. applies to the Whitby branch only (the Battersby-Glaisdale, & Glaisdale – Whitby sections where there is no signaller at any end. It takes account of the local wiring to allow the systems to be tested as groups of two machines).

2. Test

This test is to check that only ONE token can be released from the system at any one time.

a. Check all tokens are electrically locked in the instruments.

If a token is missing from the system (Pilotman, damage) one token may be removed from the system for testing purposes, and the situation recorded as part of the record of test.

If there are insufficient tokens in the system, then spare tokens may be added to the system for testing purposes, and the situation recorded as part of the record of test.

b. ALL INSTALATIONS EXCEPT WHITBY BRANCH:
Carry out token tests as shown in the token testing table 01. (For two instruments carry out tests 01 to 11, for three instruments carry out tests 01 to 28).

c. WHITBY BRANCH ONLY:
These systems shall be tested as a sequence of separate two instrument tests where the systems are numbered from one end of the system in sequence. 1, 2, 3, (4), with 2, (3) as intermediates.

- Three Instrument System: - Test 02&01, 02&03.
- Four Instrument System: - Test 02&01, 02&04, 03&01, 03&04. (1 and 4 are the ends of the system)

Carry out token tests as shown in the token testing table 02.

A token can only be withdrawn electrically when there is an even number of tokens in the system.

Token Block Controls Test Table 01

Test	Instrument 01	Instrument 02	Instrument 03
01	GO, WE *	-	-
02	GO, 0	-	-
03	GO	0	-
04	R	-	-
05	G	WE *	-
06	G, 0	0	-
07	0	-	-
08	-	R	-
09	WM	WM	-
10	REPEAT TESTS 1 TO 8		
11	R	R	-
12	G	-	WE *
13	G	-	0
14	0	0	-
15	GO, 0	-	-
16	-	-	R
17	G	WE	-
18	G	-	0
19	-	R	-
20	GO, WE	-	-
21	G	-	0
22	R	-	-
23	WM	-	WM
24	REPEAT TESTS 12 TO 22		
25	R	-	R
26	-	WM	WM
27	REPEAT TESTS 12 TO 22		
28	-	R	R

Token Block Controls Test Table 02

Test	Base Instrument	Second Instrument
01	GO, WE *	-
02	GO, 0	-
03	-	GO,0
04	R	-
05	-	GO, WE *
06	-	GO,0
07	GO,0	-
08	-	R
09	WM	WM
10	REPEAT TESTS 1 TO 8	
11	R	R
12	REPEAT TESTS FOR NEXT PAIR OF MACHINES	

*: Immediately after withdrawing a token, an attempt shall quickly be made to withdraw a second token during the same galvanometer deflection or indication

Abbreviation	Meaning
0	Unable to withdraw token
R	Replace token
WE	Withdraw token electrically
WM	Withdraw token manually
G	Give release
GO	Give own release

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 03/Test B16		
Defined Test: No Signaller Token Remote (NSTR), No Signaller Token (NST) Block Controls Test		
Issue No. 05	Issue Date: 05/03/11	Compliance Date: 03/09/11

1. General

The check sequence in the token testing table is suitable for two, three, or four token instruments.

2. Test

This test is to check that that only ONE token can be released from the system at any one time

a. Check all tokens are electrically locked in the instruments.

If a token is missing from the system (Pilotman, damage) one token may be removed from the system for testing purposes, and the situation recorded as part of the record of test.

If there are insufficient tokens in the system, then spare tokens may be added to the system for testing purposes, and the situation recorded as part of the record of test.

b. Carry out the token tests as shown in the following token testing table, using the columns appropriate to the number of instruments in the system.

- For two instruments carry out tests 1 to 19
- For three instruments carry out tests 1 to 25
- For four instruments carry out tests 1 to 34

A token can only be withdrawn electrically when there is an even number of tokens in the system.

Test	Instrument 01	Instrument 02	Instrument 03	Instrument 04
01	G, WE *	-	-	-
02	G, 0	-	-	-
03	G	0	0	0
04	R	-	-	-
05	-	G, WE *	-	-
06	-	G, 0	-	-
07	0	G	0	0
08	-	R	-	-
09	-	-	G, WE *	-

Test	Instrument 01	Instrument 02	Instrument 03	Instrument 04
10	-	-	G, 0	-
11	0	0	G	0
12	-	-	R	-
13	-	-	-	G, WE *
14	-	-	-	G, 0
15	0	0	0	G
16	-	-	-	R
17	WM	WM	-	-
18	**REPEAT TEST 1 TO 16**			
19	R	R	-	-
20	WM	-	WM	-
21	**REPEAT TEST 1 TO 16**			
22	R	-	R	-
23	-	WM	WM	-
24	**REPEAT TEST 1 TO 16**			
25	-	R	R	-
26	WM	-	-	WM
27	**REPEAT TEST 1 TO 16**			
28	R	-	-	R
29	-	WM	-	WM
30	**REPEAT TEST 1 TO 16**			
31	-	R	-	R
32	-	-	WM	WM
33	**REPEAT TEST 1 TO 16**			
34	-	-	R	R

* : Immediately after withdrawing a token, an attempt shall quickly be made to withdraw a second token during the same galvanometer deflection or indication

Abbreviation	Meaning
0	Unable to withdraw token
R	Replace token
WE	Withdraw token electrically
G	Give release on local instrument (NSTR) or Give release from signal box (NST)

End

BLOCK CONTROLS NOMENCLATURE

Normal (Line Blocked)

Refers to commutator / indication in the central / vertical position.

Compulsory Train on Line Block (CTOLB)

When the controlling track circuit(s) is occupied, the block automatically registers TRAIN ON LINE regardless of the position of the commutator.

To restore the block to either LINE CLEAR or NORMAL (LINE BLOCKED) the controlling track circuit(s) should be clear and the commutator placed at TRAIN ON LINE and then at LINE CLEAR or NORMAL (LINE BLOCKED) as required.

One Acceptance Block (OAB) (also known as Welwyn Block and One Train Block)

The same as 'CTOLB' with the additional requirement that once a LINE CLEAR has been given it is not possible to give a further LINE CLEAR until the controlling track circuit(s) of the home signal has been occupied and cleared and the signal restored, or the Signaller has operated a time release.

There are currently two types of ONE ACCEPTANCE BLOCK ('OAB'):

a) **Type 1** - Where the TRAIN ON LINE indication remains when the controlling track circuit is cleared.

b) **Type 2** - Where the TRAIN ON LINE indication returns to NORMAL (LINE BLOCKED) when the controlling track circuit is cleared.

BLOCK RECOVERY TEST

This test is to verify that the block restoration circuitry is effective (where fitted with 'OAB'). It can be used to restore the block during the NR/SMTH/Part03/Test/B09 (Defined Test: Absolute Block Controls Test) or following the replacement of a block instrument, block switch, block release winder or timer.

The indication given by the block indicator at the end of step 4 shows either TRAIN ON LINE or NORMAL (LINE BLOCKED). This is due to differences in the signalling circuitry of the former regions.

If required, the block can be restored during the test by carrying out steps 9 or 13 (as applicable) where a block release winder is provided or at step 16 where a block release timer is provided.

All Types

1. Place the commutator to LINE CLEAR. Check the block indicator shows LINE CLEAR.

2. Place the commutator to NORMAL (LINE BLOCKED). Check the block indicator shows NORMAL (LINE BLOCKED).

3. Place the commutator to LINE CLEAR. Check the block indicator shows NORMAL (LINE BLOCKED).

Where a Block Release Winder is Provided

4. Turn the winder until the N disappears. Check the winder cannot be turned anticlockwise.

   Observe the block indicator, if it shows TRAIN ON LINE carry out steps 5 to 10.

   If the block indicator shows NORMAL (LINE BLOCKED) carry out steps 11 to 14.

5. Check the block indicator shows TRAIN ON LINE.

6. Continue to turn winder until the N fully reappears. Check the block indicator shows only TRAIN ON LINE.

   NOTE: *This should take a minimum of 30 seconds, if it does not, inform your SM(S).*

7. Place the commutator to NORMAL (LINE BLOCKED). Check the block indicator shows NORMAL (LINE BLOCKED).

   If block does not restore to NORMAL (LINE BLOCKED), check wiring diagrams and place the commutator to TRAIN ON LINE then NORMAL (LINE BLOCKED) if required.

8. Place the commutator to LINE CLEAR. Check the block indicator shows LINE CLEAR.

9. Place the commutator to TRAIN ON LINE. Turn the winder until the N disappears and fully reappears. Check the block indicator shows only TRAIN ON LINE.

10. Turn the commutator to NORMAL (LINE BLOCKED). Check the block indicators at both signal boxes show NORMAL (LINE BLOCKED).

11. Check that the block indicator shows NORMAL (LINE BLOCKED).

12. Continue to turn the winder. Check that the block indicator only shows LINE CLEAR when the N fully reappears.

NOTE: *This should take a minimum of 30 seconds, if it does not, inform your SM(S).*

13. Place the commutator to TRAIN ON LINE. Turn the winder until the N disappears and fully reappears. Check the block indicator shows only TRAIN ON LINE.

14. Turn the commutator to NORMAL (LINE BLOCKED).

    Check the block indicators at both signal boxes show NORMAL (LINE BLOCKED).

Where a Block Release Timer is Provided

15. Start the timer running. Check the block indicator can only show LINE CLEAR when the timing sequence is complete.

16. Place the commutator to TRAIN ON LINE. Start the timer running.

17. When timing is complete, turn the commuter to NORMAL (LINE BLOCKED). Check the block indicators at both signal boxes show NORMAL (LINE BLOCKED).

END

1. Test

This test is to check that that the block restoration circuitry is effective. It can be used to restore the block during the TOKENLESS BLOCK CONTROLS TEST (DIRECTION LEVER) or following the replacement of any associated equipment.

During a TOKENLESS BLOCK CONTROLS TEST (DIRECTION LEVER), start at step 4 to restore the block.

15. Operate the acceptance lever to REVERSE.
16. Check the block indicator shows TRAIN ACCEPTED.
17. Check the acceptance lever at the adjacent signal box cannot be operated to REVERSE.
18. Check the acceptance lever can only be restored NORMAL when operating the CANCEL button at both signal boxes simultaneously.
19. Check the block indicator shows NORMAL at both signal boxes.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 03/Test B19		
Defined Test: FREDDY Test		
Issue No. 05	Issue Date: 05/03/11	Compliance Date: 03/09/11

Includes:	Single Line Control and TOPS Presence Detectors

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.
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.

FREDDY treadles are not approved for use on Network Rail Infrastructure and will be removed in due course. This Test is provided only for testing existing FREDDY treadles, pending their removal. Observe the block indicator, if it shows TRAIN ON LINE carry out steps 5 to 10. If the block indicator shows NORMAL (LINE BLOCKED) carry out steps 11 to 14.

1. General

A possession of the equipment is required with the necessary disconnections to ensure that routes cannot be set.

For 'One Train Working' sections, ensure that the section indicator in the controlling signal box shows 'Occupied' or 'Train in Section'.

For TOPS reporting presence detectors, check that no local wagon movements will take place whilst testing is being carried out.

2. FREDDY Set-up Details

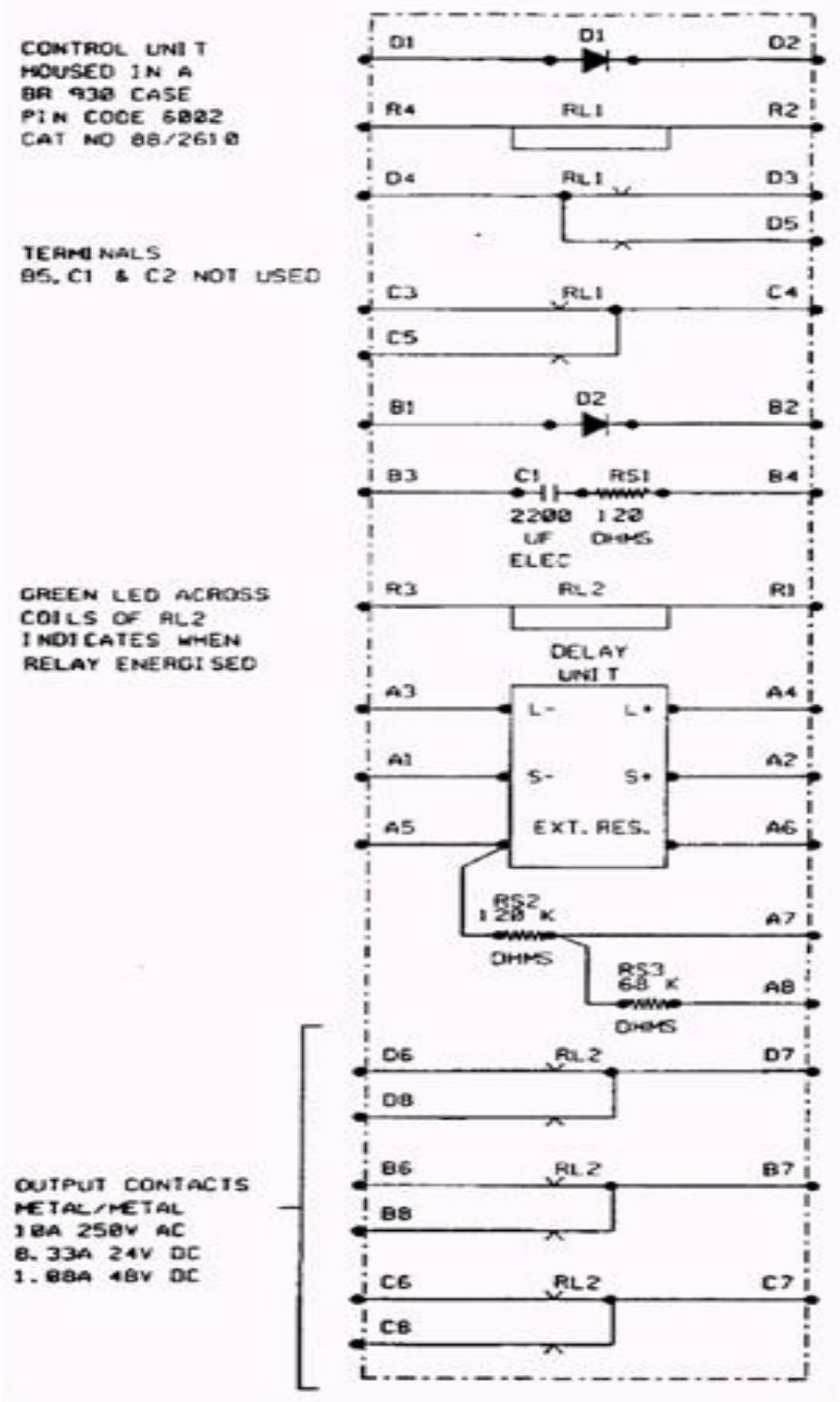
Nominal delay (Seconds)	**Straps**
0.25	A5 – A6
2.00	A5 – A8, A6 – A7
4.00	A5 – A7, A6 – A8
6.00	A6 – A7
8.00	A6 – A8
Infinite	None

Delayed release for normally de-energised configuration

Capacitor/resistor (C1 / RS1) gives a built in delay of 6 seconds. Other combinations may be added externally to give other times.

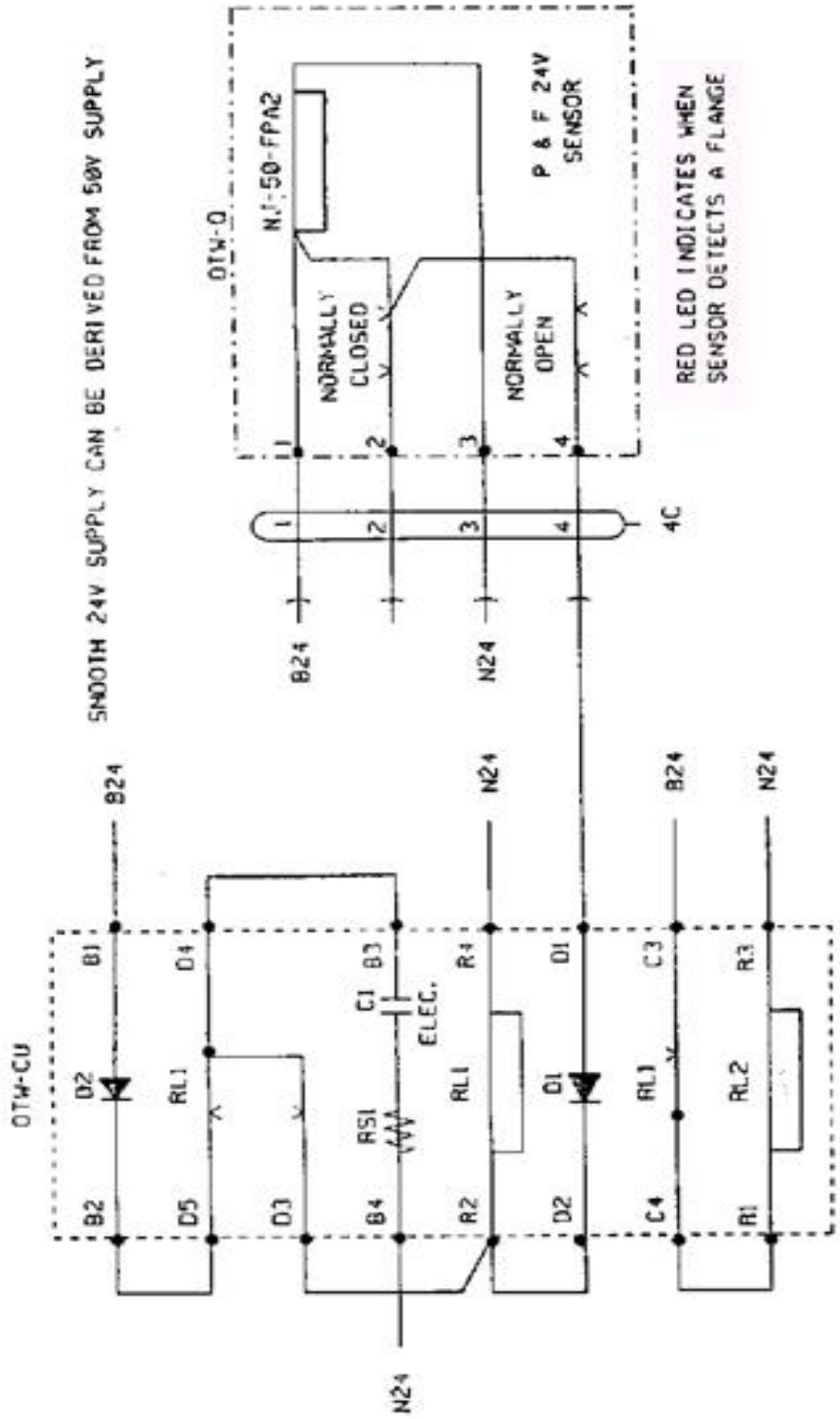
3. Circuit Details

3.1 Freddy Internal Wiring



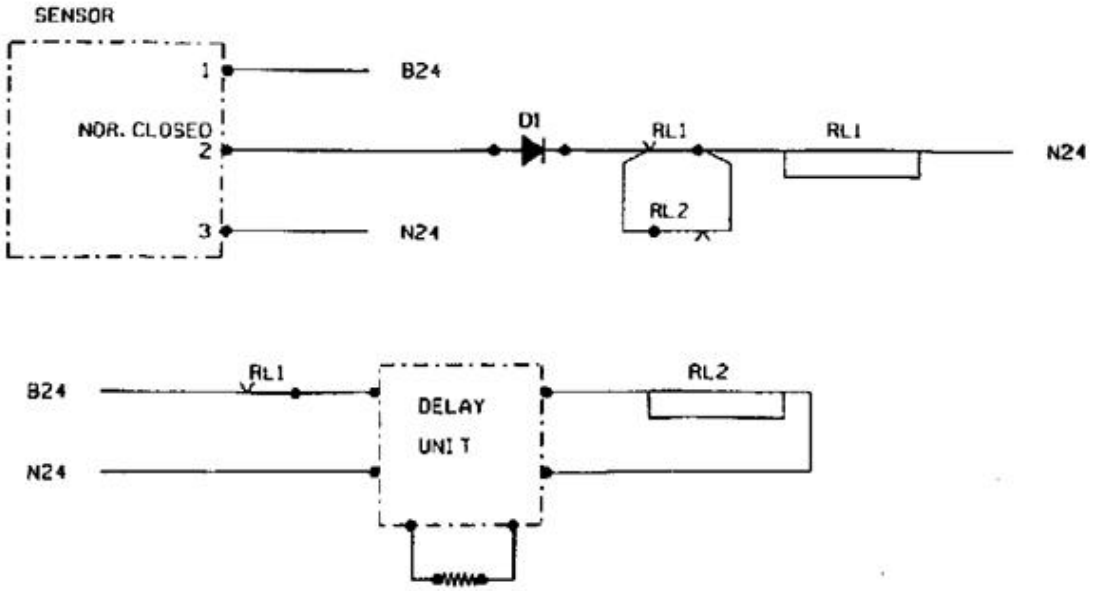
3.2 One Train Working Application

see BRS-SW67-52 for associated relay circuits
(with Control Unit RL2 contacts substituted for QRR contacts)

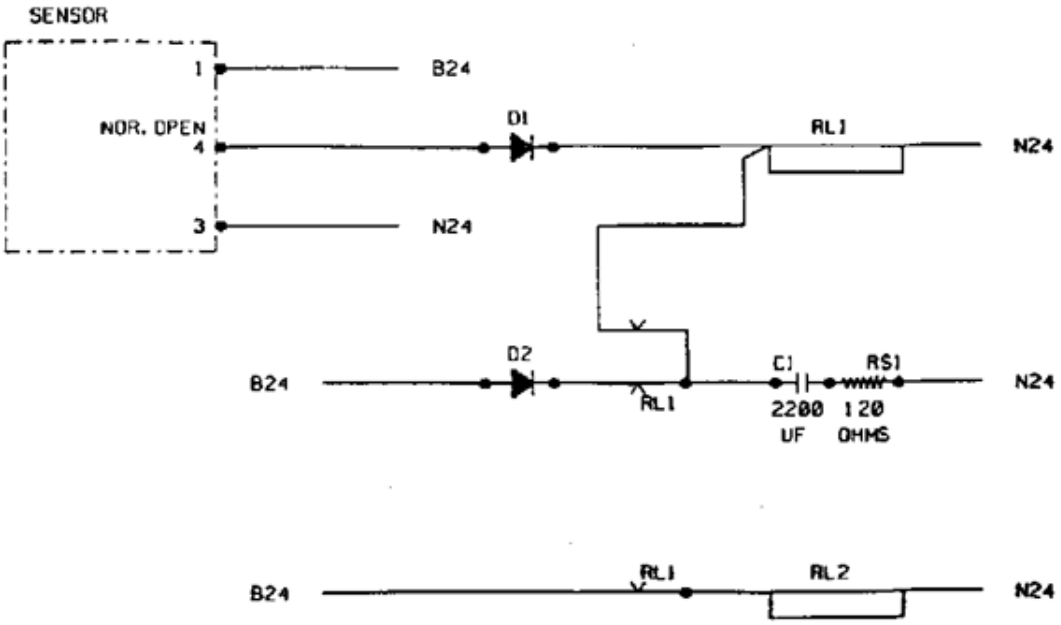


3.3 Equivalent Operating Diagrams

(1) Normally Energised Configuration



(2) Normally De-energised Configuration



4. Tests

4.1 One Train Working Circuits

The relay nomenclature used is typical and may not be found at all installations.

1. Monitor local train control relays for correct operation. Check that the orange or yellow fault LED is out and the green LED is illuminated.
2. Run a dummy wheel slowly across the sensor head in the 'onto single line' direction. Record the head detecting (relay) LED relay voltage.
3. When the presence of the dummy wheel is detected, Check that the relay mechanical indicator flag operates and Check that the green LED goes out.
4. Check either by 'closed loop supervision' of spare relay contacts RL2 or by observation of the relay operation that both RL1 and RL2 relays have operated.

RL2 is a repeat for RL1

5. When RL2 has operated, Check that either the (OTW)SR relay or the QNR and the (OTW)SR relays drop together and the QRR picks. (OFF1)TCSR and (OFF2)TCSR should remain down. Check that the green LED remains out for 6-8 seconds and Record the RL1 fixed time delay.
6. Check that both RL1 and RL2 relays drop smartly following the delay period.
7. Drop the leaving or exit track circuit(s) from the single line.
8. Repeat steps 02 and 03 and Check that the controls have operated and the green LED is out. After RL2 has operated, Check that either the QRR relay has operated or the back contacts of RL2 have energised (OFF1)TCSR.
9. After (OFF1)TCSR has operated, Check that the sequencing relay (OFF2)TCSR has operated.
10. Clear the leaving or exit track circuit(s). With both (OFF1)TCSR and (OFF2)TCSR up, Check that the (OTW)SR has picked and stuck.

    The sequence to achieve this is:

    a) RL2 operated and held by RL1 delay network (or combination QRR/RL2),
    b) RL2 operated and held by RL1 delay network,
    c) Exit track circuits occupied,
    d) Operation (sequentially) of (OFF)TCSRs,
    e) Repick of (OTW)SR,
    f) Time out of RL1/RL2,
    g) Exit track circuits clear, (OFF)TCSRs down with TPR or TZR up,

h) QNR (or FREDDY/RL2) 'Normal' to allow stick up of (OTW)SR,

i) Single line section clear, following full 'OFF' sequential control.

11. Check with the signaller that upon restoration of indication and route controls that the single line section shows 'Clear'.

12. Ask the signaller to set a signalled route onto the single line section.

13. Check that the 'onto single line' signal is showing a proceed aspect.

14. Repeat as above for 'train onto single line'.

15. Check with the signaller that the single line indication shows occupied after:

a) 'Onto single line' signal has been cleared and berth/approach track circuits occupied,

b) FREDDY operating sequence,

c) 1st wheel replacement of 'onto single line' signal following occupation of track circuits,

d) FREDDY sequence complete and track circuits clear,

e) 'Train on Branch' indicated at the signal box,

f) Either sectional route release or TORR occurs to clear USR locking and route control normalised,

g) Check that another functioned route to the single line will be locked out with the branch occupied.

16. Ask the signaller to clear the 'exit from single line' signal (in certain cases this may be approached released by the exit track circuits)

17. Drop the exit track circuits and Check the 'exit from single line' signal clears to a proceed aspect.

18. Operate FREDDY.

19. Simulate a train off the single line by occupying and clearing track circuits,. Check that 1st wheel replacement replaces the exit signal to red.

20. With FREDDY normal, Check the state of the single line indication with the signaller following final clearance of the exit track circuits (ahead of the FREDDY in direction of travel).

These are the 'onto single line' track circuits. steps 11 to 14.

21. Check that single line indication shows clear.

22. Check that sectional route release has started. (It may not be possible for the technician to fully function to next controlled signal to restore.) Either clear out by above or TORR or wait independent route JRs to operate to clear to allow points to be called again to the 'Main' or normal positions.

23. Record the installation dates of the sensor and RL1/RL2 relays (maximum 10 years between re-servicing).

4.2 TOPS Presence Detectors Used in Connection with Wagon Transponder Pads

1. Monitor RL2 relay for each FREDDY using spare contacts with the meter set to DC Volts.
2. Run a dummy wheel across the sensor in the direction of the arrow on the sensor.
3. Check that the green LED lights and the yellow or orange LED remains extinguished.
4. Record the sensor relay voltage from the display.
5. Check that the mechanical indicator flag of the sensor relay operates to indicate a change of state and the presence of a flange has been recorded.
6. Check the operation of RL1 relay and from the meter. Check that the front contacts of RL2 are made (typical value 24V DC).
7. Check and Record the servicing dates of RL1, RL2 and the presence relay in the sensor. (Maximum 10 years between re-servicing)
8. Check and Record the time delay factor of RL1 relay is between 6 and 8 seconds before the green LED extinguishes.
9. Repeat for all FREDDYs for each direction.[i.e. 2+2 or 1+1 if detected directionally 1 rail only, then correspondence becomes 1+1, and 1+1].
   (SEE LAYOUT PLAN TO ASCERTAIN CORRECT SEQUENCE)
10. Check with the Bunker operator for each FREDDY function that 'Presence' has been recorded. Ask the operator to cancel the wagon indication. (At some sites this may not be possible, in which case, wagon presence may be counted out again by operation of the opposing direction FREDDYs)
11. If the number of 'wagon axles' does not correspond to the Bunker operators' display there may be a transponder fault. This shall be reported to the infrastructure owners.
12. Close and secure all FREDDY units on completion.

4.3 Sequence Power Supplies to FREDDYS

4.3.1 For OTW Circuits or Barrier Exit Treadles

1. Check that the single line section is clear and all controls are restored to normal.
2. Remove or fail power supply to the FREDDY.
3. Check that the signaller's display shows 'Train on Branch' and the (OTW)SR has de-energised.
4. Check that both LEDs are extinguished.

5. Restore power supplies. Check that the green LED is illuminated and the orange or yellow LED is extinguished.
6. Record the time from power failure to power restored by observation of the single line indication. Check this is as specified.
7. During this time period, Check that all signal routes on and off the single line are barred.
8. Following completion of the timing out period Record the JR time.
9. Check that the single line indicator shows clear and that all applicable route controls have timed out or have been restored.
10. Check that the (OTW)SR has re-picked either as part of the JR circuit or upon FREDDY reconnection, and that the (OFF1)TCSR and (OFF2)TCSR are down with all track circuits applicable to controls clear.

4.3.2 For All Control Types

1. Measure the ripple voltage of the FREDDY PSU output with a suitable meter. Check that this figure is less by 10% of the overall voltage figure.
2. Measure and Record the PSU voltage. This must be between 22V DC and 30V DC
3. Measure and Record with a current clamp the passive current of the FREDDY from the PSU. The limits are 15 to 115mA when operated.
4. For power derived set for FREDDY, Check and Record both B and N legs for earth fault currents, using the values given in the appropriate EARTH TEST (DC) or EARTH TEST (AC).
5. Where secondary cells back the PSU, disconnect the charger and Record the On and Off voltages over a 5 minute period.

It is not recommended that a current or voltage limit shunt is applied to the cells to prove the 'Fail' LED ranges. If the cells are poor and the overall voltage falls to below 22V then the orange or yellow LED will illuminate and the operational system will fail as designed to protect.

6. Check with a suitable meter the FREDDY bus bars for earth fault currents using the values given in the appropriate EARTH TEST (DC) or EARTH TEST (AC).
7. Check and Record the charging rate of the cells using a current clamp.
8. Check that the charger cuts in to maintain cells if not a CV type.

End

1. General

This test is to check that TFM outputs operate correctly after a reset following the loss of output interface.

2. Test

After a reset has taken place:

a. Check correct operation by observing the indications on the TFM.

b. Check that all outputs fed from a Signal TFM operate correctly (e.g. aspect feeds, inductor feeds, relay feeds and ATP feeds);

Or

Check any Points fed by a Point TFM, by calling them Normal and Reverse.

End

1. Test

a. Check by operating levers that locking conforms to the mechanical locking table.

Spare and out of use levers with locking still attached shall be included in this test.

b. Check that locking is not slack and there are no irregular releases.

c. During the Mechanical Locking Function Test each successful test shall be recorded on the locking table. It is not essential to have an unmarked locking table before starting a Mechanical Locking Function Test, but there should be room for additional marks which must be made in a different colour from previous marks. Any locking table extract produced for testing purposes shall require independent checking by a competent person.

End

Ref:	**NR/SMTH/Part/04**
Issue:	18
Date:	02 December 2023
Compliance date:	02 March 2024

NR/L3/SIG/11231

NR/SMTH/Part/04

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END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AC01		
Replace or Repair an ATP Loop (Chilterns)		
Issue No. 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Check the identity of loop by physically tracing or electrically proving.
3. Check the existing loop cable is correctly labelled.
4. Check the existing loop cable has safe insulation.
5. Check any replacement cable is the correct type and is not damaged.
6. Check any replacement cable has safe insulation.

AFTER INSTALLATION WORK

7. Check the loop has been correctly installed.
8. Check that any joints are secure and sealed.
9. Test the loop transmission level is in excess of 100µA and record the test measurements on the record card.
10. Check the Mod/End LED is steady.
11. Arrange with the Signaller to illuminate one aspect and verify that the telegrams, the Site Test Certificate and the aspect displayed correspond.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AC02		
Replace an ATP LEU (Chilterns)		
Issue No. 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Power Supply Unit, Adaptor Board, Signal Adaptor Board, Telegram Generator Board, Telegram Generator TSR Board, Modulator/Output Board, Lightning Protection Board, LEU Sub-rack
Excludes:	All other ATP Equipment

GENERAL

Immediately prior to withdrawing a plug-in LEU, touch a part of the metalwork of the associated rack with the bare hand to discharge any personal static electricity.

Do not touch any board-mounted components or tracking.

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check replacement LEU is correct type and is not damaged.

Telegram Generator & Telegram Generator TSR Boards Only

3. Check replacement LEU is fitted with correct EPROMS and labelling corresponds to signal identity.

AFTER INSTALLATION WORK

4. Check replacement LEU is correctly installed.

Modulator/Output Board Replacement Only

5. Test Loop Transmission Level NR/SMS/PartB/Test/029 (ATP Equipment (Chilterns) Loop Test)) and record the test measurements on the record card, together with the reason for the test.

* 6. Arrange with the Signaller to illuminate each aspect and verify that each of the telegrams, the Site Test Certificate and the aspect displayed correspond.

7. Check or arrange for correct labelling of LEU.

8. Replace the LEU cover.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AC03		
Replace an ATP Interface (Chilterns)		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Simple Signal Interface or Complex Signal Encoder
Excludes:	All other types of Interface.

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Check replacement interface unit is correct type and is not damaged.
3. WIRE COUNT existing unit to the wiring diagram.
4. Check existing wiring has safe insulation.
5. Check existing wiring is correctly labelled.
6. (Simple Signal Interface only). Check signal controlling the LEU is Isolated from the power supply.

AFTER INSTALLATION WORK

7. Check replacement interface unit is correctly installed.
8. Check wiring is replaced as labelled.
9. WIRE COUNT replacement unit to the wiring diagram.
10. Carry out functional checks NR/SMS/PartC/AP12 (ATP Equipment (Chilterns).
11. Check or arrange for, correct labelling of interface unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AG01		
Replace an ATP Beacon (GWML)		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	GWML Beacon and Beacon Disconnection Box
Excludes:	All other ATP equipment

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Check replacement unit is not damaged.
3. Isolate existing ATP beacon in ATP enclosures.
4. WIRE COUNT beacon disconnection box to wiring diagrams.
5. Check existing wiring has safe insulation.
6. Check existing wiring is correctly labelled.

AFTER INSTALLATION WORK

7. Check replacement unit has been correctly installed.
8. Check that the height of replacement beacon is 10mm ± 1mm below the top surface of the running rails.
9. Check that the replacement beacon is mounted with the centre line of the beacon offset 150mm to the left of the track centre line looking towards the signal.
10. WIRE COUNT beacon disconnection box to wiring diagrams.
11. Reconnect beacon in ATP enclosure.
12. * Check the beacon operates correctly (LEDs on encoder flashing 50% duty cycle as follows: Signal Beacon A-H1, Infill or Additional Beacon B-H1).
13. * Test beacon signal level and check messages using ATP ground tester.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AG02		
Replace an ATP Loop (GWML)		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	GWML Loop Cable, TDA box and RDA box
Excludes:	All other ATP equipment

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Check replacement item is correct type and is not damaged.
3. Isolate existing ATP loop in ATP enclosures.
4. WIRE COUNT the TDA box to wiring diagrams.
5. Check existing wiring is correctly labelled.
6. Check existing wiring has safe insulation.
7. Check any replacement cable has safe insulation.
8. Test resistance of loop from TDA box end (340 to 400 ohm).

AFTER INSTALLATION WORK

9. Check item has been correctly installed.
10. Check any replacement cable is replaced as labelled.
11. Test resistance of loop from TDA box end (340 to 400 ohm).
12. WIRE COUNT the TDA box to wiring diagrams.
13. Reconnect loop in ATP enclosure.
14. * Test loop signal level using ATP ground tester at intervals throughout the length of the cable.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AG03		
Joint/Add a Length of Cable to a ATP Loop (GWML)		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	GWML ATP loops
Excludes:	All Other ATP Loops

General

Where an additional length of loop requires termination in TDA or RDA boxes - use NR/SMTH/Part04/CA03 (Renew a Cable or Wire).

For renewal of terminations in TDA & RDA boxes - use NR/SMTH/Part04/CA01 (Remove and Refit a Cable Core or Wire).

BEFORE INSTALLATION WORK

1. Check identity of loop by physically tracing or electrically proving.
2. Isolate loop in ATP enclosure.
3. Check any length of cable to be added is correct type and is not damaged.
4. Check any length of cable to be added has safe insulation.

AFTER INSTALLATION WORK

5. Check joint(s) secure and sealed.
6. Test resistance of loop from TDA box end (340 to 400 ohm).
7. Reconnect loop in ATP enclosure.
8. Test loop signal level using ATP ground tester at intervals throughout the length of the cable.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AG04		
Replace an ATP Encoder (GWML)		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	GWML ATP Encoders
Excludes:	All Other ATP Encoders

BEFORE INSTALLATION WORK

1. Check replacement encoder is correct type and is not damaged.
2. Check existing encoder is isolated from supply.
3. Remove and retain the parameter plugs from the existing encoder.

AFTER INSTALLATION WORK

4. Check replacement encoder is correctly installed.
5. Check parameter plugs installed in correct position on encoder.
6. Reconnect the supply to the encoder.
7. Reset replacement encoder BITE memory using ATP ground tester.
8. * Check replacement encoder operates correctly.
9. * Test the messages transmitted by the signal beacon against the encoder parameterisation sheets for all aspects and routes.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AG05		
Replace an ATP Parameter Plug (GWML)		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	GWML Main Parameter Plug, No SR Plug, TSR Plug & ESR Plug
Excludes:	All other ATP equipment

BEFORE INSTALLATION WORK

1. Check replacement plug is correct type and is not damaged.
2. Check replacement plug is correctly labelled.
3. Check encoder is isolated from power supply.
4. Remove parameter plug to be replaced, from encoder.

AFTER INSTALLATION WORK

5. Check replacement plug is installed in correct position on encoder.
6. Reconnect the power supply to the encoder.
7. Check encoder operates correctly.
8. Test the messages transmitted by the signal beacons as follows:
    a) No SR plug – confirm a message is present.
    b) ESR plug – confirm message contains ESR component.
    c) TSR plug - test message for relevant route(s) against included parameterisation sheets.
    d) Main parameter plug - test message against parameterisation sheets for all aspects and routes.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AG06		
Replace an ATP LIT (GWML)		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	GWML ATP LIT
Excludes:	All other ATP Equipment

BEFORE INSTALLATION WORK

1. Check replacement ATP LIT is correct type and is not damaged.
2. WIRE COUNT existing ATP LIT to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing ATP LIT is Isolated from the supply.

AFTER INSTALLATION WORK

5. Check replacement ATP LIT is correctly installed.
6. WIRE COUNT replacement ATP LIT to the wiring diagram.
7. * Test ATP LIT output voltage (Grey body 16-32V, Black body 32-40V).
8. Check signal aspect relevant to replaced ATP LIT illuminates.
9. Check, or arrange for, correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AP01		
Replace a TPWS Plug-in Module		
Issue No: 06	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	Overspeed Sensor Modules, Train Stop Modules, Signalling Interface Modules.
Excludes:	Transmitter loops, Self-Powered OSS Modules (SPOSM)

***** INDEPENDENCE EXEMPT *****

BEFORE INSTALLATION WORK

1. Check replacement TPWS module is Correct Type and is Not Damaged (colour and pin code) and has no bent or miss-aligned spring contacts.

2. Check replacement TPWS module mod state is correct.

3. Check plugboard is free of contamination.

4. Check replacement TPWS module is correctly sealed.

5. Check existing TPWS module is Isolated from the supply.

AFTER INSTALLATION WORK

6. Check spades are locked in the plugboard.

7. Check replacement TPWS module is Correctly Installed and the retaining clip is in place.

8. Apply NR/SMS/PartB/Test/231 - TPWS Transmitter Loop Test (following Failure) to the equipment.

9. Check, or arrange for, Correct Labelling of unit.

END

Includes:	TPWS trigger and arming loops associated with Train Stop and Overspeed Sensor Modules (including SPOSM)
Excludes:	All other transmitter loops

GENERAL

The arming loop is the first loop which the train runs over in the direction of travel for which the loops are provided, and the trigger loop is the second loop.

In some cases, there may be another loop between the arming and trigger loops, which forms part of a pair of loops provided for trains running in the opposite direction.

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check replacement loop is correct type and is not damaged.

   It is very important that buffer stop mini-loops are not replaced with standard TPWS transmitter loops and vice versa.

3. Record existing loop position on the record card, together with the reason for the test.

   It is very important that all the replacement loops are installed in the correct positions (see location diagrams).

   If necessary, mark the bearers/sleepers or carefully measure the distances between loops, signals and loops etc, before the removal of the existing loops.

4. Check replacement loop connection and plug coupler has safe insulation.

5. Check replacement loop is correctly labelled.

6. Test that replacement loop resistance is less than 10 ohm and that each core is Isolated from the screen.

   This shall only be done using a digital multi-meter (DMM) and not a high voltage insulation tester (e.g. Megger).

7. Check existing loop is isolated from the supply.

AFTER INSTALLATION WORK

8. Check replacement loop is correctly installed (no metallic debris, correct position and correct track).

   Transmitter loops shall be installed at the correct height below rail level, see NR/SMS/PartZ/Z08 (Train Protection - Reference Values).

9. Check that each loop is connected to its correct module, as shown on the location wiring diagrams.

   It is vital that each loop is connected back to its correct terminations in the TPWS enclosure or apparatus case and in particular that arming loop and trigger loop tail / feeder cables are not crossed over, particularly if the disconnection box has been disturbed.

10. Check security of the replacement loop (mountings).

11. Check the plug coupler to verify that no metallic dust, moisture or other contaminants exists between the two halves before reconnecting.

* 12. If this work has been triggered by a “Failure” carry out NR/SMS/PartB/Test/231 (TPWS Module or Transmitter Loop Test (following failure)).

* 13. If this work has been triggered by “Track Renewal Work” carry out NR/SMS/PartB/Test/232 (TPWS Module or Transmitter Loop Test (following Pway Work).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AP04		
Replace a TPWS Baseplate or Trackside Enclosure Plugboard Panel		
Issue No: 07	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	TPWS Trackside Enclosure Plugboard Panels, TPWS Baseplates.
Excludes:	All other TPWS Equipment

BEFORE INSTALLATION WORK

1. Check replacement baseplate or plugboard is Correct Type and is Not Damaged.

   Baseplates and Plugboard Panels that have the facility for both the OSS and TSS to be suppressed by energisation of the Suppression input are labelled "OSS Suppression Enabled".

   It is very important that an installation with OSS Suppression is not replaced with "non-OSS Suppression Enabled" equipment.

2. WIRE COUNT the existing baseplate or plugboard to wiring diagram.

3. Check that existing wiring has Safe Insulation.

4. Check that existing wiring is Correctly Labelled.

5. Check existing baseplate or plugboard is Isolated from the supply.

AFTER INSTALLATION WORK

6. Check replacement baseplate or plugboard is Correctly Installed.

7. Check wiring is replaced as labelled.

8. WIRE COUNT the replacement baseplate or plugboard to the wiring diagram.

9. Check all links and the fuse or MCB that are part of the circuit and baseplate are correctly replaced and secure.

10. Check the TPWS modules fitted to the baseplate or plugboards are correctly installed and the retaining clip is in place.

11. Carry out NR/SMS/PartB/Test/231 - TPWS Transmitter Loop Test (following Failure)

12. Check, or arrange for, Correct Labelling of the baseplate or plugboard.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AP05		
Replace a TPWS Failure Indication Unit (FIU)		
Issue No: 06	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	TPWS Failure Indication Unit (F.I.U.) Master Unit and Slave Unit, for use in Mechanical Signal Boxes.
Excludes:	All other TPWS equipment.

BEFORE INSTALLATION WORK

1. Check replacement FIU is Correct Type and is Not Damaged.
2. WIRE COUNT the existing FIU to wiring diagram.
3. Check that existing wiring has Safe Insulation.
4. Check that existing wiring is Correctly Labelled.
5. Check existing FIU is Isolated from the supply.

AFTER INSTALLATION WORK

6. Check replacement FIU is Correctly Installed and positioned.
7. WIRE COUNT the replacement FIU to the wiring diagram.
8. Check that the End Termination Plug is correctly attached to the top most FIU.
9. Carry out NR/SMS/PartB/Test/234 - TPWS Failure Indication Unit Test.
10. Check or arrange for Correct Labelling of the FIU.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AW01		
Replace an AWS Permanent Magnet		
Issue No: 08	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Depot test magnets, Speed Restriction Magnets
Excludes:	Vortok depot test magnets

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check replacement magnet is correct type and is not damaged.

AFTER INSTALLATION WORK

3. Check replacement magnet is correctly installed.

4. Check the lateral position and height of replacement magnet above or below rail level. For further information see NR/SMS/PartZ/Z08 (Train Protection - Reference Values).

5. Test replacement magnet. Carry out NR/SMS/PartB/Test/024 (AWS Tests) and record the test measurements on the record card together with the reason for the test.

NOTE: *For details of measuring depot test magnet strengths, see NR/GN/SIG/19040.*

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AW02		
Replace an AWS Electro-Inductor		
Issue No: 10	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	All electro and suppressor inductors
Excludes:	None

GENERAL

Both Electro and Suppressed magnets can be supplied with Mil 5015 plug coupled connection.

When testing a plug coupled unit, use a “Breakout box”. Meter leads or prods shall not be brought into contact with the plug coupled pins or sockets.

Vortok AWS magnets are designed with internal spark quench diodes, there is no requirement for external spark quench diodes in the design.

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Check replacement inductor is correct type and is not damaged.
3. Carry out a WIRE COUNT of the existing inductor to the wiring diagram.
4. If provided, remove plug coupler dust cap and check socket is clear of obstruction.
5. Check existing wiring has safe insulation.
6. Carry out INSULATION TEST replacement inductor (minimum 2M ohms terminals to case).
7. Check existing wiring is correctly labelled.
8. Check existing inductor is Isolated from the supply.

AFTER INSTALLATION WORK

9. Check replacement inductor is correctly installed.
10. Check wiring is replaced as labelled.
11. If provided, check that the plug coupler is free from damage and securely latched.
12. Carry out a WIRE COUNT of the replacement inductor to the wiring diagram.
13. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.

14. Carry out EARTH TEST (DC) supplies when replacement inductor energised.

15. Check the lateral position and height of replacement inductor above or below rail level. For further information refer to NR/SMS/PartZ/Z08 (Train Protection - Reference Values).

16. Carry out NR/SMS/PartB/Test/024 (AWS Tests) and record the test measurements on the record card together with the reason for the test.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AW03		
Replace a TrainStop/Trip Cock Tester		
Issue No: 07	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Hydraulic and Pneumatic TrainStop/Trip Cock Tester
Excludes:	Indusi Trainstop

BEFORE INSTALLATION WORK

1. Check replacement unit is correct type and is not damaged.
2. WIRE COUNT existing unit to the wiring diagram.
3. Check existing wiring has safe insulation.
4. INSULATION TEST replacement unit (minimum 2M ohm terminals to case).
5. Check existing wiring and hoses are correctly labelled.
6. Check existing unit is Isolated from the supply.

AFTER INSTALLATION WORK

7. Check replacement unit is correctly installed.
8. Check wiring is replaced as labelled.
9. WIRE COUNT replacement unit to the wiring diagram.
10. Check terminations are secure and suitably protected.
11. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.

* 12. Test voltage with supply restored.

13. Check wires, cables and hoses are clear of moving parts and are secured.
14. Check hoses are installed as labelled.
15. Carry out EARTH TEST (DC) or EARTH TEST (AC) where the supply designed to be earth free.
16. TRIP COCK TESTERS ONLY. Carry out NR/SMS/PartB/Test/177 (Treadle - Gauge Test).

* 17. Carry out NR/SMS/PartB/Test/044 (Mechanical Treadle Timing and Adjustment Test).

18. TRAINSTOPS ONLY. Test down detection with arm proving linkage disconnected.

19. TRAINSTOPS ONLY. Carry out NR/SMS/PartB/Test/026 (Trainstop Calibration Test).

* 20. Test (gauge) unit (height above rail level, positioning).

* 21. TRAINSTOPS ONLY. Test detection corresponds with the arm position for both up and down positions of the Trainstop arm.

22. TRIP COCK TESTERS ONLY. Test detection corresponds with the indication for both the raised and operated positions of the ramp/treadle arm.

23. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AW04		
Replace a Trainstop Power Pack		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Hydraulic
Excludes:	All other types

BEFORE INSTALLATION WORK

1. Check replacement Trainstop power pack is correct type and is not damaged.
2. WIRE COUNT existing Trainstop power pack to the wiring diagram.
3. Check existing wiring has safe insulation.
4. INSULATION TEST the replacement Trainstop power pack (minimum 2M ohm terminals to case).
5. Check existing wiring and hoses are correctly labelled.
6. Check existing Trainstop power pack is Isolated from the supply.

AFTER INSTALLATION WORK

7. Check replacement Trainstop power pack is correctly installed.
8. Check wiring and hoses are replaced as labelled.
9. WIRE COUNT replacement Trainstop power pack to the wiring diagram.
10. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
11. Check wires and cables are clear of moving parts.
12. Check cable is secured.
13. Carry out EARTH TEST (DC) or EARTH TEST (AC) where supplies are designed to be earth free.
14. * Check detection corresponds with arm position for both up and down positions of the Trainstop arm.
15. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AW05		
Replace an Indusi Trainstop		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Train-stop associated with a stop signal; Train-stop associated with speed control
Excludes:	Mechanical Train-stop equipment, Train-stop associated with speed control where re-railing is taking place

General

This test plan only applies on Network Rail Lines where NEXUS 'METRO' Trains operate.

BEFORE REPLACEMENT WORK

1. Using a scriber, mark position of existing Indusi train-stop on the rail.
2. Check replacement trainstop is correct type and is not damaged.
3. WIRE COUNT existing trainstop to the wiring diagram.
4. Check that any existing wiring has safe insulation.
5. INSULATION TEST replacement Indusi train-stop (minimum of 2M ohm terminals to case).
6. Check any existing wiring is correctly labelled.
7. INSULATION TEST existing cable if reused.

AFTER INSTALLATION WORK

8. Check that replacement trainstop is lined up to the scribe mark.
9. Check replacement Indusi train-stop is correctly installed and level.
10. Gauge the trainstop.

    The running edge to longitudinal centre line of magnet: 220±5mm.

    The top of the trainstop shall be level with crest of the rail, or 0-10mm below crest of rail level.

11. Check wiring is replaced as labelled.
12. Check that all cables are correctly located, secured and free from damage, particularly where the cable passes under rails.
13. WIRE COUNT replacement trainstop to the wiring diagram.
14. Check terminations are secure and suitably protected.

15. Check entry cable is secured and the Indusi train-stop wiring is not susceptible to mechanical damage.

16. Check that the Indusi Trainstop is mounted centrally in the ballast bay, or near the fastening first approached by normal traffic. Rectify as necessary.

17. Check that the Indusi train-stop and its fixings are clear of ballast.

* 18. Using Trainstop tester test the trainstop and record the results along with the reason for the test on the record card.

19. Check or arrange correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX01		
Replace an AzL 70, 70/30 and 70/30s Evaluator Card		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Thales AzL 70, 70/30 and 70/30s Axle Counter Evaluator Card
Excludes:	AzLM, AzLE and any other types of Axle Counter Evaluator Card

GENERAL

Before any work is undertaken the following shall be undertaken:

a) Take possession of the relevant axle counter section.

b) Disconnection of the output of the evaluator to the signalling system.

c) Appropriate electrostatic precautions shall be taken when handling boards. Where provided electrostatic discharge points (ESD) shall be used.

The output of the evaluator shall not be reconnected to the signalling system and possession given up unless the equipment has passed all tests and is fit for use.

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. Check that the affected section is correctly isolated from the interlocking.

2. Check replacement evaluator card is correct type and is not damaged.

AFTER INSTALLATION WORK

3. Check replacement evaluator card is correctly installed.

4. EARTH TEST (DC) or EARTH TEST (AC) supply.

* 5. Carry out NR/SMS/PartC/AX11 (Axle Counter AzL70) – Part 3 (Evaluator) or NR/SMS/PartC/AX12 (Axle Counter AzL70/30) – Part 3 (Evaluator) and record the test measurements on the record card, together with the reason for the test.

* 6. Check evaluator is reset, see NR/SMS/PartC/AX00 (Axle Counters General).

* 7. Check with Signaller that the axle counter section is clear, before reconnection of evaluator to TPR (this shall be undertaken after steps 05 and 06).

8. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX02		
Replace an AzL 70, 70/30 and 70/30s Count Head or Lineside Amplifier		
Issue No: 08	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	AzL 70, 70/30 and 70/30s Count Head or Lineside Amplifier
Excludes:	SK30H or SK30K Rail Contacts connected to a EAK30H or EAK30K. Any Other Type of Axle Counter count Head or Lineside amplifier

GENERAL

Before any work is undertaken the following shall be undertaken:

a) Take possession of the relevant axle counter section.

b) Disconnection of the output of the evaluator to the signalling system.

The output of the evaluator shall not be reconnected to the signalling system and possession given up unless the equipment has passed all tests and is fit for use.

For Further Information see SMS Appendix 15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Check that the affected section is correctly isolated the equipment from the interlocking.
3. Check replacement head or lineside amplifier is correct type and is not damaged.
4. WIRE COUNT existing head or lineside amplifier to the wiring diagram.
5. Check existing wiring has safe insulation.
6. Check existing wiring is correctly labelled.

AFTER INSTALLATION WORK

7. Check replacement head or lineside amplifier is correctly installed.
8. Check wiring is replaced as labelled.
9. WIRE COUNT the replacement head or lineside amplifier to the wiring diagram.
10. Check cable is secured.

11. Carry out NR/SMS/PartB/Test/042 (Axle Counters Dummy Wheel Test - AzL 70, 70/30, 70/30s) and record the test measurements on record card together with the reason for the test.

12. Test evaluator (BUPL, SIPL and battery voltage), carry out NR/SMS/PartC/AX11 (Axle Counter AzL70) or NR/SMS/PartC/AX12 (Axle Counter AzL70/30).

13. Check evaluator is reset, See NR/SMS/PartC/AX00 (Axle Counters General).

14. Check with Signaller that the axle counter section is clear, before reconnection of evaluator to TPR (this shall be done only after steps 11, 12 and 13 are all complete).

15. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX03		
Replace a SK30H Rail Contact (AzLM)		
Issue No: 08	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	SK30H Rail Contacts
Excludes:	All other types of Rail Contact

GENERAL

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection as required.

New rail fixing nuts and bolts shall be used when replacing a rail contact.

Cables are supplied connected and sealed to the rail contact unit.

Where a Rail Contact Adapter (RCA) is used the maximum distance between the Rail Contact and EAK is 30m.

The 8m rail contact cable shall not be used with the RCA.

The Signaller is responsible for restoring the axle counter section.

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. For Missing Equipment Only: Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Check that the replacement rail contact is of the correct type and is not damaged.
3. Power down and isolate the EAK.
4. WIRE COUNT (including the screen) the existing rail contact cable to the wiring diagram.
5. Check the existing wiring has safe insulation.
6. Check the existing wiring is correctly labelled.

AFTER INSTALLATION WORK

7. Check that the orientation of the replacement rail contact is correct to the reference (normal) direction of travel (SK1-SK2) see NR/SMS/PartC/AX15 (Axle Counter Thales AzLM).

8. Check the position of the replacement rail contact in respect of clearance points, joints, welds etc. See NR/SMS/PartC/AX00 (Axle Counters General).

9. Check the replacement rail contact is correctly installed and secure, see NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

10. Confirm that new rail fixing nuts and bolts have been used.

11. Check (if provided) the protection plates and flux plates are correctly installed and secure.

12. WIRE COUNT (including the screen) the replacement rail contact to the wiring diagram.

13. Check the cable screen is clamped correctly.

14. Check that the cable cores from the cable clamp to the terminals are twisted together.

15. Check that the cable is correctly labelled, secured and correctly routed.

16. Remove any litter and metallic objects near the replacement rail contact.

17. Check the power is restored to the EAK.

18. Test the replacement rail contact NR/SMS/PartB/Test/045 (Thales Axle Counters Dummy Wheel Test (AzLM)) and record the test measurements on the record card, together with the reason for the test.

19. Test the replacement rail contact to NR/SMS/PartB/Test/031 (Thales Axle Counter Reference Direction Function Test).

20. Check the security of the unit and any padlocks, where fitted.

    NOTE: *For Torque settings see NR/SMS/PartZ/Z03 (Train Detection – Reference Values).*

21. With the Signaller's permission, reconnect the section disconnection link(s).

22. Request the section is reset, observe that the section(s) are successfully restored to normal operation.

23. Check that the unit is correctly labelled.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX04		
Replace a EAK30H Unit (AzLM)		
Issue No: 08	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	EAK30H Lineside Junction Box, EAK30H Sub Rack
Excludes:	All other EAK Junction Boxes, EAK30H Digital Board and Analogue Board

GENERAL

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection as required.

Reference NR/SMTH/Part04/AX05 (Replace an EAK30H Board (AzLM) - Appendix A - Card Compatibility Tables.

The EAK30H shall be powered down for this task by disconnection of the power supply at the REB or the local supply.

Electrostatic precautions shall be taken when handling boards. Where provided electrostatic discharge points (ESD) shall be used.

Each detection point has a unique address set by DIP switches inside the unit.

Replacement junction boxes or sub racks need to have their DIP switch settings copied from the original box or rack, or the evaluator will not recognise the new unit.

The DIP switch settings can also be found on the location diagrams.

The Signaller is responsible for restoring the axle counter section.

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. Check that the EAK unit is isolated from the power supply.
2. Check that the replacement EAK or sub rack is of correct type and is not damaged.
3. WIRE COUNT (including the screen) the existing unit to the wiring diagram.
4. Check the Earth Bonding corresponds to the wiring diagram.
5. Check the existing wiring has safe insulation.
6. Check the existing wiring and connectors are correctly labelled.

AFTER INSTALLATION WORK

7. Check the replacement unit is correctly installed and secure.

8. Check that the DIP switch settings correspond with the address code indicated on the diagrams. The analogue card shall need to be physically removed to access the switches.

9. Check that the earth bond is correctly installed and test the continuity from the unit to earth.

10. Check that the wiring and connectors are replaced as labelled and are secure.

11. Check the cable screen is clamped correctly.

12. WIRE COUNT (including the screen) the replacement unit to the wiring diagram.

13. Restore the power to the EAK.

14. Test the replacement unit NR/SMS/PartB/Test/045 (Thales Axle Counters Dummy Wheel Test (AzLM) and record the test measurements on the record card, together with the reason for the test.

15. Test the replacement rail contact to NR/SMS/PartB/Test/031 (Thales Axle Counter Reference Direction Function Test).

16. Check the torque setting of the EAK lid bolts and base plate, see NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

17. Check the security of the unit and any padlocks, where fitted.

18. With the Signallers' permission, reconnect the section disconnection link(s).

19. Observe that the section is successfully restored to normal operation.

20. Check that the unit is correctly labelled.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX05		
Replace an EAK30H Board (AzLM)		
Issue No: 08	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	EAK30H Digital (evaluator) and Analogue (rail contact) Boards
Excludes:	EAK30H Unit and Sub rack, any other board or card in other EAK units

GENERAL

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection as required.

Electrostatic precautions shall be taken when handling boards. Where provided electrostatic discharge points (ESD) shall be used.

The EAK30H shall be powered down for this task by disconnection of the power supply at the REB or the local supply.

The unit shall not be powered up with any of the boards missing.

The digital board is ‘plug and go’, but replacement of the analogue board will require adjustment of the rail contacts.

The Signaller is responsible for restoring the axle counter section.

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. Check that the EAK unit is correctly Isolated from the power supply.

2. Check that the replacement board is correct type or equivalent (see “Appendix A” below) and is not damaged.

NOTE: *Communication technology (ISDN or DSL) needs to be consistent between Serial Card in the ACE and Digital Card in the EAK(s). Where it is planned to upgrade from ISDN to DSL refer to “Appendix A” to check compatablity with each detection point controlled by each serial card.*

AFTER INSTALLATION WORK

3. Check the replacement unit is correctly installed and secure.

4. Restore the power to the EAK unit.

5. With the Signallers' permission, reconnect the section disconnection link(s).

6. Observe that the section is successfully restored to normal operation.

For Analogue Boards Only

7. Test the operation of the replacement board NR/SMS/PartB/Test/045 (Thales Axle Counters Dummy Wheel Test (AzLM) and record the test measurements on record card together with the reason for the test.

   Replacement of the analogue board might require adjustment of the rail contacts.

8. Test the replacement rail contact to NR/SMS/PartB/Test/031 (Thales Axle Counter Reference Direction Function Test).

APPENDIX A - Card Compatibility Tables

Analogue Board

Version	Board Name	Compatible With	Board Name
3CR 01836 AEAB	Analogue board	3FW 18601 AEAB (**#1**)	High Power Analogue Board
3CR 01836 AFAA	Analogue board	3FW 18601 AEAB (**#1**)	High Power Analogue Board (H or K type)
3CR 31011 AFAA	24v Analogue board	3CR 31011 AFAA	24v Analogue board
3FW 18602 AEAB	Analogue board (RCA)	3FW 18602 AEAB	Analogue board (RCA)

Table 1 - Analogue Board

#1 When upgrading Analogue Boards to the high power varient, consideration should be taken into the increased power requirements of the high-power board.

Evaluator (Digital) Board (3CR 01859XXXX)

Version	Board Name	Compatible With
DAAB	Evaluator Board with ISDN	DBAA DBAB DBAA
DBAA	Evaluator Board with ISDN (*) and 4ms Software (Former DAAC Board)	DBAA DBAB DBAA
DBAB	Evaluator Board with ISDN (*) and 4ms Software (Former DAAB Board)	DBAB DBAA
EAAA(**#2**)	Evaluator board EAK30H, DSL, 2.4ms (380KM/H) Software	EAAA EBAA
EBAA(**#2**)	Evaluator board EAK30H, DSL, 4ms (250KM/H) Software	EBAA EAAA

Table 2 - Evaluator Board (Digital Board)

#2 Communication technology (ISDN or DSL) needs to be consistent between Serial Card in the ACE and Digital Card in the EAK(s). Where it is planned to upgrade from ISDN to DSL, the evaluator hard ware (Serial Cards) and EAK hardware (Digital Cards or K-Type EAK) will need to be replaced at the same time to check compatablity.

The DSL transmission requires the SCC CPU's to be installed (version 7HA 10057 ABAA). Where fitted, the V.24 converters are utilised also need to be upgraded from ISDN to DSL.
NOTE: *Where two EAK's are controlled from one serial card, the Digital Card in both EAK's will need to be replaced (or the EAK in the case of a K style EAK).*

NOTE: *Mixed configuration of ISDN / DSL transmission within the same ACE is supported.*

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX06		
Replace a EP/EPCM CPU Card (AzLM)		
Issue No: 08	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	AzLM EC/EPCM CPU Card
Excludes:	AzLM Evaluator Serial and Parallel Cards any other axle counter evaluator or their cards

GENERAL

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection as required.

Electrostatic precautions shall be taken when handling boards. Where provided electrostatic discharge points (ESD) shall be used.

The evaluator shall be powered down for this task by disconnection of its power supply.

Some installations have a '2 out of 3' system where the removal of one CPU card will not affect the working of the other two. If you are in doubt about the installation, ask your SM(S).

CPU boards are uniquely identified to include the data version number, replacement boards shall be operating the same site specific version of geographic data as the one they are replacing otherwise the evaluator might shut down.

The Installed Software Status Record (ISSR) will tell you the status of the installed site specific software.

The connection of a laptop with the diagnostic software will also identify the installed site specific software.

The Signaller is responsible for resetting the axle counter.

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. Check that the affected section is correctly isolated from the interlocking.
2. Check that the evaluator is correctly isolated from the power supply.
3. Check that the replacement CPU(s) board is of the correct type and is not damaged.
4. Check for correct compatibility of CPUs and Flash Cards.
5. Check that the original / replacement compact flash card status corresponds with the Installed Software Status Record (ISSR).

AFTER INSTALLATION WORK

6. Check the replacement CPU card is correctly installed and secure.

7. Restore the power to the evaluator.

8. Check that the software version of the replacement CPU card corresponds with that of the original by use of a laptop with the diagnostic software.

9. Check that the affected axle counter sections are disturbed by use of a laptop with the diagnostic software.

10. Check that the correct serial and parallel I/O card LEDs are illuminated.

11. Check that the alphanumeric display on the CPU shows a rotating bar.

12. With the Signaller's permission, reconnect the section disconnection link(s).

13. Request the section is reset, observe that the section(s) are successfully restored to normal operation.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX07		
Replace an ACE Serial/Parallel Card (AzLM)		
Issue No:08	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	AzLM Evaluator I/O Serial and Parallel Cards
Excludes:	CPU Cards and any other axle counter evaluator or their cards

GENERAL

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection as required.

Electrostatic precautions shall be taken when handling boards. Where provided electrostatic discharge points (ESD) shall be used.

The Signaller is responsible for restoring the axle counter section.

The evaluator does not require to be powered down for this task.

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. Check that the replacement card is correct type or equivalent (see “Appendix A” below) and is not damaged.

NOTE: *Communication technology (ISDN or DSL) needs to be consistent between Serial Card in the ACE and Digital Card in the EAK(s). Where it is planned to upgrade from ISDN to DSL refer to “Appendix A” to check compatablity with each detection point controlled by each serial card.*

AFTER INSTALLATION WORK

2. Check the replacement card is correctly installed and secure.

Check that the correct serial and parallel I/O card LEDs are illuminated [LED indications NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

3. Where NT/LT communication is implemented, check the correct operation of any affected serial I/O cards at adjacent ACE’s by use of diagnostics.

4. With the Signallers’ permission, reconnect the output of the affected section(s) to the signalling system.

APPENDIX A - Card Compatibility Table

ISDN Serial I/O cards (3CR01881xxxx)		
Version	**Compatible with preferred choice**	**Alternative Choice**
RAAA (NT/NT)	RAAA (NT/NT)	QBAA (Configurable), PCAA
RBAA (NT/LT)	RBAA (NT/LT)	QBAA (Configurable)
PCAA (NT/NT)	PCAA (NT/NT) or RAAA (NT/NT)	QBAA (Configurable)
QBAA (configurable)	QBAA (configurable) (**#1**)	RAAA, RBAA, PCAA (**#1**)
PFAC (NT/LT)	PFAC (NT/LT)	

#1 If in doubt on NT/LT configurable compatibility consult your SM(S).

DSL Serial I/O cards (3CR01881xxxx)	
Version	**Compatible with**
TAAA	TAAA (**#2**)
QAAA	QAAA (#2)

#2 Communication technology (ISDN or DSL) needs to be consistent between Serial Card in the ACE and Digital Card in the EAKs. Where it is planned to upgrade from ISDN to DSL, the evaluator hardware (Serial Cards) and EAK hardware (Digital Cards or K-Type EAK) will need to be replaced at the same time to check compatablity. This will be treated as extensive and simultaneous.

The DSL transmission requires the SCC CPU's to be installed (version 7HA 10057 ABAA). Where fitted, the V.24 converters are utilised will also need to be upgraded from ISDN to DSL.

NOTE1: *Where two EAK's are controlled from a single serial card, the Digital Cards in both EAK's will need to be replaced or the EAK in the case of a K style EAK.*

NOTE2: *Mixed configuration of ISDN / DSL transmission within the same ACE is supported.*

Parallel card (3CR01893xxxx)		
Version	**Compatible with preferred choice**	**Alternative Choice**
QEBB (1 vital input (GF/GF)	QEBB	QAAA, QEAC
PEBB (2 vital input GF/GF)	PEBB	PEAC, PDBB, PDAC, PAAA
REBB (2 vital inputs GF/GB)	REBB	NA
QAAA (1 vital input GF/GF)	QAAA	QEAC
PDAC (2 vital input GF/GF)	PEBB	PEAC, PDBB, PDAC, PAAA
PAAA (2 vital inputs GF/GF)	PEBB	PEAC, PDBB, PDAC, PAAA
PDBB (2 vital inputs GF/GF)	PEBB	PEAC, PDBB, PDAC, PAAA
QEAC (1 vital inputs GF/GF)	QEBB	QEAC
PEAC (2 vital inputs GF/GF)	PEBB	PEAC PDBB, PDAC, PAAA

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX08		
Remove and Refit Rail Contact (All Azl & AzLM)		
Issue No: 04	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	All Thales (AzL) Rail Contacts that are removed and refitted without disconnection of the cable to the EAK for Track Engineering Work.
Excludes:	Replacement of a Thales (AzL) Rail Contact.

GENERAL

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection as required.

The Signaller is responsible for restoring the axle counter section.

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. Check that the rail contact is not damaged, is the correct type and is correctly labelled.

2. Check that the affected section is correctly isolated from the Interlocking.

3. Power down and isolate the EAK.

4. Check the position of the rail contact using the wheel detection point position record, if this is not available measure the rail contact from a datum point that is not going to change during the work. This shall include details relating to which rail the contact is fitted on and its orientation.

AFTER INSTALLATION WORK

5. Check that the orientation of the refitted rail contact is correct to the reference direction of travel (SK1-SK2) [Direction of travel (NR/SMS/PartC/AX11, NR/SMS/PartC/AX12 & NR/SMS/PartC/AX15)].

6. Check the position of the refitted rail contact in relation the Axle counter head site form or Datum point recorded in step 4.

7. The rail contact shall not be located within 1m of block joints, ½ m of a weld & 2m of another rail contact.

NOTE: *This step is not applicable for Birmingham New Street*

8. In areas fitted with redundant rail contacts, check that the second head is located as per the requirements of the Wheel Detection Point Position Record.

9. Check the refitted rail contact is correctly installed and secure, see NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

10. Check (if provided) the protection plates and flux plates are correctly installed and secure.

11. Check the power is restored to the EAK.

12. Test the refitted rail contact, NR/SMS/PartB/Test/042 (Axle Counters Dummy Wheel Test – Azl 70, 70/30, 70/30S) or NR/SMS/PartB/Test/045 (Thales Axle Counters Dummy Wheel Test (AzLM) and record the test measurements on the record card, together with the reason for the test.

13. Test the refitted rail contact NR/SMS/PartB/Test/045 (Thales Axle Counters Dummy Wheel Test (AzLM) and record the test measurements on the record card, together with the reason for the test.

14. Test the refitted rail contact to NR/SMS/PartB/Test/031 (Thales Axle Counter Reference Direction Function Test).

15. Check the security of the unit and any padlocks, where fitted. For Torque setting see NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

16. With the Signaller's permission, reconnect the section disconnection link(s).

17. Request the section is reset, observe that the section(s) are successfully restored to normal operation.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX09		
Replace an EAK30K Unit (AzLM)		
Issue No: 03	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	EAK30K Lineside Junction Box
Excludes:	All other EAK Junction Boxes

GENERAL

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection as required.

The EAK30K is to be powered down for this task by disconnection of the power supply at the REB or the local supply.

Electrostatic precautions are to be taken when working inside the unit.

The EAK shall be changed in its entirety, changing of the electronic board contained within the EAK is strictly prohibited.

Each detection point has a unique address set by DIP switches inside the unit. Replacement junction boxes require having their DIP switches set to that of the original or the evaluator does not recognize the new unit. The DIP switch settings can also be found on the location diagram.

The Signaller is responsible for restoring the axle counter section

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

NOTE: Communication technology (ISDN or DSL) needs to be consistent between Serial Card in the ACE and Digital Card in the EAK(s). Where it is planned to upgrade from ISDN to DSL refer to “Appendix A” to check compatibility with each detection point controlled by each serial card.

1. Check that the EAK unit is correctly isolated from the power supply.
2. Check that the replacement EAK unit is of the correct type, undamaged, and is correctly labelled.
3. WIRE COUNT (including the screen) the existing unit to the wiring diagram.
4. Check the ARD plug direction corresponds to the diagram.
5. Check the Earth Bonding is correctly as shown on the wiring diagram
6. Check the existing wiring has safe insulation.

7. Check the existing wiring and connectors are correctly labelled.

AFTER INSTALLATION WORK

8. Check the replacement unit is correctly installed, secure and correctly labelled.

9. Check that the DIP switch settings correspond with the address code indicated on the diagrams.

10. Check S1 S2 and S3.

    S1 and S2 shall be set to 1, S3 shall be set to H3.

11. Check that the earth bond is correctly installed and test the continuity from the unit. See torque settings in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

12. Check that the wiring and connectors are replaced as labelled and are secured.

13. Check the cable screen is clamped correctly.

14. WIRE COUNT (including the screen) the replacement unit to the wiring diagram.

15. Check the ARD plug direction corresponds to the diagram.

16. Check the security of the unit to the pedestal. For torque settings in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

17. Restore the power to the EAK.

18. Test the replacement unit NR/SMS/PartB/Test/045 (Axle Counter Dummy Wheel Test AzLM) and record the measurements on the record card, together with the reason for the test.

19. Test the replacement rail contact to NR/SMS/PartB/Test/031 (Thales Axle Counter Reference Direction Function Test).

20. Check the security of the unit and any padlocks, where fitted. For torque settings in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

21. With the Signallers' permission, reconnect the output of the affected section(s) to the signalling system.

22. Request the section is reset, observe that the section(s) are successfully restored to normal operation.

23. Check that the unit is correctly labelled.

APPENDIX A - Card Compatibility Tables

Version	Board Name	Compatible With
DABA	EAK 30K ISDN	DABA
FEAA	EAK 30K DSL, 120v 4ms (250KM/H)	FEAA
FFAA	EAK 30K DSL, 24v 4ms (250KM/H)	FFAA
FAAA	EAK 30K DSL, 120v 2.4ms (380KM/H)	FAAA
FCAA	EAK 30K DSL, 24v 2.4ms (380KM/H)	FCAA

#2 Communication technology (ISDN or DSL) needs to be consistent between Serial Card in the ACE and Digital Card in the EAK(s). Where it is planned to upgrade from ISDN to DSL, the evaluator hard ware (Serial Cards) and EAK hardware (Digital Cards or K-Type EAK) will need to be replaced at the same time to check compatibility.

The DSL transmission requires the SCC CPU's to be installed (version 7HA 10057 ABAA). Where fitted, the V.24 converters are utilised also need to be upgraded from ISDN to DSL.

NOTE 1: *Where two EAK's are controlled from one serial card, the Digital Card in both EAK's will need to be replaced (or the EAK in the case of a K style EAK).*

NOTE 2: *Mixed configuration of ISDN / DSL transmission within the same ACE is supported.*

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX10		
Replace an Rail Contact Adaptor (RCA) (AzLM)		
Issue No: 03	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Rail Contact Adaptor connected to SK30H, EAK30H, SK30K or EAK30K
Excludes:	Removal of Rail Contact Adaptor

GENERAL

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection as required.

- The EAK shall be powered down for this task.
- Electrostatic precautions shall be taken when working inside the unit.

The Signaller is responsible for restoring the axle counter section.

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. Check that the affected section is correctly isolated form the interlocking.
2. Check that the rail contact adaptor is of the correct type and is undamaged.
3. Isolate the EAK.
4. WIRE COUNT (including the screen) the existing rail contact adapter cables to the wiring diagram.
5. Check the existing wiring has safe insulation.
6. Check the existing wiring is correctly labelled.

AFTER INSTALLATION WORK

7. Check the rail contact adaptor is mounted securely.

   The RCA shall sit in a position level or above the EAK and Rail contact to prevent water draining into the RCA.

8. Check the rail contact adaptor is correctly installed.
9. WIRE COUNT (including the screen / drain wire) the replacement rail contact adaptor to the wiring diagram.

10. Check the cable screens are clamped, zip tied or terminated correctly.

11. Check that the cable cores from the cable clamp to the terminals in the RCA and the EAK are twisted together.

12. Check that the cable is correctly labelled, secured and correctly routed.

13. Check the security and seating of the card within the RCA.

14. Check the cable glands are tight and the cable secured.

15. Check the seal on the lid is intact and is not cut or damaged (flattened).

16. Secure the metal plate inside the RCA and then secure the outer lid.

17. Power up the EAK.

18. With the Signalers permission, reconnect the section disconnection link(s).

19. Request the section is reset, observe that the section(s) are successfully restored to normal operation.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX11		
Replace a SK30K Rail Contact (AzLM)		
Issue No: 03	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	SK30K Rail Contact
Excludes:	All other types of Rail Contact

GENERAL

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection method as required.

The disconnection link shall not be reconnected, and possession given up unless the equipment has passed all tests and is fit for use.

Cables are supplied connected and sealed to the rail contact unit. A cable of any length (4m, 5.5m or 8m) can be used as long as there is sufficient to reach from the EAK.

Where a Rail Contact Adapter (RCA) is used the maximum distance between the Rail Contact and EAK is 30m.

The 8m rail contact cable shall not be used with the RCA.

The Signaller is responsible for restoring the axle counter section.

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Check that the affected section is correctly isolated from the interlocking.
3. Check that the replacement rail contact is of the correct type and is not damaged.
4. Power down and isolate the EAK.
5. WIRE COUNT (including the screen) the existing rail contact cable to the wiring diagram.
6. Check the existing wiring has safe insulation.
7. Check the existing wiring is correctly labelled.

8. If a rail clamp is fitted, check the position of the rail contact using the Wheel Detection Point Position Record. If this is not available, then the location of the rail contact shall be measured from a datum point that is not going to change during the work. This shall include verification of details relating to which rail the contact is fitted on.

AFTER INSTALLATION WORK

9. If a Rail Clamp is fitted, verify the position of the refitted rail contact in relation to the Wheel Detection Point Position Record or the Datum point recorded in Step 8.

The rail contact shall not be located within 1m of block joints, ½ m of a weld and 2m of another rail contact. Note, this is not applicable to Birmingham New Street.

In areas fitted with redundant rail contacts check that the second head is located between 2 and 3 meters away from the refitted head. Note, this is not applicable to Birmingham New Street.

10. Check the replacement rail contact is correctly installed and secured, see NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

11. Confirm that new rail fixing nuts and bolts have been used.

12. Check (if provided) the protection plates and flux plates are correctly installed and secure.

13. WIRE COUNT (including the screen) the replacement rail contact to the wiring diagram.

14. Check the cable screen is clamped correctly.

15. Check that the cable cores from the cable clamp to the terminals are twisted together.

16. Check that the cable is correctly labelled, secured and correctly routed.

17. Check the power is restored to the EAK.

18. Test the replacement rail contact NR/SMS/PartB/Test/045 (Thales Axle Counters Dummy Wheel Test (AzLM) and record the test measurements on record card, together with the reason for the test.

19. Test the replacement rail contact to NR/SMS/PartB/Test/031 (Thales Axle Counter Reference Direction Function Test).

20. Check the security of the unit and any padlocks, where fitted. For Torque setting see NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

21. With the Signaller's permission, reconnect the output of the affected section(s) to the signalling system.

22. Request the section is reset, observe that the section(s) are successfully restored to normal operation.

23. Check that the unit is correctly labelled.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX20		
Replace a Siemens AzS 350 U Axle Counter Card (VESBA)		
Issue No: 03	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	VESBA
Excludes:	BLEA12, SIRUIS2, STEU and VAU

***** INDEPENDENCE EXEMPT *****

GENERAL

Before any work is undertaken:

a) Possession of the affected axle counter evaluator (ACE) shall be taken.

b) Possession shall also be taken of any adjacent connected evaluators. This affects multiple track sections and any signalling functions carried over the evaluator transmission links.

c) The output of the evaluator shall not be reconnected to the signalling system and possession given up unless the equipment has passed all tests and is fit for use.

d) Electrostatic precautions shall be taken when handling boards. Electrostatic discharge points (ESD) are provided in the evaluator cabinet and nearby working surface to assist in this procedure.

e) Only one axle counter evaluator shall be worked on at any one time.

BEFORE INSTALLATION WORK

1. Check that possession of the affected ACE has been taken.

2. Check that the affected ACE is powered down by switching off the relevant power supply board.

3. Check that the replacement card is not damaged and is correct type. Check that the replacement card status corresponds with the Baseline document.

4. Remove the fuse from the affected VESBA card.

   The fuses of the replacement VESBA card shall be removed before the card is inserted into the evaluator rack.

AFTER INSTALLATION WORK

5. Check that the replacement card is correctly installed and secure.

6. Set both the potentiometers as far counter clockwise as they can go.

7. Replace the fuses into the replacement VESBA card.

8. Power up the affected ACE by switching on the relevant power supply board

9. Reset the system by simultaneously pressing the red buttons on both of the VAU boards for approximately 1 second.

   Observe that only the LED ‘VGL’ remains illuminated after approximately 5 seconds.

10. Test the evaluator VESBA card levels NR/SMS/PartC/AX31 (Siemens AzS 350U Axle Counter Evaluator).

11. Arrange with the Signaller to reset the affected section(s).

12. Observe that the section is successfully restored to normal operation.

13. Check, or arrange for the correct labelling of the unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX21		
Replace a Siemens AzS 350 U Axle Counter Card (SIRIUS2, STEU, VAU)		
Issue No: 03	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	SIRUIS2, STEU and VAU
Excludes:	BLEA12 and VESBA

***** INDEPENDENCE EXEMPT *****

GENERAL

Before any work is undertaken:

a) Possession of the affected axle counter evaluator (ACE) shall be taken.

b) Possession shall also be taken of any adjacent connected evaluators. This affects multiple track sections and any signalling functions carried over the evaluator transmission links.

c) The output of the evaluator shall not be reconnected to the signalling system and possession given up unless the equipment has passed all tests and is fit for use.

d) Electrostatic precautions shall be taken when handling boards. Electrostatic discharge points (ESD) are provided in the evaluator cabinet and nearby working surface to assist in this procedure.

e) Only one axle counter evaluator shall be worked on at any one time.

BEFORE INSTALLATION WORK

1. Check that possession of the affected ACE has been taken.

2. Check that the replacement card is not damaged and is correct type. Check that the replacement card status corresponds with the Baseline document.

3. Shut down the affected evaluator by switching off the RELEVANT power supply board for the affected evaluator.

AFTER INSTALLATION WORK

4. Check that the replacement card is correctly installed and secure.

5. Power up the evaluator by switching on the RELEVANT power supply board for the affected Evaluator.
6. Simultaneously press the red buttons (system reset) on each VAU boards for both computer channels for approximately 1 second. After pressing the red buttons (system reset), the LED "ANL" lights up on both VAU boards for approximately 3 seconds. After the LED "ANL" on the VAU boards has gone off, the LED "VGL" lights up.

7. Arrange with the Signaller to reset the affected sections.

8. Observe that the section(s) is/are successfully restored to normal operation.

9. Check, or arrange for the correct labelling of the unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX22		
Replace a Siemens AzS 350 U Axle Counter Card (BLEA12)		
Issue No: 04	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	BLEA12
Excludes:	VESBA, DIGDO, SIRUIS2, STEU and VAU

GENERAL

Before any work is undertaken:

a) Possession of the affected axle counter evaluator (ACE) shall be taken.

b) Possession shall also be taken of any adjacent connected evaluators. This affects multiple track sections and any signalling functions carried over the evaluator transmission links.

c) The output of the evaluator shall not be reconnected to the signalling system and possession given up unless the equipment has passed all tests and is fit for use.

d) Electrostatic precautions shall be taken when handling boards. Electrostatic discharge points (ESD) are provided in the evaluator cabinet and nearby working surface to assist in this procedure.

e) Only one axle counter evaluator shall be worked on at any one time only one BLEA12 shall be changed at any one time.

BEFORE INSTALLATION WORK

1. Check that the replacement BLEA12 card is not damaged and is correct type.

   Check that the replacement card status corresponds with the baseline document.

2. Shut down the affected evaluator by switching off the RELEVANT power supply board for the affected evaluator.

3. Check the configuration of the dip switches and jumper setting of the existing BLEA12 board to the diagrams.

AFTER CONFIGURATION OF THE BLEA12 BOARD

4. Check the configuration of the dip switches and jumper setting on the replacement BLEA12 board, to the diagrams.

AFTER INSTALLATION WORK

5. Check that the replacement card is correctly installed and secure.

6. Power up the evaluator by switching on the RELEVANT power supply board for the affected evaluator.

7. Simultaneously press the red buttons (system reset) on each VAU boards for both computer channels for approximately 1 second .After pressing the red buttons (system reset), the LED ‘ANL’ lights up on both VAU boards for approximately 3 seconds. After the LED ‘ANL’ on the VAU boards has gone off, the LED ‘VGL’ lights up.

8. Arrange with the Signaller to reset the affected section(s).

9. Observe that the section(s) is/are successfully restored to normal operation.

10. Check or arrange for the correct labelling of the unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX23		
Replace a Siemens AzSM(E) Axle Counter VENUS2 CPU Card		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	VENUS 2 CPU Card
Excludes:	IIC-OMC VENUS3, ZAN, VESUV3, VESIN, RASI V24KOP & BUREP16

General

Possession of the affected axle counter evaluator (ACE) shall be taken.

Disconnection of the output of the evaluator to the signalling system. This might affect up to 16 sections.

The output of the evaluator shall not be reconnected to the signalling system and possession given up unless the equipment has passed all tests and is fit for use.

For 1.5 seconds at the end of the update procedure the axle counter synchronizes the affected channel. At this point the axle counter is effectively blind. Therefore, no train movements shall be allowed in the affected area while the axle counter is updating the affected channel.

Electrostatic precautions shall be taken when handling boards. Electrostatic discharge points (ESD) are provided.

Only one axle counter evaluator shall be worked on at any one time.

CPU boards are uniquely identified to include the data version number.

Replacement boards shall be operating the same site-specific version of geographic data as the one they are replacing otherwise the evaluator shuts down.

The Equipment List advises you the status of the board hardware and software.

BEFORE INSTALLATION WORK

1. Check that the replacement CPU card is not damaged and is correct type. Check that the replacement card status corresponds with the “Baseline” document.

   Only use a VENUS2 that is installed with the correct program and configuration software for the evaluator being repaired

2. Shut down the affected computer channel by setting the reset switch of the relevant VENUS2 card and switching off the relevant power supply board for the affected computer channel.

AFTER INSTALLATION WORK

3. Check that the replacement CPU card is correctly installed and secure.

4. Perform the “update computer channel” procedure (S&D on line manual).

5. Check that the affected channel has updated and that the card operates correctly by observing the correct indications on the evaluator (S&D on line manual).

6. Check or arrange for the correct labelling of the unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX24		
Replace a Siemens AzSM (E) Axle Counter non CPU Card		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	VENUV 3, VESIN, RASI, BUREP16, & V24KOP
Excludes:	VENUS 2, ZAN

***** INDEPENDENCE EXEMPT *****

General

Possession of the affected axle counter evaluator (ACE) shall be taken.

Disconnection of the output of the evaluator to the signalling system. This might affect up to 16 sections.

The output of the evaluator shall not be reconnected to the signalling system and possession given up unless the equipment has passed all tests and is fit for use.

For 1.5 seconds at the end of the update procedure the axle counter synchronizes the affected channel. At this point the axle counter becomes effectively blind. Therefore, no train movements shall be allowed in the affected area while the axle counter is updating the affected channel.

Electrostatic precautions shall be taken when handling boards. Discharge points (ESD) are provided in the evaluator cabinet.

Only one axle counter evaluator shall be worked on at any one time.

BEFORE INSTALLATION WORK

1. Check that the replacement card is not damaged and is correct type. Check that the replacement card status corresponds with the “Baseline document”.

2. Shut down the affected evaluator by switching off the relevant power supply board for the affected computer channel.

AFTER INSTALLATION WORK

3. Check that the replacement card is correctly installed and secure.

4. Perform the ‘update computer channel’ procedure (S&D on line manual).

5. Check that the affected channel has updated and that the card operates correctly by observing the correct indications on the evaluator (S&D on line manual).

6. Observe that the section(s) is/are successfully restored to normal operation.

7. Check or arrange for the correct labelling of the unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX25		
Replace a Siemens AzSM (E) Axle Counter ZAN Card		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	ZAN.
Excludes:	VENUS 2, VESUV3, VESIN, RASI, V24KOP & BUREP16.

***** INDEPENDENCE EXEMPT *****

Before any work is undertaken.

- Possession of the relevant axle counter section (this may affect up to 4 sections).
- Disconnection of the output of the evaluator to the signalling system. This may affect up to 16 sections.
- The output of the evaluator shall not be reconnected to the signalling system and possession given up unless the equipment has passed all tests and is fit for use.
- The ZAN card has two input channels for the two independent ZP43 wheel detectors. Check that the removal of the affected ZAN card will not increase the current disruption to the railway operation.
- Appropriate electrostatic precautions shall be taken when handling boards.
- Only one axle counter evaluator shall be worked on at any one time.

BEFORE INSTALLATION WORK

1. Check that the replacement card is not damaged and is correct type. Check that the replacement card status corresponds with the Baseline document.
2. Remove the fuses from the affected ZAN card.

   The fuses of the replacement ZAN card shall be removed before the card is inserted in to the evaluator rack.

AFTER INSTALLATION WORK

3. Check that the replacement card is correctly installed and secure.
4. Replace the fuses into the replacement ZAN card.
5. Test the evaluator ZAN card levels NR/SMS/PartC/AX30 (Siemens AzSM (E) Axle Counter Evaluator.
6. Observe that the section(s) is/are successfully restored to normal operation.
7. Check or arrange for the correct labelling of the unit.

END

NR/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX26		
Replace a Siemens Axle Counter DEK 43 Wheel Detector or Trackside Connection Box		
Issue No. 03	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Trackside Connection Box, DEK 43 Wheel Detector
Excludes:	All other Junction Boxes, Individual Connection Box Cards

GENERAL

Before any work is undertaken;

- Take possession of the relevant axle counter section.
- The Trackside Connection Box shall be powered down by removal of the ZAN or VESBA card fuse or at the local point of supply.
- The output of the evaluator shall not be reconnected to the signalling system and possession given up unless the equipment has passed all tests and is fit for use.
- Electrostatic precautions shall be taken when handling boards. Electrostatic discharge points (ESD) are provided in the evaluator cabinet and nearby working surface to assist in this procedure.

The Signaller is responsible for resetting the axle counter.

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Check that the replacement wheel detector or trackside connection box is not damaged and is correct type.
3. Remove the fuse on the ZAN or VESBA card which supplies the Trackside Connection Box.
4. WIRE COUNT the existing wheel detector or trackside connection box to the wiring diagram.
5. Check the existing wiring has safe insulation.
6. Check the existing wiring and connectors are correctly labelled.

AFTER INSTALLATION WORK

7. Check that the replacement wheel detector or trackside connection box is correctly installed and secure.

8. Observe any restrictions that apply to the position of the axle counter equipment to other line side equipment or cabling.

9. Check that the adaptor plates are correct for the rail profile installed.

10. Check that the wiring and connectors are replaced as labelled and are secure.

11. Check the cable is clamped correctly.

12. WIRE COUNT the replacement unit to the wiring diagram.

13. Restore the power to the Wheel Detector Trackside Connection Box.

Where the wheel detector or trackside connection box is used with an AzSME evaluator

14. Test the replacement unit, see NR/SMS/PartC/AX30 (Siemens AzSM (E) Axle Counter Evaluator).

15. Test evaluator ZAN card levels, see NR/SMS/PartC/AX30 (Siemens AzSM (E) Axle Counter Evaluator).

16. Check that the ZAN card LED's illuminate correctly, when the head is influenced, see NR/SMS/PartC/AX30 (Siemens AzSM (E) Axle Counter Evaluator).

Where the wheel detector or trackside connection box is used with an AzS350U evaluator

17. Test the replacement unit:

    a) For ZP 43 V use NR/SMS/PartC/AX29 (Siemens AzS ZP 43 V Wheel Detector Equipment).

    b) For ZP 43 D use NR/SMS/PartC/AX28 (Siemens AzS ZP 43 D Wheel Detector Equipment).

18. Test evaluator VESBA card levels see NR/SMS/PartC/AX31 (Siemens AzS 350U Axle Counter Evaluator).

19. Check that the VESBA card LED's illuminate correctly, when the head is influenced NR/SMS/PartC/AX31 (Siemens AzS 350U Axle Counter Evaluator).

20. Check the security of the unit and any padlocks where fitted.

21. Observe that the section is successfully restored to normal operation.

22. Check that the unit is correctly labelled.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX27		
Replace a Siemens Axle Counter ZP 43 PCB Card		
Issue No: 04	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	All ZP 43 PCB cards
Excludes:	All other Siemens cards

GENERAL

Before any work is undertaken:

a) Possession of the affected axle counter section shall be taken (this affects more than one section).

b) The output of the evaluator shall not be reconnected to the signalling system and possession given up unless the equipment has passed all tests and is fit for use.

c) Electrostatic precautions shall be taken when handling boards. Electrostatic discharge points (ESD) are provided in the evaluator cabinet and nearby working surface to assist in this procedure.

d) Only one axle counter evaluator shall be worked on at any one time.

e) The Signaller is responsible for resetting the axle counter.

BEFORE INSTALLATION WORK

1. Check that the replacement card is not damaged and is correct type.

2. Check that the replacement card status corresponds with the baseline document.

3. Remove the fuse on the ZAN or VESBA card which supplies the Trackside Connection Box.

AFTER INSTALLATION WORK

4. Check that the replacement card is correctly installed and secure.

5. For ZP 43 D check that switch S1 is set to FR.

6. Replace the fuse on the ZAN or VESBA card which supplies the Trackside Connection Box.

7. Test the replacement unit:

   a) For ZP 43 V use NR/SMS/PartC/AX29 (Siemens AzS ZP 43 V Wheel Detector Equipment).

   b) For ZP 43 D use NR/SMS/PartC/AX28 (Siemens AzS ZP 43 D Wheel Detector Equipment).

Where the wheel detector or trackside connection box is used with an AzSME evaluator:

8. Test the evaluator ZAN card levels NR/SMS/PartC/AX30 (Siemens AzSM (E) Axle Counter Evaluator).

9. Check that the ZAN card LED's illuminate correctly, when the wheel detector is influenced.

Where the wheel detector or trackside connection box is used with an AzS350U evaluator

10. Test evaluator VESBA card levels NR/SMS/PartC/AX31 (Siemens AzS 350U Axle Counter Evaluator).

11. Check that the VESBA card LED's illuminate correctly, when the head is influenced.

12. Observe that the section(s) is/are successfully restored to normal operation.

13. Check that the unit is correctly labelled.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/AX28		
Replace a Siemens WSD Wheel Detector (ACM 100 Axle Counter)		
Issue No. 03	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Siemens WSD Wheel Detector only
Excludes:	ZP D 43 and ZP 43 V Wheel Detection Equipment - Trackside Connection Box, DEK 43 Wheel Detector and all other Junction Boxes or Individual Connection Box Cards

Before any work is undertaken the following shall be undertaken:

a) Possession taken of the relevant axle counter section.

b) Disconnection of the output of the ACM module (evaluator) to the signalling system where applicable.

c) The WSD wheel detector shall be powered down by removal of the appropriate links.

The output of the ACM shall not be reconnected to the signalling system and possession given up unless the equipment has passed all tests and is fit for use.

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.

The signaller is responsible for resetting the axle counter.

BEFORE INSTALLATION WORK

1. Observe any restrictions that apply to the position of the axle counter equipment to other line side equipment or cabling.

2. Check that the adapter plate (C25326-A39-C2 for BS 113A and Bull-Head Rail and C25326-A39-C17 for UIC 54 and UIC 60) is correct for the rail profile installed.

3. Check that the wheel detector is correctly isolated from the ACM by disconnection at the appropriate links.

4. Check that the replacement wheel detector is not damaged and is the correct type.

5. Wire count the existing wheel detector to the wiring diagram.

6. Check the existing wiring has safe insulation.

7. Check the existing wiring and connectors are correctly labelled.

EXCHANGE OF WSD

8. Disconnect the wheel detector cabling in the corresponding disconnection box.
9. Remove the cable securing clips from the WSD cable
10. Remove the wheel detector from the rail web bracket
11. Installation is reversal of the removal using a torque of (45 Nm) to fix the wheel detector to the bracket.
12. Refer to cabling wiring diagrams when reconnecting the wheel detector wires.

AFTER INSTALLATION WORK

13. Check that the replacement wheel detector is correctly installed and secured [Mechanical checks in (NR/SMS/Part/C/AX51)].
14. Check that the wiring and connectors are replaced as labelled and are secure.
15. Check the cable is clamped correctly.
16. Wire count the replacement unit to the wiring diagram.
17. Reconnect the appropriate links to the wheel detector.
18. Calibrate and test the replacement unit [NR/SMS/Part/B/Test038].
19. Observe that the section is successfully restored to normal operation.
20. Check that the unit is correctly labelled.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/AX29		
Replace a Siemens Axle Counter ACM 100 Module		
Issue No. 02	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Siemens ACM 100 Axle Counter ACM Module

Before any work is undertaken the following shall be undertaken:

a) Possession of the relevant ACM module. Possession shall also be taken of any adjacent connected ACMs. This will affect multiple track sections and any signalling functions carried over the ACM transmission links.

b) Disconnection of the output of the evaluator to the signalling system where ISOL links are not locally available.

The output of the evaluator shall not be reconnected to the signalling system and possession given up unless the equipment has passed all tests and is fit for use.

Only one ACM can be replaced at any one time, in order to prevent inadvertent exchange of ID plugs.

Precaution shall be taken when the handling ID Plug. Do not touch the connecting pins.

Spares shall be kept in the original packaging

The signaller is responsible for resetting the axle counter.

BEFORE INSTALLTION WORK

1. Check that the replacement ACM Module is Not Damaged and is the Correct Type.
2. Check that the ID Plug corresponds with the signalling records.
3. Check that the ACM Module is Correctly Isolated from the power supply.

AFTER INSTALLTION WORK

4. Check that the replacement ACM Module is Correctly Installed and secure.
5. Remove the ID Plug from the faulty ACM Module and insert into replacement ACM.
6. Check that the ID Plug is Correctly Installed and secure.
7. Re-connect power to the ACM Module.
8. After 15 seconds the ACM will enter its configuration acceptance mode, indicated by a flashing green “OK” LED with all other LEDs not lit. If you are sure that the original ID Plug is correctly inserted in the replacement ACM, press and hold the front panel buttons labelled RST_RR1 and RST_RR2 simultaneously (mimimum 3 seconds). This will enable the new ACM and it will then enter its normal operation mode, indicated by a solid green “OK” LED.

9. Arrange with the signaller to reset the affected sections.

10. Observe that the section(s) is/are successfully restored to normal operation.

11. Check that the unit is correctly labelled.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/AX30		
Replace a Siemens Axle Counter System Sub-Components		
Issue No. 02	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Sub -Component parts associated with the Siemens ACM100 Axle Counter system.
Excludes:	All other Axle Counter types and Sub-Components.

Before any work is the following shall be undertaken:

a) Possession of the relevant ACM modules. Possession shall also be taken of any adjacent connected ACMs. This will affect multiple track sections and any signalling functions carried over the ACM transmission links.

b) Disconnection of the output of the evaluator to the signalling system where ISOL links are not locally available.

The output of the evaluator shall not be reconnected to the signalling system and possession given up unless the equipment has passed all required tests and is fit for use.

Precaution shall be taken when the handling ID Plug. Do not touch the connecting pins.

Spares shall be kept in the original packaging

The signaller is responsible for resetting the axle counter.

BEFORE INSTALLATION WORK

1. Check the replacement unit is not damaged and is of the correct type.
2. Isolate the specific power supply for the component being replace.
3. Check the existing connection wiring and connectors are correctly labelled.

Battery Module

4. Battery Modules are supplied fully charged but will self-discharge over time.
5. Remove the replacement Battery Module fuse.
6. Disconnect the power supply wiring to the battery module.
7. Remove and replace the battery module from the DIN rail.
8. Reconnect the power supply.
9. Check that the replacement Battery Module is correctly Installed, secured and labelled.
10. Refit the Battery Module fuse.
11. Switch on the Power Supply Unit.

12. Check that the Uninterruptible Power Supply Module front “BAT >85%” lamp is steady on.

Ethernet Switch

13. Allow the replacement battery to charge and check that the Uninterruptible Power Supply Module front “BAT >85%” lamp is steady on. (**Note**: Recharge may take >12 hrs, hence confirm within 7days)

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14. Disconnect power and communications cables from the unit.

15. Remove and replace the module from the DIN rail.

16. Reconnect the power and communications cables to the unit.

17. Check that the replacement Ethernet Switch Module is Correctly Installed, secured and labelled.

18. Check that the Ethernet Switch Module is correctly labelled.

19. Reconnect the Power Supply Unit.

ID Plug

Only one ID plug should be replaced at any one time in order to prevent inadvertent exchange of ID plugs.

20. Check that the New ID Plug corresponds with the signalling records.

21. Check that the Module requiring the replacement ID plug is correctly isolated from the power supply.

22. Remove the ID Plug from the unit.

23. Fit the new ID Plug.

24. Check that the replacement ID Plug is correctly installed, secured and labelled.

25. Reconnect the Power Supply Unit.

26. After 15 seconds the ACM will enter its configuration acceptance mode, indicated by a flashing green “OK” LED with no other LEDs lit. If you are sure that the replacement ID Plug is correctly inserted in the ACM, press and hold the front panel buttons labelled RST_RR1 and RST_RR2 simultaneously (minimum 3 seconds). This will enable the ACM and it will then enter its normal operation mode, indicated by a solid green “OK” LED.

Power Supply Unit

27. Isolate the Power Supply Unit from the incoming AC supply.
28. Remove battery module fuse.
29. Remove wiring to the Power Supply Unit.
30. Remove and replace the Power Supply Unit from the DIN rail.
31. Check that the replacement Power Supply Unit is correctly installed and secure.
32. Check that the Power Supply Unit is correctly labelled.
33. Reconnect the AC supply to the Power Supply Unit.
34. Replace the Battery Module Fuse.
35. Switch on the Power Supply Unit front switch.
36. Check that the “DC 24V” lamp is steady on.

Surge Filter

37. Disconnect the wiring from the Surge Filter.
38. Remove and replace the Surge Filter from the DIN rail.
39. Reconnect the wiring to the Surge Filter.
40. Check that the replacement Surge Filter is correctly installed, secured and labelled.
41. Reconnect the Power Supply Unit.

Uninterruptable Power Supply

42. Check that the replacement Uninterruptible Power Supply Module front DIP switches positions, corresponds with the table below. (L = Left, R = Right).

43. Remove Battery Module fuse.

1	R
2	R
3	L
4	R
5	L
6	R
7	R
8	R
9	L
10	R
1	R
2	R
3	R
4	R
5	R
6	R
7	R
8	R
9	L

44. Disconnect the wiring from the UPS module.

45. Remove and replace the UPS module from the DIN rail.

46. Check that the replacement Uninterruptible Power Supply Module is correctly installed, secured and labelled.

47. Refit the Battery Module fuse.

48. Reconnect the Power Supply Unit.

49. Check that the Uninterruptible Power Supply Module front “OK” lamp is steady on.

AFTER INSTALLATION WORK

50. Arrange with the signaller to reset the affected sections.

51. Observe that the section(s) is/are successfully restored to normal operation.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX31		
Replace a Siemens WSD Wheel Detector secured with Rail Clamp (ACM 100 Axle Counter)		
Issue No: 04	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Siemens WSD Wheel Detector secured with Rail Clamp only
Excludes:	Siemens WSD Wheel Detector when bolted to rail web

GENERAL

Before any work is undertaken the following shall be undertaken:

a) Possession taken of the relevant axle counter section.

b) Disconnection of the output of the ACM module (evaluator) to the signalling system where applicable.

c) The WSD wheel detector shall be powered down by removal of the associated links.

The output of the ACM shall not be reconnected to the signalling system and possession given up unless the equipment has passed all tests and is fit for use.

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 might cause occupation of the track sections.

The wheel detector is very sensitive.

The Signaller is responsible for resetting the axle counter section.

Mechanical checks can be found in NR/SMS/PartC/AX51 (Siemens Axle Counter ACM 100 (ACM Module and WSD Wheel Detector).

Further information on the Siemens Axel Counter can be found in NR/SMS/Appendix/01 (General Information on the Siemens Axle Counter System).

BEFORE INSTALLATION WORK

1. Observe any restrictions that apply to the positioning of the axle counter equipment in relation to other line side equipment or cabling.

2. Check the wheel detector is correctly isolated from the ACM by disconnection at the associated links.

3. Check the replacement wheel detector is not damaged and is the correct type.

4. Carry out a WIRE COUNT on the existing wheel detector to the wiring diagram.

5. Check the existing wiring has safe insulation.

6. Check the existing wiring and connectors are correctly labelled.

AFTER INSTALLATION WORK

7. Check that the replacement wheel detector is correctly installed and secured.

8. Check that the wiring and connectors are replaced as labelled and are secure.

9. Check the cable is clamped correctly.

10. Carry out a WIRE COUNT on the replacement unit to the wiring diagram.

11. Reconnect the links to the wheel detector.

12. Calibrate and test the replacement unit NR/SMS/PartB/Test/038 (Siemens ACM 100 - Calibration of Wheel Detector).

13. Observe that the section is successfully restored to normal operation.

14. Check that the unit is correctly labelled.

END

NR/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX40		
Replace a Frauscher Wheel Sensor RSR123		
Issue No: 09	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Frauscher wheel sensor RSR123 (or F500 Wheel Sensor for SATWS and ATWS)
Excludes:	All other wheel sensor systems

GENERAL

If the wheel sensor is associated with an EBI Gate 200 Level Crossing System, disconnect the power supply before undertaking installation work.

The possession of the axle counter section shall not be given up unless the equipment has passed all the tests and is fit for use.

Protection/Possession arrangement shall be taken before commencing work on any track sections.

Liaise with Signaller before carrying out this test.

For EBI Gate 200 Level Crossing System the Technician is responsible for resetting the axle counter, on all other systems it is the Signaller's responsibility.

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Mark the web of the rail to indicate the location of the sensor to assist with locating the replacement unit.

3. Check that the replacement wheel sensor is of the correct type and is not damaged.

AFTER INSTALLATION WORK

4. Check that the new sensor is mounted at the same location using the marked rail web as a reference point.

5. Check the rail head sensor securing nuts are tightened to torque values shown in NR/SMS/PartC/AX41 (Frauscher RSR123 Wheel Sensors) - Periodic Task 2.

6. Measure the distance between the next rail joint or the next rail weld.
The distance shall be at least 60 cm.

7. Carry out NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) – Periodic Task 3.

Final Checks (excluding EBI Gate 200 & Vamos Level Crossing Systems)

8. Carry out NR/SMS/PartB/Test/040 (Frauscher: RSR123 Wheel sensor adjustment – associated with AEB Boards) - Section 1.

9. Check the rail sensor current/voltages as described in NR/SMS/PartC/AX41 (Frauscher RSR123 Wheel Sensors) - Service B.

10. Carry out NR/SMS/PartB/Test/037 (Frauscher: RSR123 Wheel Sensor Occupancy Detection Capability Test). ✱

Final Checks - EBI Gate 200 Level Crossing System

11. Adjust both wheel sensor systems and detection capability as described in NR/SMS/PartB/Test/082 (Frauscher : RSR123 Wheel sensor adjustment for systems fitted with IMC & ACB Boards) - Sections 1 to 5.

Final Checks - Vamos Level Crossing System

12. Adjust both wheel sensor systems and detection capability as described in NR/SMS/PartB/Test/157 (Frauscher : RSR123 Wheel sensor adjustment – associated with IMC Boards) - Sections 1 to 3.

Final Checks – SATWS and ATWS Trackworker Safety System

13. Following the installation of the train detector, use a connected SATWS or ATWS control unit and warning device to carry out a functional test to confirm that the system operates correctly.

    The functional test involves waiting for a train to pass over the sensor or (where possible), using the dummy wheel to simulate a train.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX41		
Replace an Advanced Evaluation Board AEB		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Advanced Evaluation Board AEB
Excludes:	All other types of boards

GENERAL

Protection/Possession arrangement shall be taken before commencing work on any track sections.

Liaise with Signaller before carrying out this test.

Boards can be plugged and unplugged with voltage applied

When replacing boards, it is recommended that you remove only one board at a time from the system, as this will prevent one board being mistaken for another.

IMPORTANT: If an AEB is replaced because of an unknown failure, also replace the respective BSI.

The Signaller is responsible for resetting the axle counter.

BEFORE INSTALLATION WORK

1. Check that the replacement AEB is of the correct type and not damaged.

2. Check the following details for each new AEB-board in accordance with design and configuration documents (copies of which are contained in the site prints) or by means of the ASD or FDS:

    a) Board ID.

    b) DIP-switch settings.

AFTER INSTALLATION WORK

3. Carry out a Sensor Head adjustment as described in NR/SMS/PartB/Test/040 (Frauscher: RSR123 Wheel sensor adjustment – associated with AEB Boards).

4. Check the sensor system currents by means of the ASD/FDS or at the test sockets of the AEB, as described in NR/SMS/PartC/AX41 (Frauscher : RSR123 Wheel Sensors).

5. Check the occupancy detection capability as described in NR/SMS/PartB/Test/040 (Frauscher: RSR123 Wheel sensor adjustment – associated with AEB Boards).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX42		
Replace a COM-AdC and/or COM-WNC Board		
Issue No: 03	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Frauscher COM-AdC and/or COM-WNC Boards
Excludes:	All other types of board

GENERAL

Appropriate Protection / Possession arrangement shall be taken before commencing work on any track sections

Liaise with Signaller before carrying out this test.

Boards can be plugged and unplugged with voltage applied.

When replacing boards, it is recommended that you remove only one board at any time from the system, as prevents one board being mistaken for another.

The Signaller is responsible for resetting the axle counter.

BEFORE INSTALLATION WORK

1. Check that the replaced COM-AdC and/or COM-WNC is of the correct type and not damaged.

DURING WORK

2. Remove the CF (Compact Flash) card of the defective COM-AdC or COM-WNC and transfer it to the new COM-AdC or COM-WNC. Refer to NR/SMTH/Part04/AX43 (Replace a (Compact Flash) CF Card).

NOTE: *The 'on board' CF card on the replacement COM AdC or COM WNC card is blank, therefore it is essential that the existing CF Card is transferred to the new COM AdC or COM WNC as this holds the site-specific safety critical data configuration.*

3. Check the following details for each new COM-board in accordance with design and configuration documents (copies of which are contained in the site prints) or by means of the ASD or FDS.

   - Board ID.
   - DIP-switch settings.

AFTER INSTALLATION WORK

4. Check the occupancy detection capability as described in NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter: Occupancy Detection Capability).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX43		
Replace a (Compact Flash) CF Card		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Frauscher CF(Compact Flash) mounted on a COM-AdC and/or COM-WNC card
Excludes:	All other types of CF (Compact Flash)

Appropriate Protection / Possession arrangement shall be taken before commencing work on any track sections.
Liaise the Signaller before carrying out this test.

When changing CF cards, it is recommended, that no additional CF cards are in the vicinity, so as to avoid one card being mistaken for another.

Boards can be plugged and unplugged with voltage applied.

When replacing boards, it is recommended to check that you remove only one board at a time from the system, as prevents one board being mistaken for another.

BEFORE INSTALLATION WORK

1. Check that the CF card contains the correct configuration according to the design and configuration documents.

Configuration files stored on a PC can only be used if a full verification has to be done in the same way as commissioning. If there are no configuration files available then they should be regenerated according to the specifications of the design and configuration documents, then saved on to the CF card which shall be verified again.

2. Switch off the power supply to all boards on the CAN segment.

It is possible that more than one board rack is connected to the CAN segment.

DURING WORK

3. Remove the CF card and transfer it to the new COM Card or replace the CF card with a new card. Only one CF card should be changed at a time to make sure cards the correct card in reinstalled.

AFTER INSTALLATION WORK

4. Switch on the power supply to all boards on the CAN segment and Check all boards have powered up.

5. Check the system is functioning as described in section 4 of NR/SMTH/Part04/AX42 (Replace a COM-AdC and/or COM-WNC Board).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part-04/AX44		
Replace an Overvoltage Protection Unit BSI005		
Issue No. 04	Issue Date: 04/03/17	Compliance Date: 31/05/17

Includes:	Overvoltage Protection Unit BSI005 Standard and Plug Coupled version
Excludes:	All other types of Overvoltage Protection Unit

Protection / Possession arrangement shall be taken before commencing work on any track sections
Liaise with signaller before carrying out this test.

If the overvoltage protection unit is associated with an EBI Gate 200 Level Crossing System, disconnect the power supply before undertaking installation work.

Care should be taken when removing the clamps of the BSI005 as they can be subject to transient over voltages.

If an AEB/IMC is replaced in cause of an unknown failure the respective BSI005 shall be replaced also (see NR/SMTH/AX41, NR/SMTH/AX50).

IDENTIFICATION

Standard Unit

Plug Coupled Version

BEFORE INSTALLATION WORK

Both types

1. Check that the replacement overvoltage protection unit is of the Correct Type and Not Damaged.

Standard Unit

2. Check existing wires are securely tightened in their terminal blocks
3. Check existing wiring has Safe Insulation.
4. Check existing wiring is Correctly Labelled.
5. Check existing unit is Isolated from the supply.


The green and yellow terminal blocks are disconnected by pulling them gently towards you

Plug Coupled Version

6. Check the plug coupler for damage

AFTER INSTALLATION WORK

Standard Unit

7. Check replacement unit is Correctly Installed (Unit is level).
8. Check the termination blocks have been fully pressed home. They should be flush with the front plate.
9. Check there no metallic debris in the vicinity of the terminals.
10. Check wiring is replaced as labelled.

Plug Coupled Version

11. Check Plug coupler is secure and fully pressed home

Final Checks Standard Unit and Plug Coupled (excluding EBI Gate 200 and Vamos System)

12. Check the sensor system currents on the test sockets of the AEB as described in NR/SMS/AX41.
13. Check the axle detection capability of the respective wheel sensor as described in NR/SMS/AX40

Final Checks Standard Unit - EBI Gate 200 Level Crossing System (Only)

14. Power up the EBI Gate system NR/SMS/Test082 Section 4 & 5.

Final Checks Standard Unit – Vamos Level Crossing System (Only)

15. Power up the VAMOS system NR/SMS/Test157 Section 2.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX45		
Replace a Power Supply Board (Crowbar)		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Power Supply Board (Crowbar)
Excludes:	All other types of boards

GENERAL

Liaise with Signaller before carrying out this test.

Electrostatic precautions shall be taken when handling the evaluation board and/or the board rack.

The removal of this card will power down the entire CAN Bus.

The Signaller is responsible for resetting the axle counter.

Boards can be plugged and unplugged with voltage applied.

BEFORE INSTALLATION WORK

1. Check that the replaced power supply board is of the correct type and not damaged.

AFTER INSTALLATION WORK

2. Check the green PWR LED on the front panel of the Power Supply Board is illuminated when the board is securely in position.

3. Check that the other boards mounted in the rack power up.

4. Carry out a reset on the AEB is described in NR/SMS/PartB/Test/040 (Frauscher: RSR123 Wheel sensor adjustment – associated with AEB Boards).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX46		
Replace an Input/Output Extension Board IO-EXB		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Input/Output Extension Board IO-EXB
Excludes:	All other types of boards

GENERAL

Protection/Possession arrangement shall be taken before commencing work on any track sections.

Liaise with Signaller before carrying out this test.

Electrostatic precautions shall be taken when handling the evaluation board and/or the board rack.

The Signaller is responsible for resetting the axle counter.

Boards can be plugged and unplugged with voltage applied.

BEFORE INSTALLATION WORK

1. Check that the replaced IO EXB board is of the correct type and not damaged.

2. Check the following details for each new IO EXB -board in accordance with design and configuration documents (copies of which are contained in the site prints) or by means of the ASD or FDS:

    - Board ID

AFTER INSTALLATION WORK

3. When the IO-EXB board is replaced it displays the following message in the alpha-numeric display: ER1 then 111 followed by ER2 111. This indicates the IO-EXB and AEB are out of synchronisation.

<u>To synchronise the system</u>

4. Synchronise the system by using the buttons located on the front panel of the IO EXB board (See Figure 1).

<u>Track section A</u>

a) Contact the Signaller and confirm that no trains are in the section.

b) Push both buttons to the left (in direction of “Section A”) within 500 ms.

c) Retain both buttons in this position for at least 500 ms.

d) Release both buttons within 500 ms.

Track section B (If Configured)

a) Contact the Signaller and confirm that no trains are in the section.

b) Push both buttons to the right (in direction of “Section B”) within 500 ms.

c) Remain both buttons in this position for at least 500 ms.

d) Release both buttons within 500 ms.

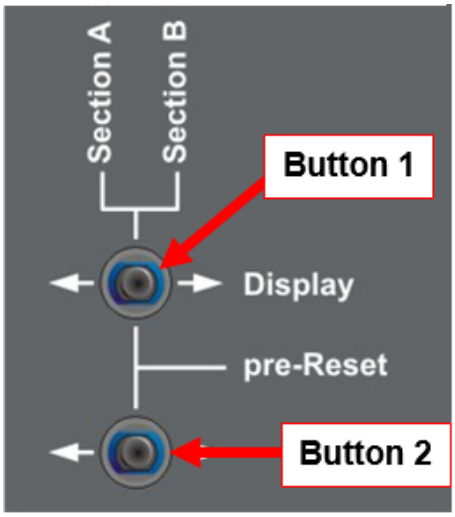


Figure 1 – Buttons on the IO-EXB Board

5. Remove and refit the AEB associated with the IO-EXE board that has been replaced.

6. Check that the clear/occupied status for the respective track section(s) is/are indicated correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX50		
Replace a Frauscher IMC Board		
Issue No: 04	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Frauscher : IMC Boards
Excludes:	All other types of boards

Protection / Possession arrangement shall be taken before commencing work on any track sections Liaise with Signaller before carrying out this test.

The Technician is responsible for resetting the axle counter if this board is associated with one.

If an IMC board is replaced because of an unknown failure the respective over voltage protection unit (BSI) shall also be replaced.

When replacing boards, it is recommended that only one board is removed from the system at any one time. This prevents one board being mistaken for another.

BEFORE INSTALLATION WORK

1. Check that the replacement IMC is of the correct type and not damaged.

2. Power down the system

AFTER INSTALLATION WORK

3. Carry out a Sensor Head adjustment as described in NR/SMS/PartB/Test/082 (Frauscher : RSR123 Wheel sensor adjustment for systems fitted with IMC & ACB Boards) or NR/SMS/PartB/Test/157 (Frauscher : RSR123 Wheel sensor adjustment for systems fitted with IMC Boards) - Section 1.

4. After the IMC board is replaced and the EBI Gate 200 is powered up, the ACB displays the following message in the alpha-numeric display -109, -209 alternating.

5. When used as part of an EBIGate200 system reset the relevant block section NR/SMS/PartB/Test/082 (Frauscher : RSR123 Wheel sensor adjustment for systems fitted with IMC & ACB Boards) – Section 3.

6. Check the wheel sensor detection capability as described in NR/SMS/PartB/Test/082 (Frauscher : RSR123 Wheel sensor adjustment for systems fitted with IMC & ACB Boards) Section 4 & 5 or NR/SMS/PartB/Test/157 (Frauscher : RSR 123 Wheel Sensor Adjustment - associated with IMC Boards) Section 3.

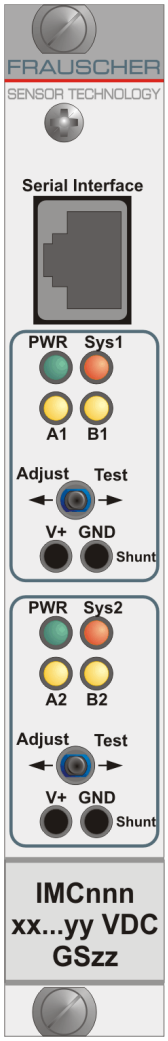


Figure 1 – IMC Board

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX51		
Replace a Frauscher ASC2000 Axle Counter Board ACB		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Frauscher ACS2000 : ACB Boards associated with the EBI Gate 200 Level Crossing System
Excludes:	All other types of boards

Appropriate Protection / Possession arrangement shall be taken before commencing work on any track sections

Liaise with Signaller before carrying out this test.

Appropriate electrostatic precautions shall be taken when handling the board and/or the board rack.

The Technician is responsible for resetting the axle counter.

BEFORE INSTALLATION WORK

1. Check that the replaced ACB board is of the correct type and not damaged.
2. Power down the EBI Gate 200 System.

AFTER INSTALLATION WORK

3. After the ACB board is replaced and the EBI Gate 200 is powered up, the ACB displays the following message in the alpha-numeric display -109, -209 alternating.
4. Confirm the Block Section is clear and operate the “Reset” switch.
5. Check that the clear/occupied status for the respective block section is indicated correctly.
6. Simulate a train passing through the block section as described in NR/SMS/PartB/Test/082 (Frauscher : RSR123 Wheel sensor adjustment for systems fitted with IMC & ACB Boards) - Section 3.

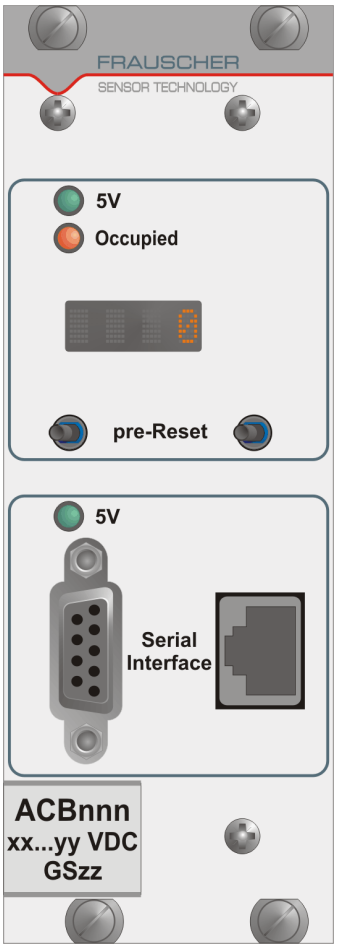


Figure 1 – ACB Board

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX52		
Replace a Frauscher ACS2000 : SIC Fuse Board		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Frauscher ACS2000 : SIC Fuse Board associated with the EBI Gate 200 Level Crossing System
Excludes:	All other types of boards

Appropriate Protection / Possession arrangement shall be taken before commencing work on any track sections.

Liaise with Signaller before carrying out this test.

When replacing boards, it is recommended to check that at any time; only one board is removed from the system, as this prevents one board being mistaken for another.

The Technician is responsible for resetting the axle counter.

BEFORE INSTALLATION WORK

1. Check that the replacement SIC fuse board is of the correct type and not damaged.

2. Power down the EBI Gate 200 System.

AFTER INSTALLATION WORK

3. Power up the EBI Gate 200 System.

4. After the SIC fuse board is replaced and the EBI Gate 200 is powered up, the ACB displays the following message in the alpha-numeric display -109, -209 alternating.

5. Reset the relevant block section NR/SMS/PartB/Test/082 (Frauscher : RSR123 Wheel sensor adjustment for systems fitted with IMC & ACB Boards) - Section 3.

6. Check the wheel sensor detection capability as described in NR/SMS/PartB/Test/082 (Frauscher : RSR123 Wheel sensor adjustment for systems fitted with IMC & ACB Boards) - Section 4.

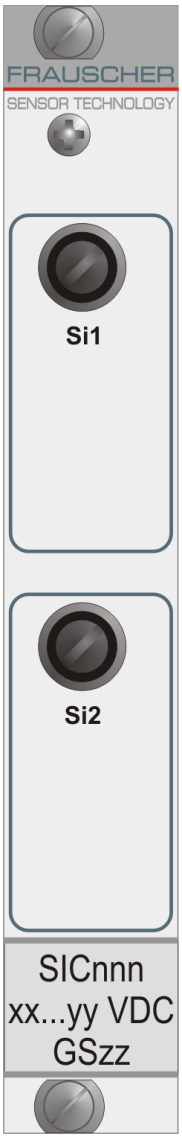


Figure 1 – SIC Board

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX53		
Remove and Refit Frauscher Wheel Sensor RSR123		
Issue No: 02	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Remove and refit the same Frauscher RSR-123 Wheel Sensor (or F500 Wheel Sensor for SATWS or ATWS) and associated Rail Claw for Track Engineering work
Excludes:	Replacement of Frauscher RSR-123 Rail Sensor (see SMTH/Part04/AX40). Any other type of Axle Counter Wheel Sensor

GENERAL

If the wheel sensor is associated with an EBI Gate 200 Level Crossing System, disconnect the power supply before undertaking work.

The possession of the axle counter section shall not be given up unless the equipment has passed all the tests and is fit for use.

Protection/Possession arrangement shall be taken before commencing work on any track sections.

Liaise with Signaller before carrying out this test.

For EBI Gate 200 Level Crossing System the Technician is responsible for resetting the axle counter, on all other systems it is the Signaller's responsibility.

BEFORE INSTALLATION WORK

1. Check the physical siting of the of the Rail Sensor by referring to the Detection Point siting form. If a siting form is not available, the rail sensor position shall be accurately measured from a datum point, which is not going to change during the work, and recorded. The record shall also include which rail the sensor is fitted to.

2. On removal of the Rail Claw, the condition of the washer shall be assessed. If there is any evidence of damage or deterioration, then the washer shall be renewed as part of the work

AFTER INSTALLATION WORK

3. Check that the Rail Sensor is correctly mounted at the same location in relation to the Detection Point siting form or datum point recorded in Step 1.

4. Carry out NR/SMS/PartC/AX41 (Frauscher : RSR123 Wheel Sensors) - Periodic Task 2 – Head Sensor Security.

5. Check there is a minimum 600mm between the Rail Sensor and any rail joint or rail weld.

6. Carry out NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) – Periodic Task 3 – Rail Sensor Height Check.

Final Checks (excluding EBI Gate 200 & Vamos Level Crossing Systems)

7. Carry out NR/SMS/PartB/Test/040 (RSR123 Wheel Sensor Adjustment – associated with AEB Boards) – Steps 1.1 to 1.8 only.

8. Carry out NR/SMS/PartC/AX41 (Frauscher : RSR123 Wheel Sensors) - Service B – Wheel Sensor Calibration Checks.

9. Carry out NR/SMS/PartB/Test037 (Frauscher: RSR123 Wheel Sensor Occupancy Detection Capability Test).

Final Checks - EBI Gate 200 Level Crossing System

10. Adjust both wheel sensor systems and detection capability as described in NR/SMS/PartB/Test/082 (Frauscher : RSR123 Wheel Sensor Adjustment – associated with IMC & ACB Boards) - Sections 1 to 5.

Final Checks - Vamos Level Crossing System

11. Adjust both wheel sensor systems and detection capability as described in NR/SMS/PartB/Test/157 (Frauscher : RSR123 Wheel Sensor Adjustment – associated with IMC Boards) - Sections 1 to 3.

Final Checks – SATWS and ATWS Trackworker Safety System

12. Following the installation of the train detector, use a connected SATWS or ATWS control unit and warning device to carry out a functional test to confirm that the system operates correctly.

    The functional test involves waiting for a train to pass over the sensor or (where possible), using the dummy wheel to simulate a train.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX60		
Replace a Converter ISDN Ethernet (CIE) (AzLM)		
Issue No: 02	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Converter ISDN Ethernet (CIE) (AzLM)
Excludes:	All other types of Converter

GENERAL

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection as required.

Electrostatic precautions shall be taken when working inside the unit.

The Signaller is responsible for restoring the axle counter section.

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. Check that the affected section is correctly isolated form the interlocking.
2. Check that the replacement is of the correct type or equivalent and is undamaged. (see Appendix A – Equivalent Types).
3. Check that the wiring of is correct to diagram and correctly labelled.
4. Check that the program plug is correctly labelled and is for the correct CIE.
5. Power down the CIE.

AFTER INSTALLATION WORK

6. Check the replacement unit is correctly installed, correct type and secure.
7. Check that all Wago plugs and wires are secured and terminated correctly (Line 1 & Line 2 are keyed).
8. Check that the programming plug is secure and corresponds with the CIE functions and is the correct one for the CIE.
9. Power up the CIE.
10. Check that the LED indications on the CIE are working correct.
11. Check both network A and B channels are working.
12. With the Signaller’s permission, reconnect the equipment to the interlocking.

13. Request the section is reset, observe that the section(s) are successfully restored to normal operation.

APPENDIX A - Equivalent Types

Type	Equipment Name	Equivalent Type
3JA 13539 AAAA	Converter ISDN Ethernet (CIE)	3JA 13539 ABAA

Do not replace a 3JA 13539 ABAA with a 3JA 13539 AAAA.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX61		
Replace a Converter ISDN Ethernet (CIE) DC - DC Power Supply (AzLM)		
Issue No: 02	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Converter ISDN Ethernet (CIE) DC - DC Power Supply
Excludes:	All other types of types of Converter Power Supply

GENERAL

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection as required.

Electrostatic precautions shall be taken when working inside the unit.

The Signaller is responsible for restoring the axle counter section

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. Check that the affected section is correctly isolated from the interlocking.
2. Check that the replacement is of the correct type and is undamaged.
3. Check that the wiring of is correct to diagram and correctly labelled.
4. Power down the CIE DC - DC Power Supply.

AFTER INSTALLATION WORK

5. Check the replacement unit is correctly installed, correct type and secure.
6. Check that all Wago plugs and wires are secured and terminated correctly.
7. Power up the CIE DC - DC Power Supply.
8. Check that the LED indications on the CIE DC - DC Power Supply are working correct.
9. With the Signaller’s permission, reconnect the equipment to the Interlocking
10. Request the section is reset, observe that the section(s) are successfully restored to normal operation.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX62		
Replace a Single Channel Controller (SCC) CPU Card (AzLM) in a 2oo2 System		
Issue No: 03	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Single Channel Controller (SCC) CPU Card (AzLM) 2oo2 ACE
Excludes:	All other types of CPU Card, Single Channel Controller (SCC) CPU Card (AzLM) 2oo3 ACE

GENERAL

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection as required.

Electrostatic precautions shall be taken when handling boards. Where provided electrostatic discharge points (ESD) shall be used.

The evaluator shall be powered down for this task by disconnection of its power supply.

The Program plug is uniquely identified to include the data version number.

The Program plug will have the unique ACE name and version number of the software.

The Installed Software Status Record (ISSR) will tell you the status of the installed site specific software.

The connection of a laptop with the diagnostic software will also identify the installed site specific software.

The Signaller is responsible for restoring the axle counter section.

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. Check that the affected CPU(s) is correctly isolated from the power supply.
2. Check that the replacement CPU(s) board is of the correct type and is not damaged.
3. Check for correct compatibility of CPUs and program plugs.
4. Check that the original / replacement Program plug status corresponds with the Installed Software Status Record (ISSR).

AFTER INSTALLATION WORK

5. Check the replacement CPU card(s) is correctly Installed and secure.

6. Restore the power to the affected CPU(s).

7. After approximately 3 minutes check via diagnostics that the CPU's are functional.

8. Check that the software version of the replacement CPU card(s) corresponds with that of the original by use of a laptop with the diagnostic software.

9. Check that the sections under the ACE's control are available for reset (if applicable). The diagnostic software can be used to perform this check.

10. With the Signaller's permission, reconnect the section disconnection link(s).

11. Request that each section under the ACE control is reset, observe that the section(s) are successfully restored to normal operation.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX63		
Replace a Power Data Coupling Unit (PDCU) (AzLM)		
Issue No: 02	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Power Data Coupling Unit (PDC) (AzLM)
Excludes:	All other types of Power Data Coupling Unit

GENERAL

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection as required.

The Signaller is responsible for restoring the axle counter section.

For Further Information see NR/SMS/Appendix/15 – General Information on the Thales Axle Counter Systems.

BEFORE INSTALLATION WORK

1. Check that the affected section is correctly isolated from the interlocking.
2. Check that the replacement unit is of the correct type or equivalent and is undamaged. (See Appendix A – Equivalent types)
3. If applicable, isolate the Power Data Coupling Unit (PDCU).
4. WIRE COUNT the existing Power Data Coupling Unit (PDCU) to the wiring diagram.
5. Check the existing wiring has safe insulation.
6. Check the existing wiring is correctly labelled.

AFTER INSTALLATION WORK

7. Check that the replacement unit is securely installed.
8. WIRE COUNT the Power Data Coupling Unit (PDCU) to the wiring diagram.
9. Check the existing wiring is correctly labelled.
10. Check the wires are correctly twisted to the point of termination.
11. Reconnect the Power Data Coupling Unit (PDCU) to each Serial card.
12. If applicable, power up the Power Data Coupling Unit (PDCU).
13. Check the red LED is not illuminated.

14. With the Signaller's permission, reconnect the equipment to the Interlocking.

15. Request the section is reset, observe that the section(s) are successfully restored to normal operation.

16. Check that the unit is correctly labelled.

APPENDIX A - Equivalent types

Type	Equipment Name	Equivalent Type
3CR 01892 AAAA	Power Data Coupling Unit (PDCU)	3CR 01892 BAAB

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX64		
Replace a DC - DC Convertor (Power Supply to EAK) (AzLM)		
Issue No: 02	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	DC - DC Converter (Power Supply to EAK) (AzLM)
Excludes:	All other types of DC – DC Power Converter

GENERAL

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection as required.

Electrostatic precautions shall be taken when working inside the unit.

The Signaller is responsible for restoring the axle counter section.

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. Check that the affected section(s) are correctly isolated from the Interlocking.
2. Check that the replacement DC – DC Power Converter is of the correct type, is undamaged and is correctly labelled.
3. Isolate the DC – DC Power Converter.
4. WIRE COUNT the existing DC – DC Power Converter to the wiring diagram.
5. Check the existing wiring has safe insulation.
6. Check the existing wiring is correctly labelled.

AFTER INSTALLATION WORK

7. Check the DC – DC Power Converter is mounted securely and labelled correctly.
8. WIRE COUNT the replacement DC – DC Power Converter to the wiring diagram.
9. Power up the DC – DC Power Converter.
10. Check the U_A green LED is illuminated.
11. Check the output voltage of the replaced unit on the PDCU busbar.

Any paralleled units shall be powered down during this test.

12. With the Signaller's permission, reconnect the output of the affection section(s) to the signalling system.

13. Request the section is reset, observe that the section(s) are successfully restored to normal operation.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX65		
Replace an ACE DC - DC Power Card (AzLM) 2oo2 ACE		
Issue No: 02	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Replace an ACE DC - DC Power Card (AzLM) 2oo2 ACE
Excludes:	All other DC –DC Power cards, DC – DC Power Card AzLM 2oo3 ACE

GENERAL

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection method as required.

Electrostatic precautions shall be taken when working inside the unit.

The Signaller is responsible for restoring the axle counter section

The ACE shall be powered down for the replacement of this card.

For Further Information see NR/SMSAppendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. Check that the ACE is correctly isolated from the power supply.

2. Check that the replacement DC - DC Convertor card is of the correct type and is not damaged.

   If replacement unit is PowerOne variant check the supplier version number is V106 or greater, see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems) for further details.

AFTER INSTALLATION WORK

3. Check the replacement DC - DC Convertor card is correctly installed and secure.

4. Restore the power to the ACE.

5. Check that the correct serial and parallel I/O card LEDs are illuminated see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems) – LED Indications.

6. Check the LED on the front of the DC/DC Power cards. If extinguished the voltages are out of tolerance and shall be investigated.

7. With the Signaller's permission, reconnect the equipment to the interlocking.

8. Request the section is reset, observe that the section(s) are successfully restored to normal operation.

9. If possible, observe the passage of a train over the affected section(s).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX66		
Replace an ISDN V.24 Converter		
Issue No: 03	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	ISDN V.24 converter
Excludes:	All other Axle Counter Cards and converters

GENERAL

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection as required.

The Signaller is responsible for restoring the axle counter section.

The ACE does not have to be powered down for this task.

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. Check that the affected section is correctly isolated form the interlocking.
2. Check that the replacement unit is of the correct type or equivalent and is undamaged.
3. Isolate the ISDN V.24 Converter.
4. WIRE COUNT the existing ISDN V.24 converter to the wiring diagram.
5. Check the existing wiring has safe insulation.
6. Check the existing wiring is correctly labelled.

AFTER INSTALLATION WORK

7. Check that the replacement unit is securely installed.
8. WIRE COUNT the ISDN V.24 Converter to the wiring diagram.
9. Check the existing wiring is correctly labelled.
10. Check the wires are correctly twisted to the point of termination.
11. Power up the ISDN V.24 Converter.
12. Check the status of the LED's, see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems) for more details.
13. With the Signaller's permission, reconnect the equipment to the Interlocking.

14. Request the section is reset, observe that the section(s) are successfully restored to normal operation.

15. Check that the unit is correctly labelled.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX69		
Replace a Thales Axle Counter Sub-rack		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Replace a Thales Axle Counter Sub-rack
Excludes:	All other types of Axle Counter and Non-Axle Counter Sub-rack

GENERAL

This Test Plan shall not be attempted without the express consent of the S&TME and needs to be done in conjunction with Thales. A "Release of Controls" is required and this is not easily achieved safely.

Before any work is undertaken the following shall be undertaken:

a) Possession of the axle counter section(s) shall be taken.

b) Disconnection of the output of the evaluator to the signalling system.

c) During the replacement process "No Additional work", disturbance to EAK's or any other equipment connected to the ACE shall be allowed.

d) Electrostatic precautions shall be taken when working inside the unit.

Alternative protection shall be in place before the reconnection of the disconnection links to allow the testing of the reset circuits.

The ACE shall be powered down for the replacement of this unit.

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. Check that the affected section(s) are correctly isolated from the Interlocking.
2. Check that the ACE is correctly isolated from the power supply.
3. Check that the replacement ACE Sub-rack is of the correct type and is not damaged.
4. WIRE COUNT the ACE Sub rack to the wiring diagrams.
5. Check the existing wiring has safe insulation.
6. Check the existing wiring and connectors are correctly labelled.

AFTER INSTALLATION WORK

7. Check the replacement Sub rack is correctly installed and secure.

8. Check that all cards in the Sub-rack are fitted and secure.

9. Check that the wiring and connectors are replaced as labelled and secure.

10. WIRE COUNT the replacement unit to the wiring diagram.

11. If fitted, check the replacement power supply card is correctly installed and secure.

12. Restore the power to the ACE.

13. Check that the correct I/O card LEDs are illuminated correctly and use diagnostic system (where available) NR/SMS/Appendix/15) (General Information on the Thales Axle Counter Systems) – LED indications.

14. Check the LED indications on the cards and the diagnostic system (where available) to shows the affected section(s) are disturbed.

15. If fitted, check the LED's on the front of power supply cards. If extinguished the voltages are out of tolerance and are to be investigated.

16. If fitted, check the LED's on the CPUs are showing the correct indication.

17. With the Signaller's permission, reconnect the equipment to the Interlocking.

18. Where the ACE has multiple sections and outputs to the interlocking this shall be tested and corresponded to the correct section, reset type and the correct indication to the Signaller.

19. This shall be completed for each section and each output and shall be observed using the AzLM Diagnostic software as well as the LED indications (not applicable for 70/30).

20. Check with the Signaller all the affected section(s) are showing occupied.

21. Request the section(s) is reset, observe that the section(s) are successfully restored to normal operation.

22. If possible, observe the passage of a train over the affected section(s).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX70		
Replace a Sedlbauer unit (PMC Transformer) (AzLM)		
Issue No: 02	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Sedlbauer unit (PMC Transformer) (AzLM)
Excludes:	All other types of PMC Transformer

GENERAL

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection as required.

The Signaller is responsible for restoring the axle counter section.

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. Check that the affected section is correctly isolated from the interlocking.
2. Check that the replacement unit is of the correct type and is undamaged.
3. Isolate the data line.
4. WIRE COUNT the existing Sedlbauer unit (PMC Transformer) to the wiring diagram.
5. Check the existing wiring has safe insulation.
6. Check the existing wiring is correctly labelled.

AFTER INSTALLATION WORK

7. Check that the replacement unit is securely installed.
8. WIRE COUNT the Sedlbauer unit (PMC Transformer) to the wiring diagram.
9. Check the quality of the soldered terminations.
10. Check the existing wiring and unit is correctly labelled.
11. Check the wires are correctly twisted to the point of termination.
12. Reinstate the data line and check for any relevant error messages using the diagnostic software.
13. With the Signaller’s permission, reconnect the equipment to the Interlocking.

14. Request the section is reset, observe that the section(s) are successfully restored to normal operation.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX73		
Replace a Single Channel Controller (SCC) CPU Card (AzLM) in a 2oo3 System		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Single Channel Controller (SCC) CPU Card (AzLM) 2oo3 ACE
Excludes:	All other types of CPU Card, Single Channel Controller (SCC) CPU Card (AzLM) 2oo2 ACE

GENERAL

The preferred method for this task is not to power down the evaluator, as each CPU can be changed on an individual basis, the associated re-synchronisation time has been proven to be no more than 10 minutes.

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection as required.

Electrostatic precautions shall be taken when handling boards. Where provided electrostatic discharge points (ESD) shall be used.

The Program plug is uniquely identified to include the data version number.

The Program plug will have the unique ACE name and version number of the software.

The Installed Software Status Record (ISSR) will tell you the status of the installed site specific software.

The connection of a laptop with the diagnostic software will also identify the installed site specific software.

The Signaller is responsible for restoring the axle counter section

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. Check that the affected CPU(s) is correctly isolated from the power supply.
2. Check that the affected CPU(s) board is of the correct type and is not damaged.
3. Check for correct compatibility of CPU(s) and program plugs.
4. Check that the original / replacement Program plug status corresponds with the Installed Software Status Record (ISSR).

AFTER INSTALLATION WORK

5. Check the replacement CPU card(s) is correctly Installed and secure.

6. Restore the power to the affected CPU(s).

7. After approximately 10 minutes check via diagnostics that the CPU's are functional.

8. Check that the software version of the replacement CPU card(s) corresponds with that of the original by use of a laptop with the diagnostic software.

9. Check that the sections under the ACE's control are available for reset (if applicable). The diagnostic software can be used to perform this check.

10. If required, request any disturbed sections under the ACE control are reset, observe that the section(s) are successfully restored to normal operation.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX74		
Replace an ACE DC - DC Power Card (AzLM) 2oo3 ACE		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Replace an ACE DC - DC Power Card (AzLM) 2oo3 ACE
Excludes:	All other DC – DC Power cards, DC – DC Power Card AzLM 2oo2 ACE

GENERAL

The preferred method for this task is not to power down the evaluator, as each DC – DC converter can be changed on an individual basis.

Before any work is undertaken on the axle counter system you shall reach a clear understanding with the Signaller on the work being undertaken and any impact on the signalling system. Implement protection method as required.

Electrostatic precautions shall be taken when working inside the unit.

The Signaller is responsible for restoring the axle counter section

For Further Information see NR/SMS/Appendix 15 (General Information on the Thales Axle Counter Systems.

BEFORE INSTALLATION WORK

1. Check that the affected section(s) are correctly isolated from the Interlocking.

2. Check that the replacement DC - DC Power Converter card is of the correct type, is undamaged and is correctly labelled.

AFTER INSTALLATION WORK

3. Check the DC – DC Power Converter card is correctly installed, secure and correctly labelled.

4. If required, restore the power to the DC – DC power converter.

Check that the correct serial I/O card and/or CPU LEDs are illuminated, see NR/SMS/Appendix 15 (General Information on the Thales Axle Counter Systems) – LED Indications.

5. Check the LEDs on the front of the DC/DC Power cards. If extinguished, the voltages are out of tolerance and shall be investigated.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX95		
Replace a RSE Wheel Sensor Assembly		
Issue No. 02	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	RSE wheel sensor
Excludes:	All other wheel sensor systems.

GENERAL

Liaise with Signaller before carrying out this test.

Wiring Assessment

Before undertaking any work an assessment of the condition of the wiring shall be undertaken (with particular regard to insulation degradation) to ascertain whether its condition allows the changes to be made safely.

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check that the replacement wheel sensor is of the correct type and is not damaged.

3. Check existing wiring at the cable junction box is correctly labelled.

4. WIRE COUNT the cable junction box to the wiring diagram.

DURING WORK (If the rail is to be replaced)

5. Check the adapter plate being fitted is the correct type for the rail section.

6. Check that if the sensor is to be fitted to 113lb flat bottom rail that an assessment has been made as to the effects of drilling two 13mm holes outside the normal drilling zone of the rail.

AFTER INSTALLATION WORK

7. Check tail cable is correctly wired to the cable junction box (polarity conscious, secure at junction box end, correctly routed and secured) and labelling is correct.

8. WIRE COUNT the cable junction box to the wiring diagram.

9. Check terminations are secure.

10. Examine the sensing head fixings to the rail. Check that they are secure and that there is no evidence of movement.

11. Check the height setting of the wheel sensor as described in NR/SMS/PartC/AX99 (Trains Entering Terminal Stations System (TETS) - Clause 1.8.

12. Check the operation of the wheel sensor as described in NR/SMS/PartC/AX99 (Trains Entering Terminal Stations System (TETS) - Clause 1.11.

13. Repeat clauses 11 and 12 after a settling period of at least twenty train movements.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX96		
Replace a RSE Wheel Sensor Assembly Cable Junction Box		
Issue No. 02	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	RSE Wheel Sensor Cable Junction Box
Excludes:	All other Junction Boxes

GENERAL

Liaise with Signaller before carrying out this test.

Wiring Assessment

Before undertaking any work an assessment of the condition of the wiring shall be undertaken (with particular regard to insulation degradation) to ascertain whether its condition allow the changes to be made safely.

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Check that the replacement wheel sensor is of the correct type and is not damaged.
3. WIRECOUNT the cable junction box to the wiring diagram.
4. Check the cable core colours/number to the wiring diagram.
5. Check existing wiring at the cable junction box is correctly labelled.
6. Isolate the existing cable junction box from the supply.

AFTER INSTALLATION WORK

7. Check the junction box is correctly installed.
8. Check tail cables are correctly wired to the cable junction box (polarity conscious, secure at junction box end, correctly routed and secured) and labelling is correct.
9. WIRECOUNT the cable junction box to the wiring diagram.
10. Check terminations are secure.
11. Reconnect the supply to the cable junction box.
12. Check the operation of the wheel sensor as described in NR/SMS/PartC/AX99 (Trains Entering Terminal Stations System (TETS)) - Clause 1.11.
13. Carry out the ASR 4 functional test as described in NR/SMS/PartC/AX99 (Trains Entering Terminal Stations System (TETS)) - Clause 3.2 for each wheel sensor that was linked via the replaced cable junction box.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX97		
Replace a ARS 4 Evaluation Board or Enclosure		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	ARS 4 Evaluator Interface Board, Voltage Converter Board or Enclosure
Excludes:	All other Evaluator Unit Boards or Enclosures.

Liaise with signaller before carrying out this test.

Wiring Assessment

Before undertaking any work an assessment of the condition of the wiring shall be undertaken (with particular regard to insulation degradation) to ascertain whether it is in a suitable condition to allow the changes to be made safely.

BEFORE INSTALLATION WORK

1. Check that the unit is of the Correct Type and is Not Damaged.
2. Check the anti-static protection is still in place if the unit is a board.
3. Isolate the existing unit from the supply.
4. Check the existing wiring is correctly labelled.
5. WIRECOUNT the existing terminals to the wiring diagram.

AFTER INSTALLATION WORK

6. Check replacement evaluator interface PCB, voltage converter PCB or holder is correctly installed.
7. Check the wiring is replaced to diagram and labelling is correct.
8. WIRECOUNT the replacement unit terminals to the wiring diagram.
9. Check terminations are secure.
10. Check the operation of the wheel sensor as described in NR/SMS/AX99 Clause 1.11.
11. Carry out the ASR 4 functional test as described in NR/SMS/AX99 Clause 3.2 for each wheel sensor that was linked via the replaced cable junction box.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/AX98		
Replace a ARS 4 Power Supply		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	ARS 4 Power Supply
Excludes:	All other Power Supplies.

Liaise with signaller before carrying out this test.

Wiring Assessment

Before undertaking any work an assessment of the condition of the wiring shall be undertaken (with particular regard to insulation degradation) to ascertain whether it is in a suitable condition to allow the changes to be made safely.

BEFORE INSTALLATION WORK

1. Check that the replacement power supply is of the Correct Type and is Not Damaged.

2. WIRECOUNT the existing power supply to the wiring diagram.

3. Check existing wiring is correctly labelled.

4. Isolate the existing unit from the power supply.

AFTER INSTALLATION WORK

5. Check the power supply is correctly installed.

6. WIRECOUNT the power supply to the wiring diagram.

7. Check terminations are secure and labelling is correct.

8. Reconnect the power supply and check the 50V d.c. (nominal) supply voltage to the evaluation unit.

   This should measure between 45 - 72Vd.c.

9. Check the operation of the wheel sensor as described in NR/SMS/AX99 Clause 1.11.

10. Carry out the ASR 4 functional test as described in NR/SMS/AX99 Clause 3.2 for each wheel sensor that was linked via the replaced cable junction box.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/BA02		
Replace a Platform Identification Beacon System (Including Sub-components)		
Issue No: 03	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Platform Identification Beacon System (PIBS) equipment only
Excludes:	All other track mounted Balises or Beacons

GENERAL

Voltages over 110V might be present in this equipment.

The unique location and identification details for each individual beacon are defined by means of the coding plug in the control panel and are documented on the site record diagram.

BEFORE INSTALLATION WORKS

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check that the replacement component, mountings and fixings are not damaged and are the correct type (beacon mountings shall be correct for the type of sleepers; cable type shall be C3 or E3 as shown on site record diagram).

3. Record the existing beacon position (BEACON ONLY).

   The correct placement of the reinstalled beacon is critcal (see location diagram), this might necessitate marking appropriate bearers/sleepers or carefully measuring the distances between beacon and signal, etc., before removal of the existing beacon.

4. Record the identification number on back of existing coding plug.

5. Check that the replacement component connection (and plug coupler where applicable) has safe insulation.

6. Check that the replacement component is correctly labelled.

7. Check that the existing component is isolated from the supply.

AFTER INSTALLATION WORKS

8. Check that the replacement beacon or component is correctly installed (no metallic debris, correct position, correct track, correct coding plug).

   The beacon should be installed at the correct height and not above rail level.

9. Check the security of the replacement component (mountings and fixings).

10. Examine the plug coupler (where applicable) and check that no metallic dust, moisture or other contaminants exists between the two halves before reconnecting.

    It is vital that each beacon component is connected back to its correct terminations on the control panel and in particular that adjacent beacons are not crossed over, particularly if the disconnection box has been disturbed.

11. Check that the replacement component is correctly labelled.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/BA03		
Replace a Balise or Beacon		
Issue No: 02	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	TASS, Tracklink III Beacon, Siemens Fixed, Alstom Fixed and Ansaldo Fixed Type
Excludes:	KVB, Tracklink II Beacon, Siemens switchable, Alstom switchable and Ansaldo switchable

GENERAL

The unique location and identification details for each individual Beacon is stated on the Location Area Plan.

The following forms are available:

- NR/SMTH/Part02/Form/04 (Balise - Certificate of Conformity).

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Verify that the details contained in the Certificate of Conformity match the new Balise which is to be installed.

NOTE: *If the Balise is to be "removed and replaced" without fitting a new Balise then step 2 need not be completed.*

3. Check the Beacon and Mountings are not damaged.

4. Check the Balise Positioning Form corresponds to the intended location of the Beacon.

AFTER INSTALLATION WORK

5. Check the replaced Beacon is securely mounted.

6. Verify the Beacon is located in accordance with the Balise Positioning Form.

7. Check the labelling of both beacon and mounting are visible and readable.

8. If possible, check the correct operation of the Balise by observing the passage of a train over it.

NOTE: *This task can be completed remotely using data downloads.*

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/BA07		
Program a Balise or Beacon		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Tracklink lll, Fixed Ansaldo, Siemens and Alstom Eurobalises.
Excludes:	Tracklink II, PIBS and all switchable balise types.

BEFORE PROGRAMMING

1. Check the replacement Balise is the for the correct application / system.

2. Check the Balise is the correct type and is not damaged.

3. Verify you have the correct version of Balise Positioning / Siting Form for the Balise to be replaced.

4. Verify you have the correct telegram information for the Balise to be replaced.

AFTER PROGRAMMING

5. Check the ID label on the Balise and the Certificate of Conformity match.

6. Confirm the correct telegram information has been loaded onto the Balise.

7. Check the details on the Certificate of Conformity are correct, all the relevant sections have been completed and the Programmer has signed where required.

8. Sign and date the Certificate of Conformity seal it in a clear plastic pouch and attached it to the Balise.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/BA08		
Replace an Alstom Switchable Balise		
Issue No: 03	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Alstom Switchable Balise and Balise Disconnection Box
Excludes:	All other types of Balise

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check existing Balise and mounting bracket assembly is correctly labelled (compare with the Balise Positioning Form).

3. All replacement Balises shall be installed in the correct position (see Balise Positioning Forms). This can necessitate marking the bearers / sleepers or carefully measuring from the setting out feature specified on the Balise Positioning Form.

4. Check replacement unit is not damaged and is the correct type.

5. Check the condition / type of the existing sleeper. Check that the replacement mounting bracket assembly can be accommodated as a new installation.

6. Check the replacement unit is correctly labelled.

7. If the Balise is to be renewed, check the replacement Balise for the installation of correct data via a Certificate of Conformity.

If a Disconnection box is fitted

8. WIRE COUNT the Balise disconnection box to wiring diagrams.

9. Isolate existing Balise in LEU enclosure.

10. Check existing wiring has safe insulation.

11. Check existing wiring is correctly labelled.

AFTER INSTALLATION WORK

12. Check that the replacement unit has been correctly installed (in accordance with the Balise Positioning form).

13. If screws and bolts are used for fastening the Vortok mounting bar to concrete or wooden sleepers, check that they are tightened to the correct torque. Check the Balise fixings are secure. i.e. The tab washers are applied correctly. Refer to NR/SMS/PartZ/Z08 (Train Protection – Reference Values).

14. Reconnect Balise in LEU enclosure (Switchable Balise or disconnection box only).

15. WIRE COUNT Balise disconnection box to wiring diagrams (disconnection box only).

16. For the replacement of a Switchable Balise or disconnection box, check the micro coder operates correctly by inspecting the LEU Micro-coder indications, which should be as follows:

- OUT1 and OUT2: off or flashing green (for unused output).
- ERR: off.
- OK: Flickering green.
- ETH1 TX and ETH2 TX: off.
- ETH1 LNK and ETH2 LNK: off.

17. For a Switchable Balise, disconnection box or associated cabling, check the messages transmitted by the Switchable Balise against the LEU parameterisation sheets for any route set from the associated signal.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/BA12		
Replace a KVB Balise		
Issue No. 02	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	KVB Fixed, switchable and Marker Balise and/or brackets
Excludes:	Any other type of Balise

GENERAL

An "BCC encoding plug" is attached to the UCS card in the encoder. It determines the codes that are sent to switchable Balise.

An "BCB encoding plug" is attached to a fixed Balise. It determines the codes generated by the Balise.

Inserting the wrong coding plug causes the wrong message to be sent to the Train potentially causing a Wrong side Failure.

BEFORE RE-INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Where the bracket is to be removed measure and record the position of the Balise to the fixed asset identified on the Balise siting form.
3. Check the replacement item is the correct type and is not damaged.
4. Check the BCB (fixed Balise) coding plug labelling currently fitted is correct to the configuration documents **(FIXED BALISE ONLY)**.

AFTER RE-INSTALLATION WORK

5. Check that the correct Balise type has been fitted.
6. Check the security and tightness of the Balise to the mounting brackets.
7. Check that the plug coupler has been correctly attached to the Balise and is secure **(SWITCHABLE BALISE ONLY).**
8. Check that the correct BCB (fixed Balise) coding plug has been fitted to the Balise and is secure **(FIXED BALISE ONLY).**
9. Check the Balise has been fitted in the correct position to the fixed asset.
10. Measure and record the Balise height from the centre point of the Balise.

This should be between 70-163mm below rail height.

11. Measure the height of each of the four corners of the Balise and compare these against the centre point measurement, the difference is to be no more than <40mm.

12. Verify that the Balise is centrally mounted between and parallel to the running rails, by measuring from each corner to the foot of the rail.

* 13. Carry out NR/SMS/PartB/Test/209 (KVB Balise Test) – Section 1, Balise Test.

* 14. Carry out NR/SMS/PartB/Test/209 (KVB Balise Test) – Section 2, “Presence train” Test.

15. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/BA13		
Replace a KVB encoding plug (BCB and BCC)		
Issue No. 1	Issue Date: 01/09/18	Compliance Date: 01/12/18

Includes:	KVB BCC (Encoder coding plug) and KVB BCB (Balise coding plug)
Excludes:	Any other type of encoding plug

Details of configuration information can be found in the DCO (Dossier de Configuration).

The BCC plug is attached to the UCS card in the encoder. It determines the codes that are sent to switchable Balise.

The BCB plug is attached to a fixed Balise. It determines the codes generated by the Balise.

Inserting the wrong coding plug will cause the wrong message to be sent to the Train potentially causing a Wrong side Failure.

Appropriate electrostatic precautions shall be undertaken when handling any cards in the encoder rack.

BEFORE RE-INSTALLATION WORK

1. Check the replacement item is the correct type and is not damaged.

2. Check the encoding plug currently fitted is correct to the configuration documents.

3. Isolate the Encoder rack (BCC ONLY).

AFTER INSTALLATION WORK

4. Check that the correct coding plug has been fitted and is secure.

5. Arrange for the encoder rack to be powered and check the UCS (processor) card green and yellow LEDs illuminate together.

   Check within 30 seconds the yellow LED has extinguished and the green LED stays lit. (BCC ONLY)

6. Carry out SMS/PartB/Test 209 – Balise Test, Section 4.

   Test ALL possible output codes generated for ALL outputs are correct to the configuration documents using the Maintenance test tool attached to the maintenance port of the SBI (output) card. (BCC ONLY).

7. Carry out SMS/PartB/Test 209 – Balise Test, Section 1. Test the code generated by the Balise is correct using the Maintenance Testing Tool on the Balise. (BCB ONLY)

8. Check or arrange for correct labelling of unit

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/BA14		
Replace a KVB UCS processor card		
Issue No. 01	Issue Date: 01/09/18	Compliance Date: 01/12/18

Includes:	KVB UCS card
Excludes:	Any other type of card

Removal and replacement of the BCC shall be undertaken using the appropriate SMTH test plan.

The BCC plug is attached to the UCS card in the encoder. It determines the codes that are sent to switchable Balise.

Details of configuration information can be found in the DCO (Documentation de Dossier).

Inserting the wrong coding plug will cause the wrong message to be sent to the Train potentially causing a Wrong side Failure.

Appropriate electrostatic precautions shall be undertaken when handling any cards in the encoder rack.

BEFORE RE-INSTALLATION WORK

1. Check the replacement item is the correct type and is not damaged.
2. Check the BCC currently fitted to the UCS card is correct to the configuration documents.
3. Isolate the Encoder rack.

AFTER RE-INSTALLATION WORK

4. Check the UCS card has been correctly installed.
5. Arrange for the encoder rack to be powered and check the UCS (processor) card green and yellow LEDs illuminate together.

   Check within 30 seconds the yellow LED has extinguished and the green LED stays lit.
6. Check that the correct BCC coding plug has been fitted to the UCS card.
7. Carry out SMS/PartB/Test 209 – Balise Test, Section 4.

   Test ALL possible output codes generated for ALL outputs are correct to the configuration documents using the Maintenance test tool attached to the maintenance port of the SBI (output) card.
8. Check or arrange for correct labelling of unit.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/BA15		
Replace a KVB ECI or KVB SBI card		
Issue No. 01	Issue Date: 01/09/18	Compliance Date: 01/12/18

Includes:	KVB ECI (input) or SBI (output) card
Excludes:	Any other type of card

Details of configuration information can be found in the DCO (Dossier de Configuration).

Appropriate electrostatic precautions shall be undertaken when handling any cards in the encoder rack.

BEFORE RE-INSTALLATION WORK

1. Check the replacement item is the correct type and is not damaged.
2. Isolate the Encoder rack.
3. Wire count the output card outputs to the wiring diagram (SBI CARD ONLY).

AFTER RE-INSTALLATION WORK

4. Check the replacement card has been correctly installed.
5. Wire count the outputs to the wiring diagram (SBI CARD ONLY).
6. Arrange for the encoder rack to be powered up and check the inputs on the maintenance test tool agree with the configuration documents.

   Arrange for one input to change state and check the change of state is read on the Maintenance test tool. (ECI CARD ONLY)

   For additional information see SMS Appendix 23 – General information on the KVB Test Set Sections 6 & 9.

7. Test one output from the SBI card using the maintenance test tool connected to the output or placed on the Balise and check it is correct to the configuration documents.

   Arrange for a change of state code to be generated by the output card and check the code changes using the maintenance test tool attached to the SBI output or placed on the Balise and check the code is correct to the configuration documents. (SBI CARD ONLY).

   Refer to SMS/PartB/Test 209 – Balise test Sections 1 & 2.

8. Check or arrange for correct labelling of unit.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/BA16		
Replace a KVB Cable Attenuator		
Issue No. 01	Issue Date: 01/09/18	Compliance Date: 01/12/18

Includes:	KVB cable attenuator
Excludes:	Any other type of attenuator

***** INDEPENDENCE EXEMPT *****

Details of configuration information can be found in the DCO (Dossier de Configuration).

The attenuator is fitted where the output card to beacon cable is less than 150m.

BEFORE RE-INSTALLATION WORK

1. Check the replacement attenuator is the correct type and is not damaged.

AFTER RE-INSTALLATION WORK

2. Check the replacement attenuator has been correctly installed.

3. Test one correct message is being generating by the beacon using the KVB Maintenance Test tool laid on the Balise.

Refer to SMS/PartB/Test 209 – Balise Test, Section 1.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/BA17		
Replace a KVB Encoder Power Card		
Issue No. 01	Issue Date: 01/09/18	Compliance Date: 01/12/18

Includes:	KVB encoder power card
Excludes:	Any other type of card

Details of configuration information can be found in the DCO (Dossier de Configuration).

Appropriate electrostatic precautions shall be undertaken when handling any cards in the encoder rack.

BEFORE RE-INSTALLATION WORK

1. Check the replacement card is the correct type and is not damaged.

2. Isolate the encoder rack.

AFTER RE-INSTALLATION WORK

3. Check the replacement card has been correctly installed.

4. Arrange for the encoder rack to be powered and check the green LED illuminates on the power card.

5. Check the UCS (processor) card green and yellow LEDs illuminate together.

   Check within 30 seconds the yellow LED has extinguished and the green LED stays lit.

6. Test at least one correct message is being generated from the output card in the encoder rack using the KVB Maintenance Test tool.

   Refer to SMS/PartB/Test 209 – Balise Test, Section 4.

7. Check or arrange for correct labelling of unit.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/BA18		
Replace a KVB Encoder Rack/Housing		
Issue No. 01	Issue Date: 01/09/18	Compliance Date: 01/12/18

Includes:	KVB Encoder Rack/Housing
Excludes:	Any other type of Rack/Housing & replacement of any other KVB component

Details of configuration information can be found in the DCO (Dossier de Configuration).

Appropriate electrostatic precautions shall be undertaken when handling any cards in the encoder rack.

BEFORE RE-INSTALLATION WORK

1. Check the replacement component is the correct type and is not damaged.
2. Check the BCC currently fitted to the UCS card is correct to the configuration documents.
3. Isolate the encoder rack.
4. Wire count the output card outputs to the wiring diagram.

AFTER RE-INSTALLATION WORK

5. Check the replacement component has been correctly installed.
6. Wire count the outputs to the wiring diagram.
7. Check that the correct BCC coding plug has been fitted to the UCS card.
8. Arrange for the encoder rack to be powered and check the UCS (processor) card green and yellow LEDs illuminate together.

   Check within 30 seconds the yellow LED has extinguished and the green LED stays lit.

9. Carry out SMS/PartB/Test 209 – Balise Test, Section 4.

   Test ALL possible output codes generated for ALL outputs are correct to the configuration documents using the Maintenance test tool attached to the maintenance port of the SBI (output) card.

10. Check or arrange for correct labelling of unit.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/BA19		
Program a Siemens S21 Switchable (Transparent) Eurobalise		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	S21 Switchable (Transparent) Balise
Excludes:	All other types of Balise or Beacon

GENERAL

The process for programming a switchable (transparent) Balise is the same as that for a fixed Siemens S21 Balise. BA07, the SMTH for programming Balises and beacons deliberately excludes switchable Balises as they require a separate competency.

BEFORE PROGRAMMING

1. Check the replacement Balise is for the correct application / system.

2. Check the Balise is the correct type and is not damaged.

3. Verify you have the correct version of Balise Positioning / Siting Form for the Balise to be replaced.

4. Verify you have the correct telegram information for the Balise to be replaced.

AFTER PROGRAMMING

5. Check the ID label on the Balise and the Certificate of Conformity match.

6. Confirm the correct telegram information has been loaded onto the Balise.

7. Check the details on the Certificate of Conformity are correct, all the relevant sections have been completed and the Programmer has signed where required.

8. Sign and date the Certificate of Conformity, seal it in a clear plastic pouch and attached it to the Balise.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/BA20		
Replace a Siemens S21 Switchable (Transparent) Eurobalise		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	S21 Switchable (Transparent) Balise
Excludes:	All other types of Balise or Beacon

GENERAL

The unique location and identification details for each individual S21 Balise are stated on the corresponding Balise Positioning Form. The Signalling Plan and ETCS Data Generation Plan (EDGP) also indicate general positioning information for each Balise group. The Location Area Plan indicates general positioning information for switchable Balise groups only**.**

The following forms are available:

a) NR/SMTH/Part02/Form/04 (Balise - Certificate of Conformity).

b) Balise Positioning Form.

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Confirm the switchable (transparent) Balises identity using the Location Area Plan.

2. **For Missing Equipment Only:** Using the Balise Positioning Form relating to the missing Balise, identify and mark the location where the replacement Balise is to be fitted.

NOTE: *If either the Location Area Plan or Balise Positioning Form is not available contact your (SM)S before proceeding.*

3. Verify that the details contained in the Certificate of Conformity match both the details on the Balise Positioning Form and the labelling on the replacement Balise.

NOTE: *If the details do not match contact your (SM)S before proceeding.*

4. Check the Balise and mountings are not damaged.

5. Check the Balise Positioning Form corresponds to the intended location of the Balise.

6. WIRE COUNT Balise disconnection box to wiring diagrams.

7. Check existing wiring has safe insulation.

8. Check existing wiring is correctly labelled.

9. Isolate Balise.

AFTER INSTALLATION WORK

10. Check the replaced Balise is securely mounted.

11. If screws and bolts are used for fastening the Vortok mounting bar to concrete or wooden sleepers, check that they are tightened to the correct torque. Check the Balise fixings are secure. Refer to NR/SMS/PartZ/Z08 (Train Protection – Reference Values).

12. Verify the Balise is located in accordance with the Balise Positioning Form.

13. Check the labelling of both Balise and mounting are visible and readable.

14. Check that the tail cable from the Balise is secure.

15. WIRE COUNT Balise disconnection box to wiring diagrams (disconnection box only).

16. Check wiring is correctly labelled.

17. Correspond the LEU with the switchable (transparent) data Balise for both the straight and divergent route using the MD4 checksum sheets and the TPG unit (to read back MD4 checksums).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/BA22		
Replace a Siemens S21 MS Lineside Electronic Unit (LEU)		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Replacement of Siemens LEU S21 MS (Modular Standard)
Excludes:	All other types of Lineside Electronic Unit

GENERAL

Unauthorised tampering with wiring or with the stored data might cause the system to no longer function safely.

The configuration key fixed to the baseplate of the LEU shall not be removed at any time. The configuration key for each of the replacement LEUs is pre-configured by the supplier and is supplied fixed to the baseplate of its LEU. There is no requirement to replace configuration keys or to check that a configuration key matches the LEU or Balise group.

Individual modules of the LEU S21 MS unit cannot be replaced. The LEU S21 MS shall always be replaced as a unit

Electrostatic precautions shall be taken when handling boards. Where provided electrostatic discharge points (ESD) shall be used.

Before replacing the LEU S21 MS, confirm the arrangements with the Signaller for the work to be carried out.

Asset Identification Image

Figure 1 - LEU S21 MS (Modular Standard)

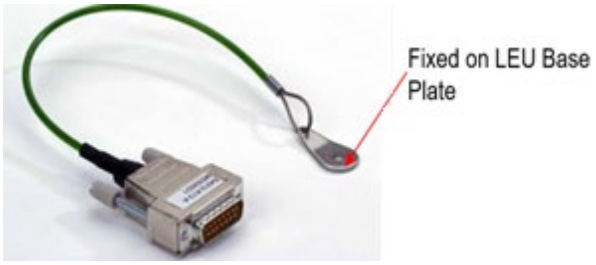


Figure 2 – LEU Configuration Key

BEFORE INSTALLATION

1. Check the replacement LEU is of the correct configuration by checking the LEU id label on the front of the unit.

2. Check that the 3 x plug couplers (X1, X2 and X4) and 1 x earth wire have safe insulation and are correctly labelled.

3. Isolate the LEU from the power supply using the MCB circuit breaker which is present either on the side or below the LEU unit.

AFTER INSTALLATION

4. Check the replacement LEU is correctly installed on to the REB rack.

5. Check that the 3 x plug couplers (X1, X2 and X4) and 1 x earth wire are correctly and securely installed.

6. Reinstate the power supply to the LEU from the MCB circuit breaker.

7. Check the top LED display on the LEU is showing a small ‘o’ that alternates between top and bottom at intervals of one second to confirm the LEU is working as expected. See Figure 3.

NOTE: *that the bottom LED does not display any indication as it is not utilised on Thameslink.*

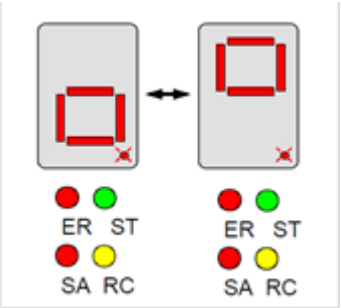


Figure 3 - Front display of each channel in front of the LEU

8. Check that the green ST light under the top LED display is lit to confirm the LEU is transmitting a valid telegram.

9. Correspond the LEU with the switchable (transparent) Balise for both the straight and divergent routes, using the MD4 checksum sheets and the TPG unit (to read back MD4 checksums).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/BL01		
Replace a Block Instrument		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Tokenless block, Block bell
Excludes:	Token, Tablet, Staff, No-signaller key token, Intermediate token, auxiliary and control instruments

GENERAL

For the purpose of any wire labelling the block instrument shall be viewed from the rear.

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Check replacement block instrument is not damaged and is correct type.
3. Check that the internal wiring of the replacement block instrument corresponds to the internal wiring of the redundant block instrument.
4. Check that the contact arrangement of the replacement instrument corresponds functionally to the contact arrangement of the redundant instrument.
5. WIRE COUNT existing block instrument to the wiring diagram.
6. Check existing wiring has safe insulation.
7. INSULATION TEST replacement instrument (minimum 2M ohms terminals to case).
8. Check existing wiring is correctly labelled.
9. Check existing instrument is Isolated from the supply.

AFTER INSTALLATION WORK

10. Check replacement block instrument is correctly installed.
11. Check wiring is replaced as labelled.
12. WIRE COUNT replacement block instrument to the wiring diagram.
13. Check terminations are secure and suitably protected.
14. Carry out EARTH TEST (DC) or EARTH TEST (AC) where circuits are designed to be earth free.
15. * Check correct correspondence of block instrument with adjacent signal box and any intermediate block instruments/indicators, for all indications.

16. BLOCK CONTROLS TEST **(NOT PERMISSIVE (FREE BLOCK) OR NON INTEGRAL BLOCK BELL).**

17. BLOCK RECOVERY TEST **(NOT PERMISSIVE (FREE BLOCK) OR NON INTEGRAL BLOCK BELL).**

18. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/BL02		
Replace a Block Switch		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Standard Block Switch
Excludes:	Intermediate block section signal switch

BEFORE INSTALLATION WORK

1. Check replacement block switch is not damaged (broken pin) and is correct type.
2. WIRE COUNT existing block switch to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring is correctly labelled.

AFTER INSTALLATION WORK

5. Check replacement block switch is correctly installed.
6. Check wiring is replaced as labelled.
7. WIRE COUNT replacement block switch to the wiring diagram.
8. Check terminations are secure and suitably protected.
9. Carry out EARTH TEST (DC) or EARTH TEST (AC) on block circuits which where designed to be earth free.

* 10. Check correct correspondence of block instruments and bells between the controlling signal box and each adjacent signal box when controlling signal box is both switched in and out (All lines, TOL, LC, bells).

* 11. Check correct correspondence of all other circuits, including telephones, which pass through block switch between controlling signal box. This includes each adjacent signal box when controlling signal box is both switched in and out.

* 12. BLOCK CONTROLS TEST.

* 13. BLOCK RECOVERY TEST **(WELWYN AND ONE ACCEPTANCE BLOCK CONTROLS ONLY).**

14. Check, or arrange for correct labelling of unit.

END

BEFORE INSTALLATION WORK

1. Check replacement block winder is not damaged and is correct type.
2. Carry out a WIRE COUNT existing block winder to the wiring diagram.
3. Check the existing wiring has safe insulation.
4. Check the existing wiring is correctly labelled.

AFTER INSTALLATION WORK

5. Check the replacement block winder is correctly installed.
6. Check the wiring is replaced as labelled.
7. Carry out a WIRE COUNT on the replacement block winder to the wiring diagram.
8. Check the terminations are secure and suitably protected.
9. Carry out EARTH TEST (DC) where the circuits are designed to be earth free.
10. Carry out a BLOCK RECOVERY TEST on the equipment.
11. Check the block winder is correctly sealed.
12. Check, or arrange for correct labelling of the unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/BL04		
Replace a Single Line Block Instrument		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Token, no-signaller key token intermediate token and auxiliary instruments
Excludes:	Tokenless block and one train staff instruments

General

- The term token also includes tablet and staff.

BEFORE INSTALLATION WORK

1. Check and record in the logbook the number of tokens in each instrument in the system, and any tokens that might have been removed (Pilotman, damage).
2. Check replacement instrument is not damaged and is correct type (Configuration).
3. Check that the internal wiring of the replacement instrument corresponds to the internal wiring of the redundant instrument.
4. Check that the contact arrangement of the replacement instrument corresponds functionally to the contact arrangement of the redundant instrument.
5. WIRE COUNT the existing instrument to the wiring diagram.
6. Check existing wiring has safe insulation.
7. INSULATION TEST replacement instrument (minimum 2M ohms terminals to case).
8. Check existing wiring is correctly labelled.
9. Check existing instrument is Isolated from the supply.

AFTER INSTALLATION WORK

10. Check all tokens are removed from the instrument to be replaced.
11. Check replacement instrument is set to the same phase as the instrument being replaced **(EXCLUDES TABLET INSTRUMENTS).**
12. Check that all tokens removed from the redundant instrument are installed into the replacement instrument.
13. Check replacement instrument is correctly installed.
14. Check wiring is replaced as labelled.
15. WIRE COUNT replacement instrument to the wiring diagram.
16. Check wires and cables are clear of moving parts.

17. Carry out EARTH TEST (DC) or EARTH TEST (AC) where circuits have been designed to be earth free.

18. Check correct correspondence of block instrument with adjacent signal box and any intermediate block instruments/indicators, for all indications.

19. Check that with any contact in the normal proving circuit broken, the by–pass resistor allows enough current to pass to operate the block bells but this inhibits the operation of the token lock relay at each instrument in the system **(HOME/DISTANT/SECTION SIGNAL NORMAL PROVING CIRCUITS ONLY**).

20. Check that a token cannot be withdrawn with a contact in the normal proving circuit broken **(HOME/DISTANT/SECTION SIGNAL NORMAL PROVING CIRCUITS ONLY).**

    Repeat step 20 for each contact in all the Normal proving circuits in the system **(HOME/DISTANT/SECTION SIGNAL NORMAL PROVING CIRCUITS ONLY).**

21. Carry out BLOCK CONTROLS TEST.

22. Check that a token once withdrawn, can be replaced in the same instrument and that any release previously effective is now cancelled.

23. Check or arrange for correct labelling of instrument.

24. Check all instruments in the system are secure and locked.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/BL05		
Replace a Control Instrument		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Ground frame release control instrument, intermediate block section signal switch
Excludes:	Tokenless block instruments, key release instruments

BEFORE INSTALLATION WORK

1. Check replacement instrument is not damaged and is correct type (Commutator lock positions).
2. Check that the internal wiring of the replacement instrument corresponds to the internal wiring of the redundant instrument.
3. Check that the contact arrangement of the replacement instrument corresponds functionally to the contact arrangement of the redundant instrument.
4. WIRE COUNT the existing instrument to the wiring diagram.
5. Check existing wiring has safe insulation.
6. INSULATION TEST replacement instrument (minimum 2M ohms terminals to case).
7. Check existing wiring is correctly labelled.
8. Check existing instrument is isolated from the supply.
9. Check replacement instrument is set to the same commutator position as the instrument to be replaced.

AFTER INSTALLATION WORK

10. Check replacement instrument is correctly installed.
11. Check wiring is replaced as labelled.
12. WIRE COUNT replacement instrument to the wiring diagram.
13. EARTH TEST (DC) or EARTH TEST (AC) circuits where designed to be earth free.
14. * Check commutator is locked in the correct positions.
15. * Check commutator lock is released only by the correct function.
16. * Test that each contact only makes in the positions as specified in the wiring diagrams.
17. * Check that with each contact broken the correct circuit function de-energises.
18. Check, or arrange for, correct labelling of instrument.

19. Check the instrument is secure and locked.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CA01		
Remove and Refit an Existing Cable Core or Wire		
Issue No: 08	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	A single cable core or wire. This includes a previously disconnected core or wire (proceed from step 6).
Excludes:	A broken wire or cable core (CA13), Line Wires (Telegraph) (CA31) and Telecoms cables (CAB001)

GENERAL

Where a cable core or wire is not correctly labelled, see NR/SMTH/Part03/A06 (Defined Check: Check for Correct Labelling).

BEFORE DISCONNECTION

1. WIRE COUNT the cable core/wire to the wiring diagram.
2. Track cables only: Check bonding, jumpering and polarities to bonding plan.
3. Check cable core/wire is correctly labelled.
4. Check cable core/wire has safe insulation.
5. Note the position of any links, red dome nuts or equivalent.

AFTER RE-CONNECTION

6. Check cable core/wire is correctly installed and has not been damaged whilst disconnected.
7. Check cable core/wire is replaced as labelled.
8. Check cable core/wire is not susceptible to mechanical damage.
9. Track cables only: Check bonding, jumpering and polarities to bonding plan.
10. WIRE COUNT the cable core/wire to the wiring diagram.
11. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
12. Check with the Maintenance Test Plan for the item of equipment fed by the affected cable or wire and carry out steps marked with an asterisk ✱.
13. Check or arrange for correct labelling of cable core/wire.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CA02		
Renew a Multi-Core Cable		
Issue No: 07	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Multicore signalling cables
Excludes:	a) Renewing a cable with intermediate terminations, links or contacts. b) Refitting any removed or broken cable core(s)/wires that are not correctly labelled. c) Telecom cables (see Part 06). d) Plug coupled cables.

GENERAL

Where it is not possible to fully complete this test plan for all cable cores, this test plan shall only be used when authorised by the SM(S).

A cable changeover being carried out under this Test Plan shall only be left unattended after the completion of step 10, provided that ALL of the following criteria are met:

a) Testing cannot be completed due to shift change; possession constraints or staff being called to a higher priority safety related failure.

b) Steps 11 to 23 of the test plan have been completed for ALL circuits that have been changed over to the new cable.

c) A label shall be attached to both ends of the cable giving the following details:

- An explanation of the work being undertaken. The start date/time and estimated date/time when the work is to be completed.
- The signature and name of the SMTH Tester.
- Contact details for the person responsible for the work.
- The work shall be completed, and any access restrictions removed within 1 week.

Operationally equivalent cables (with a greater or equal number of cores) are defined in NR/SMS/PartZ/Z05 (Cable – Reference Values).

BEFORE INSTALLATION WORK

Existing Cable

1. Check identity of existing cable by physically tracing or positively electrically proving.

2. Check no intermediate terminations, links or contacts exist between the ends to be disconnected.

3. WIRE COUNT the existing cable to the wiring diagrams.

4. Check cable terminals associated with the existing cable are correctly labelled.

Replacement Cable

5. Check replacement cable is not damaged and is correct type.

6. Check replacement cable is prepared for change over (all joints are properly made, and cable ends are crimped or precisely stripped for clamp type terminations).

7. CONTINUITY TEST all cores in the replacement cable.

8. Check replacement cable has safe insulation.

9. INSULATION TEST all cores in the replacement cable.

10. Check replacement cable is correctly labelled.

For Each Circuit (pair) to be Changed Over

11. Check the existing cable cores are isolated at both ends.

12. CONTINUITY TEST the existing cores to prove there is not a cross in the circuit.

13. Check existing cable cores have correct insulation (i.e., cut back and bomb-tailed) (see NR/L3/SIG/10064/E052).

AFTER INSTALLATION WORK

For Each Circuit (pair) When it has Been Changed Over

14. Check that any existing red straps have been recovered and diagrams altered to show red straps recovered. Return the circuit diversion labels to your SM(S). **(RECTIFICATION OF TEMPORARY DIVERSIONS ONLY)**

15. Check each replacement cable core is correctly installed.

16. Check each replacement cable core is replaced as labelled.

17. Check replacement cable cores are not susceptible to mechanical damage.

18. WIRE COUNT the replacement cable cores to the wiring diagram.

19. Check any links, red dome nuts or equivalent, are correctly replaced to diagram and secure.

20. CABLE FUNCTION TEST each circuit.

21. Refer to the Maintenance Test Plan for the item of equipment fed by the affected cable and carry out steps marked with an asterisk "✱".

Spare Cores

22. Check each replacement cable core is correctly Installed.

23. Check each replacement cable core is replaced as labelled.

24. Check any additional spare cores in the replacement cable are terminated (e.g., a 37 core in lieu of 32 core: - cores 33 to 37 shall be terminated where practicable).

25. Check spare cores in the replacement cable, that cannot be terminated, are correctly insulated (bomb tailed with ends cut back) (see NR/L3/SIG/10064/E052).

26. Check replacement cable cores are not susceptible to mechanical damage.

27. Check links are removed at both ends of any terminated spare cores.

28. WIRE COUNT the spare cores in the replacement cable to the wiring diagram.

Final Checks

29. Check or arrange for correct labelling of cable.

30. Check or arrange for correct installation of cable in the cable route.

31. Check or arrange for replacement diagrams for operationally equivalent cables only.

The following information shall be included and submitted with the SMTH log sheet):

- Cable identification.
- Cable from/to.
- Replacement cable type/size/cores.
- Spare cores.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CA03		
Renew a Cable or Wire		
Issue No: 09	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	a) Internal wiring between terminals and/or equipment. b) External single core cables between terminals and/or equipment. c) Track circuit jumper cables.
Excludes:	a) Renewing a cable/wire with intermediate terminations, links or contacts. b) Refitting any removed or broken cable core(s)/wires. c) Telecoms tail cables (see Part 06). d) Plug coupled cables.

GENERAL

Operationally equivalent cables (with a greater or equal number of cores) are defined in NR/SMS/PartZ/Z05 (Cable – Reference Values).

BEFORE INSTALLATION WORK

1. EARTH TEST (AC) or EARTH TEST (DC) all busbars affected by the work or check ELD / remote monitoring systems.

2. WIRE COUNT the cable core/wire to the wiring diagram (where more than one cable core/wire is to be removed at once).

3. Check the insulation condition of adjacent wires.

4. Check the identity of each cable/wire by physically tracing.

   Physically tracing is the preferred method, but if this might cause additional damage to a degraded wire or adjacent wire(s) then identification by positively electrically proving is to be used.

5. Check no intermediate terminations, links or contacts exist between the ends to be disconnected.

6. Check the replacement cable/wire is not damaged and is correct type.

   Where degraded wires are present, the replacement wire should, if practicable, be run in a different route from the wire to be replaced. If this is not practicable, then extreme caution should be taken during the replacement to prevent damage to new/existing wires, i.e., rather than pulling wires through, they should be carefully laid in.

7. Label all new cables/wires at each end.

8. Check equipment terminals associated with the existing cable/wire are correctly labelled.

9. Check existing cable/wire is isolated from the supply.

10. CONTINUITY TEST each wire/core of the replacement cable/wire (excluding track circuit cables).

11. Check replacement cable/wire has safe insulation.

    If the insulation is of a different type from the existing wiring, check that they are permitted to be run together or are segregated, see NR/L3/SIG/11303 (Signalling Installation).

AFTER INSTALLATION WORK

12. Check replacement cable/wire is correctly installed.

13. Check replacement cable/wire is replaced as labelled.

14. CONTINUITY TEST each core in the replacement cable/wire.

15. INSULATION TEST the replacement cable/wire.

16. Check replacement cable/wire is not susceptible to mechanical damage.

17. WIRE COUNT the replacement cable/wire to the wiring diagram.

18. Check any links, red dome nuts or equivalent, are correctly replaced to diagram and secure.

19. CABLE FUNCTION TEST the affected circuits.

20. Refer to the Maintenance Test Plan for the item of equipment fed by the affected cable and carry out steps marked with an asterisk *.

Final Checks

21. EARTH TEST (AC) or EARTH TEST (DC) each busbar affected by the work or check the remote monitoring system, if fitted.

22. Check or arrange for correct labelling of cable/wire.

23. Check that any existing red straps have been recovered and diagrams altered to show red straps recovered. Return the circuit diversion labels to your SM(S), (rectification of temporary diversions only).

24. Check that, where existing degraded wire could not be completely removed, it has been insulated at each end using ‘end caps/bomb tails’ and secured so that it cannot come into contact with working circuitry (degraded wires only). see GI/E052 (Insulation of Unterminated Wires).

25. Check or arrange for replacement diagrams (operationally equivalent cables only).

The following information shall be included with the SMTH logbook sheet:

a) Cable identification.

b) Cable from/to.

c) Replacement cable type/size/cores.

d) Spare cores terminated/insulated.

e) Additional links used.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CA04		
Joint or Add a Length of Cable		
Issue No: 07	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	1. All multicore, tail, and track cables, requiring jointing after damage or where additional length is now required 2. Plug Coupled Cables mid-section only
Excludes:	1. Plug Coupled Cables where a connector is involved. 2. Telecoms tail cables (see CAB001). 3. Jointing or adding length to single core internal wire (wire shall be renewed).

GENERAL

Operationally equivalent cables (with a greater or equal number of cores) are defined in NR/SMS/PartZ/Z05 (Cable – Reference Values).

BEFORE INSTALLATION WORK

1. Check identity of existing cable by physically tracing or positively electrically proving.

2. Check that there are no intermediate terminations in the section of cable to be replaced.

3. Check any length of cable to be added is not damaged and is correct type.

4. Check any length of cable to be added has safe insulation.

   If the insulation is of a different type from the existing wiring, check that they are permitted to be run together or should be segregated (see NR/L3/SIG/11303).

5. CORRELATION CHECK the cable core to the wiring diagram where a cable is to be removed from a termination point.

6. Check all cable cores are correctly labelled at the jointing point.

7. Check affected cable is isolated at terminated ends.

AFTER INSTALLATION WORK

8. Check cable cores are jointed as labelled.

9. CONTINUITY TEST affected cable wire.

10. Check joints are secure and sealed.

11. Carry out an INSULATION TEST affected cable (this shall be undertaken after joint is sealed).

12. Check any links, and red dome nuts or equivalent, are correctly replaced and secure at terminated ends.

13. CABLE FUNCTION TEST the affected circuits.

14. Refer to the Maintenance Test Plan for the item of equipment fed by the affected cable and carry out steps marked with an asterisk *.

15. CORRELATION CHECK cable core/wire to the wiring diagram where a cable has been removed from a termination point.

Spare Cores

16. Check any additional spare cores in the replacement cable are terminated (e.g. 37core in lieu of 32core, cores 33 to 37 shall be terminated where practicable).

17. Check spare cores in the replacement cable, that cannot be terminated, are correctly insulated (bomb tailed with ends cut back), see NR/L3/SIG/10064/E052 (Insulation of Unterminated Wires).

18. Where a cable has been removed from a termination point, check any links, red dome nuts or equivalent, are correctly replaced to diagram and secured.

Final Checks

19. Check or arrange for correct labelling of cable.

20. Check or arrange for replacement diagrams (operationally equivalent cables only).

The following information shall be included with the SMTH log sheet:

a) Cable identification.

b) Cable from/to.

c) Replacement cable type/size/cores.

d) Spare cores terminated/insulated.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CA05		
Divert a Faulty Cable Core		
Issue No: 08	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Faulty cable diversion, one core at a time
Excludes:	Telecoms tail cables

BEFORE INSTALLATION WORK

1. Check that there are no intermediate terminations in the section of cable to be diverted.

2. Check faulty core is isolated at both ends.

   NOTE: *Steps 3 and 4 can be deferred, after completion of a minimum test of all spares or 10% of the cable capacity, whichever is greater. Deferral requires the authority of the SM(S).*

3. CONTINUITY TEST all cores in the existing cable.

4. INSULATION TEST all cores of the existing cable.

5. Check cable core to be used is spare (no other connections or voltage present).

6. Check cable core to be used has safe insulation.

7. WIRE COUNT faulty cable core to the wiring diagram.

AFTER INSTALLATION WORK

8. Check red jumper wires have been used and are the correct type.

9. Check red dome nuts, or equivalent, have been fitted to prevent link reinsertion.

10. Check wiring diagrams have been correctly amended to show the alteration.

11. Check red jumper wires are correctly installed and secure. WIRE COUNT red jumper wires to the amended diagram.

12. Check isolated cable core is suitably secured and insulated.

13. CABLE FUNCTION TEST diverted circuit.

14. Check that all contacts in the affected circuit at locations at each end of the core diversion are independently proved in the circuit operation.

    NOTE: *In polarised circuit configuration, where it is not practicable to test contacts individually, confirmation of correct polarities will suffice for this element of the circuit under test.*

15. Refer to the Maintenance Test Plan for the item of equipment fed by the affected cable and carry out steps marked with an asterisk *.

16. Check, or arrange for, correct temporary labelling of diverted cable cores (see NR/SMTH/Part01/Module/12 (The Diversion of a Circuit/Relay Contact or Emergency Equipment Relocation).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CA06		
Renew a Plug Coupled Cable ("interconnect") with a Non-Certified Replacement		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	1. MIL5015 Plug Coupled Cables without a valid Certificate of Conformance (including missing environmental caps) or which cannot be certified/tested prior to use. 2. Where a cable has been laid out in preparation for installation and left unattended for a period of 28 days or more. 3. Where a cable is to be pulled through a UTX/URX.
Excludes:	1. MIL5015 Supplier Certified Plug Coupled Cables ("interconnects") 2. Unsealed Plug Coupled Cables or without a certificate which have been tested in accordance with instructions from your line manager 3. Cables with plug couplers on only one end ("leads")(use CA08)

GENERAL

Use this test plan if:

a) There is doubt about the validity of the Certificate of Conformance, the cable packaging is damaged, or the environmental seals (weather caps) are missing.

b) The cable has been installed but left unconnected for 28 days or more.

c) Damage is suspected during installation.

d) Where a cable is to be pulled through a UTX/URX.

BEFORE INSTALLATION WORK

4. Check identity of existing cable and receptacle/plug by checking it is labelled correctly to the diagram by physically tracing or positively electrically proving.

5. Check that the replacement cable is of the correct type, length and for physical damage.

6. Check receptacles and couplers of existing cable are correctly labelled at both ends of the cable.

7. Isolate the existing cable from the supply.

8. CONTINUITY TEST all cores in the replacement cable using breakout box/es, for cables above 12 core testing shall be carried out on the location disconnection links (Excluding Track Circuit Cables).

9. INSULATION TEST the replacement cable using a breakout box/es, for cables above 12 core testing shall be carried out on the location disconnection links.

10. Check replacement cable is correctly labelled.

DURING INSTALLATION WORK

11. Examine cable plug coupler receptacle or plug and existing panel mounted receptacle or plug for signs of contamination, moisture, or degradation/damage. Confirm the O-ring seal is intact.

AFTER INSTALLATION WORK

12. Check plug in connecters are correctly aligned, are securely mated and are mechanically locked.

13. Check that the cable has been correctly installed.

14. Check the cables are replaced correctly to the wiring diagram (where more than one cable has been removed at once).

15. Refer to the Test Plan for the item of equipment fed by the affected cable and carry out the steps marked with an asterisk ✱.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CA07		
Renew a Plug Coupled Cable ("interconnect") with a Certified Replacement		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	1. Supplier Certified Plug Coupled Cables ("interconnects"). 2. Unsealed Plug Coupled Cables or without a certificate which have been tested in accordance with instructions from the SM(S).
Excludes:	1. Plug Coupled Cables without a valid Certificate of Conformance (including missing environmental caps) or which cannot be certified/tested prior to use (use CA06 for uncertified cables). 2. Where a cable has been laid out in preparation for installation and left unattended for a period of 28 days or more. 3. Where a cable is to be pulled through a UTX/URX (use Plan CA06) Cables with plug couplers on only one end ("leads") (use CA08). 4. Cables with plug couplers on only one end ("leads").

GENERAL

Do not use this test plan if:

a) There is doubt about the validity of the Certificate of Conformance, the cable packaging is damaged, or the environmental seals (weather caps) are missing.

b) The cable has been installed but left unconnected for 28 days or more.

c) Damage is suspected during installation.

BEFORE INSTALLATION WORK

1. Check identity of existing cable and receptacle/plug by checking it is labelled correctly to the diagram by physically tracing or positively electrically proving.

2. Check that the replacement cable is of the correct type, length and for physical damage.

3. Check that the Certificate of Conformance, packaging, seals and environmental caps are present and intact.

4. Check receptacles and couplers of existing cable are correctly labelled at both ends of the cable.

5. Isolate the existing cable from the supply.

6. Check replacement cable is correctly labelled.

DURING INSTALLATION WORK

7. Examine replacement cable plug coupler pins/sockets and existing receptacles for signs of contamination, moisture, or degradation/damage. Confirm the O-ring seal is intact.

AFTER INSTALLATION WORK

8. Check that the cable has been correctly installed.

9. Check cables are replaced correctly to the wiring diagram (where more than one cable has been removed at once).

10. Check plug in connecters are correctly aligned, securely mated and mechanically locked.

11. Refer to the Test Plan for the item of equipment fed by the affected cable and carry out the steps marked with an asterisk *.

12. On completion of the test plan a copy of the Certificate of Conformance shall be returned with the log sheet to the SM(S).

If any damage is observed or suspected during installation, testing shall be required as detailed in NR/SMTH/Part04/CA06 (Renew a Plug Coupled Cable ("interconnect") with a Non-Certified Replacement).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CA08		
Replacing one end of a damaged "interconnect" cable		
Issue No: 04	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	a) Replacing one end of a plug coupled damaged cable ("interconnect")
Excludes:	b) Adding a section of cable between two plug coupled ends. (See NR/SMTH/Part04/CA04) c) Telecoms Tail cables (see NR/SMTH/Part/06)

GENERAL

Failure to isolate cables before disconnection can result in voltages being present on exposed pins or cable cores.

This test plan is applicable where a length of cable with a single plug coupler is to be spliced onto an existing plug coupled cable, e.g., when an existing plug coupler (or cable within the vicinity of a plug coupler) has been damaged and requires replacement.

Where possible, the whole cable should be replaced with a certified replacement before jointing is considered.

BEFORE INSTALLATION WORK

Existing Cable

1. Check identity of existing cable and receptacle/plug by checking it is labelled correctly to the diagram or by physically tracing.

2. Isolate the existing cable at both ends.

3. Unplug both ends.

Replacement Cable

4. Check that the replacement cable is the correct length and the plug coupler connector/configuration match the existing cable and are not damaged.

5. Check all cable cores are correctly labelled at jointing point.

DURING INSTALLATION WORK

6. Examine replacement cable plug coupler pins/sockets and existing receptacle for signs of contamination, moisture or degradation/damage.

AFTER INSTALLATION WORK

7. Check replacement cable cores are jointed as labelled.

8. CONTINUITY TEST all cores in the replacement cable using breakout boxes or disconnection links (excluding track circuit cables).

9. Check joints are secure and sealed.

10. INSULATION TEST the replacement cable using a breakout box or disconnection links (this shall be undertaken after joint is sealed).

11. Check plug in connecter is correctly aligned, is securely mated and is mechanically locked.

12. CABLE FUNCTION TEST the affected circuits.

13. Check the Test Plan for the item of equipment fed by the affected cable and carry out steps marked with an asterisk ✱.

14. Check or arrange for correct labelling of cables.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CA09		
Replace a panel mounted wired receptacle or plug (Non-Certified Replacement)		
Issue No: 03	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	a) MIL5015 panel mounted receptacles or plugs with prewired harness without a valid Certificate of Conformance or with missing environmental caps.
Excludes:	a) MIL5015 Sealed Supplier Certified panel mounted receptacles or plugs with prewired harness. b) MIL5015 Non-Supplier Certified panel mounted receptacles or plugs, with prewired harness which have been pre-tested in accordance with instructions from your Line Manager. c) All other types of Receptacles and plugs.

GENERAL

Failure to isolate cables and wires before disconnection can result in voltages being present on exposed pins.

This test plan is applicable where a panel mounted wired receptacle or plug, or its internal wiring harness has been damaged and requires replacement.

This test is not applicable if:

a) The replacement panel mounted wired receptacle or plug is still sealed and has a valid Certificate of Conformance attached to it.

b) The replacement panel mounted wired receptacle or plug is undamaged and the environmental seals (end caps) are fitted correctly.

On some of the early projects, panel mounted receptacles or panel mounted plugs were sometimes not completely populated, i.e., not all the pins or sockets had wires connected to them. This practise is now discontinued. This can mean that a replacement could have a number of wires which are not shown on the location diagrams.

Unterminated wires shall be bomb tail crimped and secured. The additional wire shall be added to and identified on the diagram.

Disconnected receptacles and plugs should be replaced one at a time.

BEFORE INSTALLATION WORK

1. Check identity of existing panel mounted receptacle or plug, by checking it is labelled correctly to the diagram or by physically tracing the wires from the harness.

2. Check that the replacement panel mounted receptacle or plug and its pre-wired harness, are not damaged and match the connector/configuration of the existing assembly.

3. WIRE COUNT the existing panel mounted receptacle or plug to the wiring diagram.

4. CONTINUITY TEST all cores in the replacement panel mounted receptacle or plug using breakout boxes.

5. INSULATION TEST the replacement panel mounted receptacle/plug using breakout boxes.

6. Note any links, and red dome nuts or equivalent, are correct to diagram.

7. Isolate both ends of the cable which is to be unplugged.

8. Check affected wires are isolated at terminated ends of the harness.

9. Remove the outgoing plug coupled cable, fit an environmental cap and secure it.

10. Examine cable plug coupler receptacle or plug and existing panel mounted receptacle or plug for signs of contamination, moisture, or degradation/damage. Confirm the O-ring seal is intact.

11. Check all wires are correctly labelled at their termination point.

AFTER INSTALLATION WORK

12. Check replacement wires are correctly terminated and correctly labelled.

13. Check the outgoing cable connector coupling ring is correctly aligned, is securely mated and is mechanically locked.

14. WIRE COUNT the replacement panel mounted receptacle or plug to the wiring diagram.

15. Check any links, and red dome nuts or equivalent, are correctly replaced to diagram and secure.

16. CABLE FUNCTION TEST the affected circuits.

17. Check the Maintenance Test Plan for the item of equipment fed by the affected cable and carry out steps marked with an asterisk*.

18. Check or arrange for correct labelling of the panel mounted receptacle or plug.

The following information shall be included with the SMTH log sheet:

a) Replacement receptacle or plug serial number.

b) The results of both the CONTINUITY TEST and the INSULATION TEST

END

Includes:	a) Sealed Supplier Certified panel mounted receptacles or plugs with prewired harness. b) Non-Supplier Certified panel mounted receptacles or plugs, with prewired harness which have been pre-tested in accordance with instructions from your SM(S). AND c) The replacement panel mounted wired receptacle or plug is undamaged and the environmental seals (end caps) are fitted correctly.
Excludes:	a) Panel mounted receptacles with missing environmental caps, or damage is suspected. b) All other types of receptacles and plugs.

GENERAL

Failure to isolate cables and wires before disconnection can result in voltages being present on exposed pins.

This test plan is applicable where a panel mounted wired receptacle or plug, or its internal wiring harness has been damaged and requires replacement.

If the environmental caps are missing or damaged the unit cannot be used and a replacement unit should be sourced.

On some of the early projects panel mounted receptacles or panel mounted plugs were sometimes not completely populated, i.e., not all the pins or sockets had wires connected to them. This practise is now discontinued. This can mean that a replacement could have a number of wires which are not shown on the location diagrams.

Unterminated wires shall be bomb tail crimped and secured. The additional wire shall be added to and identified on the diagram.

Disconnected receptacles and plugs should be replaced one at a time.

BEFORE INSTALLATION WORK

1. Check identity of existing panel mounted receptacle or plug, by checking it is labelled correctly to the diagram or by physically tracing the wires from the harness.

2. Check that the replacement panel mounted receptacle or plug and its pre-wired harness are not damaged and match the connector/configuration of the existing assembly.

3. WIRE COUNT the existing cable cores to the wiring diagram.

4. Note any links, and red dome nuts or equivalent, are correct to diagram.

5. Isolate both ends of the cable which is to be unplugged.

6. Check affected wires are isolated at terminated ends of the harness.

7. Remove the outgoing plug coupled cable, fit an environmental cap and secure it.

8. Examine cable plug coupler receptacle or plug and existing panel mounted receptacle or plug for signs of contamination, moisture, or degradation/damage. Confirm the O-ring seal is intact.

9. Check all wires are correctly labelled at their termination point.

AFTER INSTALLATION WORK

10. Check replacement wires are correctly terminated and correctly labelled.

11. Check the outgoing cable connector coupling ring is correctly aligned, is securely mated and is mechanically locked.

12. WIRE COUNT the replacement cable cores to the wiring diagram.

13. Note any links, and red dome nuts or equivalent, are correct to diagram.

14. CABLE FUNCTION TEST the affected circuits.

15. Check the Test Plan for the item of equipment fed by the affected cable and carry out steps marked with an asterisk *.

16. Check or arrange for correct labelling of panel mounted receptacle or plug.

The following information shall be included with the SMTH log sheet:

a) Replacement receptacle or plug serial number.

b) The Certificate of Conformance shall be returned to the SM(S).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CA11		
Replace a Non-Standard Westrace Plug Coupler Wiring Loom		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	Non-Standard Westrace Plug Coupler and Wiring Loom
Excludes:	All other plug coupler or wiring loom

This test plan is applicable only for a Non-Standard Westrace Plug Coupler Wiring Loom where its internal wiring harness or plug couplers has been damaged and requires replacement.

As each Non-Standard Westrace wiring loom is unique to the installation, this test is only applicable if:

- The replacement Non-Standard Westrace plug coupler has been specifically manufactured for the specific SOM24/Gland plate.
- The new Non-Standard Westrace plug coupler wiring is of suitable length to be installed.
- Specific authority from the S&TME is granted before the work takes place.

Failure to isolate the SOM24 modules and plug couplers to the Westrace Level Crossing Controller can result in unwanted aspect clearances, crossing operation or damage to the Westrace system.

Come to a clear understanding with the Signaller the extent of the work to be carried out, the equipment that will be affected by the work and the timescales involved in installation and testing.

Check routes are normalised, and level crossing is in Local Control and the barriers pumped into the raised position.

BEFORE INSTALLATION WORK

1. Obtain the agreement of the S&TME to use the replacement Non-Standard Westrace plug coupler harness.

2. Check replacement Non-Standard Westrace plug coupler is not damaged.

3. Check replacement Non-Standard Westrace plug coupler has safe insulation.

4. Check replacement Non-Standard Westrace plug coupler wiring is correct to the Non- standard Westrace plug coupler pin number. Refer to the site copies of the diagrams *

NOTE: *The diagrams refer the Non-Standard Westrace plug coupler analysis from the non-wire side.*

5. Check replacement Non-Standard Westrace plug coupler pins are the correct male or female pins to the site copy diagrams.

6. Check replacement Non-Standard Westrace plug coupler pins are of the correct length for mating male and female pins and that they are secure in the plug coupler base unit.

7. Check guide pins and jack screws are correct to the Non-Standard Westrace plug coupler site copy diagrams.

8. Check any wiring which has a requirement to be a twisted pair is correct to the site copy diagrams.

9. Continuity test all cores in the replacement Non-Standard Westrace plug coupler.

10. Check existing Non-Standard Westrace plug coupler is isolated from the supplies at all terminals and the SOM24 Module power supply is Isolated.

11. Wire count existing Non-Standard Westrace plug coupler terminals to the wiring diagram.

12. Check existing Non-Standard Westrace plug coupler terminals are correctly labelled.

13. Check using the site copy, the existing Non-Standard Westrace plug coupler wiring by physically tracing.

DURING THE INSTALLATION

- Remove the existing Non-Standard Westrace plug coupler from the SOM24 Module Connector Plate and or Gland Plate.
- Insert and secure the new Non-Standard Westrace plug coupler to the SOM24 Module Connector Plate and or Gland Plate ensuring the plug coupler is the correct orientation.
- Working in a logical order, carry out a "wire by wire" replacement of the existing Non-Standard Westrace plug coupler wiring harness with the new, removing each wire as soon as it is removed.
- Insulate each removed wire as soon as it is removed.

AFTER INSTALLATION WORK

14. Check replacement Non-Standard Westrace plug coupler is correctly installed on the correct SOM24 Module Connector Plate and / or Gland Plate and check the plug coupler retaining screws or clips for security.

15. Check replacement wires are correctly terminated.

16. Check terminated twisted pair wires are twisted up to 25mm (1 inch) from the terminals.

17. Wire count affected wires to the site diagrams.

18. Arrange for the Westrace Level Crossing Controller to be powered up and observe the module status indications.

NOTE: *Come to a clear understanding with the Signaller that the Westrace Level Crossing Controller is to be powered up and that all Signal Routes are normalized to minimalize unwanted aspects clearing to proceed SOM24 Modules are powered up* ✱

19. Check the Maintenance Test Plan for the item of equipment fed by the affected Non-Standard Westrace Plug Coupler and carry out steps marked with an asterisk ✱

NOTE: *If the affected Non-Standard Westrace plug coupler goes to a Level Crossing Controller, carry out a Level Crossing Sequence Test* NR/SMS/PartB/Test/070 (AHBC Operational Sequence Test) or NR/SMS/PartB/Test/075 (MCB Operational Sequence Test).

20. Earth Test circuits where designed to be earth free.

21. Check at the TF-L for any error messages on the Technician's terminal and arrange for them to be removed.

22. Check or arrange for correct labelling of the Non-Standard Westrace plug coupler.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CA12		
Remove and Refit a Multi-core Cable		
Issue No: 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	a) Tail cable and Multi-core cables. b) This includes a previously disconnected core or wire (proceed from step 6).
Excludes:	a) Single cable cores or wires (CA01). b) Cable cores or wires that are Broken (CA13). c) Telecoms cables (CAB001).

BEFORE DISCONNECTION

1. WIRE COUNT cable cores to the wiring diagram.
2. Check cable is correctly labelled.
3. Check cable cores are correctly labelled.
4. Check cable cores have safe insulation.
5. Record the position of any links, red dome nuts or equivalent.

AFTER RE-CONNECTION

6. Check cable cores are correctly installed and have not been damaged whilst disconnected.
7. Check cable cores are replaced as labelled.
8. Check the cable is not susceptible to mechanical damage.
9. WIRE COUNT the cable cores to the wiring diagram.
10. Confirm any links, and red dome nuts or equivalent, are correctly replaced and are secure.
11. Check with the Maintenance Test Plan for all items of equipment fed by the affected cable and carry out steps marked with an asterisk ✱.
12. CABLE FUNCTION TEST the affected cable.
13. Check or arrange for correct labelling of the cable or cable cores.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CA13		
Re-termination of a Broken Existing Cable Core or Wire		
Issue No: 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	A single cable core or wire which has broken or pulled loose from a crimp
Excludes:	a) Any re-termination where the reconnection point cannot be proved by use of the diagrams and/or tracing or electrical proving the circuit. b) Any disconnection that has been made in a controlled way and is labelled.

BEFORE RE-CONNECTION

1. Check for evidence on site, in signalling diagrams, plans, layouts and records that the wire was previously connected. If no evidence is found, stop and inform your SM(S).

2. Note any links, and red dome nuts or equivalent that are in place.

AFTER RE-CONNECTION

3. Check cable core/wire is correctly installed and has not been damaged whilst disconnected.

4. Check cable core/wire is replaced as labelled.

5. Check cable core/wire is not susceptible to mechanical damage.

6. WIRE COUNT the cable core/wire to the wiring diagram.

7. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.

8. INSULATION TEST the cable core/wire. This is not required for a track circuit bonding cable.

9. Check with the Test Plan for the item of equipment fed by the affected cable or wire and carry out steps marked with an asterisk ✱.

10. CABLE FUNCTION TEST the affected circuits (multicore signalling cables only and where more than one cable core has been removed at once).

11. Check or arrange for correct labelling of cable core/wire.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CA14		
Replace AZLM Axle Counter Lineside Cable		
Issue No: 01	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	AzLM Lineside 2, 10, and 20 pair cable replacement
Excludes:	All other cables

GENERAL

Before any work takes place, the following shall be undertaken:

a) Take possession of the relevant axle counter sections.

b) Disconnection of the output of the evaluator to the signalling system.

c) The EAK30K is to be powered down for this task by disconnection of the power supply at the REB or the local supply.

The output of the evaluator shall not be reconnected, and possession of the axle counters given up unless the equipment has passed all tests and is fit for use.

The Signaller is responsible for resetting the axle counter.

For Further Information see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

BEFORE INSTALLATION WORK

1. Where applicable, check EPR is applied to all sections fed by the cable under test.
2. Check that all EAK's fed by the cable are isolated.
3. Check and note position of any jumpers or links.
4. WIRE COUNT existing cable to the wiring diagram.
5. Check cable terminations associated with the existing cable are correctly labelled.
6. Check replacement cable is not damaged and of correct type.
7. Check replacement cable has safe insulation.
8. Check replacement cable is correctly labelled.

AFTER INSTALLATION WORK

9. Check replacement cable is not damaged and is correct type.
10. Check replacement cable is correctly installed.

NOTE: *See guidance on axle counter cable installation in NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems) and in Appendix A.*

11. WIRE COUNT replacement cable to the wiring diagram.

12. CONTINUITY TEST replacement cable.

13. INSULATION TEST replacement cable.

    NOTE: *Insulation testers should be set to 250V.*

14. Carry out a BALANCED PAIR TEST on all pairs.

    NOTE: *For BALANCED PAIR TEST see Appendix A.*

15. Reconnect power to all EAK's.

16. Check that both lights on all relevant serial cards are lit.

17. Request that all affected sections are reset, observe that the sections are restored to normal operation.

18. Observe ACE diagnostics and check that all affected EAK's are communicating with the ACE.

    NOTE: *ACE diagnostics should be checked after a period of 24 hours to confirm uninterrupted transmission between the ACE and EAK(s).*

APPENDIX A

Balanced Pair Test

For each pair of wires forming a circuit they should have resistance values to within 1 ohm of each other or 0.5% of the loop resistance for longer cables.

a) Take two cores for the circuit under test.

b) Choose a third core for reference.

c) Measure the loop resistance between the 1st core and reference core. Reading (1).

d) Measure the loop resistance between the 2nd core and reference core. Reading (2).

e) The difference in the two readings (1 & 2) is the 'unbalance 'in the pair.

f) Check that the difference in the readings is less than 1Ω.

Correct Installation

Cable insulation should be stripped back to a minimum of 8mm at all terminations (see Figure 1).

Confirm that the twist is maintained on each pair within the cable to within 25mm of termination (see Figure 2).

Figure 1 – Cables Stripped to a minimum of 8mm

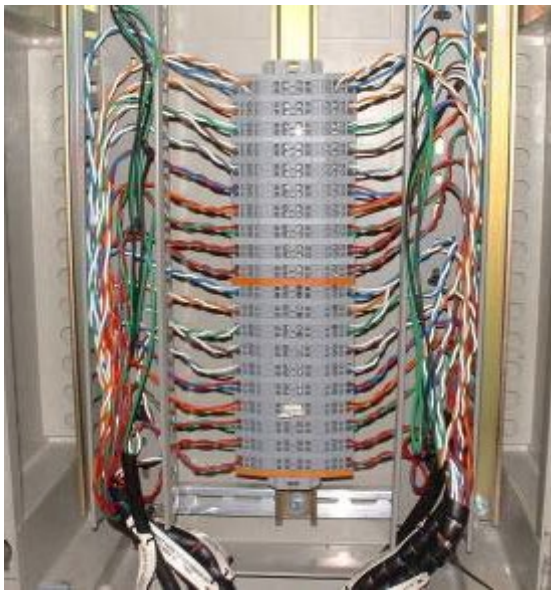


Figure 2 – Twist maintained up to the cable termination

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CA21		
Renew a Single Ended Plug Coupled Cable ("lead") with a Certified Replacement		
Issue No: 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	a) Supplier Certified Single Ended Plug Coupled Cable ("lead"). b) Unsealed Plug Coupled Cables or without a certificate which have been tested in accordance with instructions from your SM(S).
Excludes:	a) Single Ended Plug Coupled Cable ("lead") without a valid Certificate of Conformance (including missing environmental caps) or which cannot be certified/tested prior to use (use CA22 for uncertified cables). b) Where a cable has been laid out in preparation for installation and left unattended for a period of 28 days or more. c) Single Ended Plug Coupled Cable which are not fitted with a MIL5015 Specification plug or receptacle. (eg TPWS, Point machine, SSI cables etc.)

GENERAL

Do not use this test plan if:

a) There is doubt about the validity of the Certificate of Conformance, the cable packaging is damaged, or the environmental seals (weather caps) are missing.

b) The cable has been installed but left unconnected for 28 days or more.

c) If any damage is observed or suspected during installation, testing shall be required as detailed in NR/SMTH/Part04/CA22 (Renew a Single Ended Plug Coupled Cable ("lead") with a Non Certified Replacement).

BEFORE INSTALLATION WORK

Existing Cable

1. Check identity of existing cable and receptacle/plug by checking it is labelled correctly to the diagram or by physically tracing or positively electrically proving.

2. WIRE COUNT the existing cable to the wiring diagrams at the free end.

3. Check cable terminals associated with the existing cable are correctly labelled at the free end.

4. Note any links, and red dome nuts or equivalent, are correct to diagram.

5. Isolate the existing cable from the supply.

Replacement Cable

6. Check that the replacement cable is of the correct type, length and for physical damage.

7. Check that the Certificate of Conformance, packaging, seals and environmental caps are present and intact.

8. Check replacement cable is correctly labelled.

DURING INSTALLATION WORK

9. Examine replacement cable plug coupler pins/sockets and existing receptacles for signs of contamination, moisture, or degradation/damage. Confirm the O-ring seal is intact.

AFTER INSTALLATION WORK

10. Check that the cable has been correctly installed.

11. Check cables are replaced correctly to the wiring diagram (where more than one cable has been removed at once).

12. Check plug in connecters are correctly aligned, are securely mated and are mechanically locked.

13. WIRE COUNT the replacement cable cores to the wiring diagram.

14. Check any links, and red dome nuts or equivalent, are correctly replaced to diagram and secure.

15. CABLE FUNCTION TEST each circuit.

16. Refer to the Test Plan for the item of equipment fed by the affected cable and carry out the steps marked with an asterisk ✱.

17. On completion of the test plan a copy of the Certificate of Conformance shall be returned with the log sheet to the SM(S)

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CA22		
Renew a Single Ended Plug Coupled Cable ("lead") with a Non-Certified Replacement		
Issue No: 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	a) Single Ended Plug Coupled Cable ("lead") without a valid Certificate of Conformance (including missing environmental caps) or which cannot be certified/tested prior to use. b) Where a cable has been laid out in preparation for installation and left unattended for a period of 28 days or more. c) Single Ended Plug Coupled Cable which are not fitted with a MIL5015 Specification plug or receptacle. (eg TPWS, Point machine, SSI cables etc.)
Excludes:	a) Supplier Certified Single Ended Plug Coupled Cable ("lead"). b) Unsealed Plug Coupled Cables or without a certificate which have been tested in accordance with instructions from your line manager

GENERAL

Use this test plan if:

a) There is doubt about the validity of the Certificate of Conformance, the cable packaging is damaged, or the environmental seals (weather caps) are missing.

b) The cable has been installed but left unconnected for 28 days or more.

c) Damage is suspected during installation.

BEFORE INSTALLATION WORK

Existing Cable

1. Check identity of existing cable and receptacle/plug by checking it is labelled correctly to the diagram or by physically tracing or positively electrically proving.

2. WIRE COUNT the existing cable to the wiring diagrams at the free end.

3. Check cable terminals associated with the existing cable are correctly labelled at the free end.

4. Note any links, and red dome nuts or equivalent, are correct to diagram.

5. Isolate the existing cable from the supply.

Replacement Cable

6. Check that the replacement cable is of the correct type, length and for physical damage.

7. Check replacement cable is correctly labelled.

8. CONTINUITY TEST all cores in the replacement cable using breakout box/es, for cables above 12 core testing shall be carried out on the location disconnection links (excluding Track Circuit Cables).

9. INSULATION TEST the replacement cable using a breakout box/es, for cables above 12 core testing shall be carried out on the location disconnection links.

DURING INSTALLATION WORK

10. Examine replacement cable plug coupler pins/sockets and existing receptacles for signs of contamination, moisture, or degradation/damage. Confirm the O-ring seal is intact.

AFTER INSTALLATION WORK

11. Check that the cable has been correctly installed.

12. Check cables are replaced correctly to the wiring diagram (where more than one cable has been removed at once).

13. Check plug in connecters are correctly aligned, are securely mated and are mechanically locked.

14. WIRE COUNT the replacement cable cores to the wiring diagram.

15. Check any links, and red dome nuts or equivalent, are correctly replaced to diagram and secure.

16. CABLE FUNCTION TEST each circuit.

17. Refer to the Test Plan for the item of equipment fed by the affected cable and carry out the steps marked with an asterisk *.

18. Check or arrange for correct labelling of the panel mounted receptacle or plug.

The following information shall be included with the SMTH logbook sheet:

a) Cable and receptacle/plug identification.

b) Replacement receptacle or plug serial number.

c) Replacement receptacle serial number.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CA31		
Renew a Telegraph Line Wire		
Issue No: 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Telegraph Line wires (on Pole Routes)
Excludes:	All other type of Wire or Cable

BEFORE DISCONNECTION

1. **For Missing Wire/s Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. WIRE COUNT the Line wire to the wiring diagram.

3. Check Line wire is correctly labelled.

4. Check Line wire has safe insulation (if applicable).

AFTER RE-CONNECTION

5. Check Line wire is correctly installed and has not been damaged whilst disconnected.

6. Check the Line wire is correctly regulated.

7. Check the Line wire is not susceptible to mechanical damage.

8. WIRE COUNT the Line wire to the wiring diagram.

9. Check with the Maintenance Test Plan for the item of equipment fed by the affected Line wire/ and carry out steps marked with an asterisk ✱.

10. Check equipment fed by the Line wire operates correctly.

11. Check or arrange for correct labelling of Line wire.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CA32		
Remove and Refit a Telegraph Line Wire		
Issue No: 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Telegraph Line wires (on Pole Routes)
Excludes:	All other type of Wire or Cable

BEFORE DISCONNECTION

1. WIRE COUNT the Line wire to the wiring diagram.
2. Check Line wire is correctly labelled.
3. Check Line wire has safe insulation (If applicable).

AFTER RE-CONNECTION

4. Check Line wire is correctly installed and has not been damaged whilst disconnected.
5. Check Line wire is replaced as labelled.
6. Check the Line wire is correctly regulated.
7. Check the Line wire is not susceptible to mechanical damage.
8. WIRE COUNT on the Line wire to the wiring diagram.
9. Check with the Maintenance Test Plan for the item of equipment fed by the affected Line wire/ and carry out steps marked with an asterisk*.
10. Check equipment fed by the Line wire operates correctly.
11. Check or arrange for correct labelling of Line wire.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CA40		
Replace a Frauscher Concentrator 'Hotlink' Crossover Cable		
Issue No: 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Frauscher Concentrator 'Hotlink' Crossover Cable
Excludes:	All other Patch Cables

GENERAL

Electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

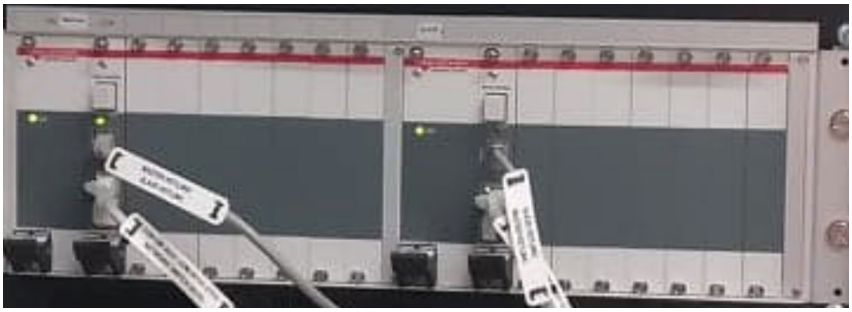


Figure 1 – Frauscher Concentrator 'Hotlink' Crossover Cable

BEFORE INSTALLATION WORK

1. Check that the replacement Hotlink Crossover Cable is of the correct type, version and is <2m long.
2. Check the replacement is not damaged.
3. Confirm the new cable is correctly labelled or transfer the labels from the existing cable during the replaced process.
4. Check identity of existing cable by physically tracing.
5. Check cable terminations are not damaged and are correctly labelled.

AFTER INSTALLATION WORK

6. Check each cable is correctly installed and secure.
7. Remove the currently (Master) operating System COM card and observe that the changeover to the (Slave) system occurs then repeat and observe that the system reverts back to starting arrangement of Master and Slave.
8. Confirm the Power and Status LEDs are indicating correct status on the PSC & COM cards.
9. If any Error indications are observed, further investigation shall be carried out. Refer to product O&MM.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CE01		
Replace a Secondary Cell or Battery		
Issue No: 09	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	All alkaline or acid secondary cells, used singly or as part of a battery
Excludes:	Telecoms cells or batteries

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check replacement cell/battery is not damaged and is correct type and that the total number of cells remains unaltered.

   The output voltage and power of the battery charger shall be as specified for the replacement cell or battery.

3. Isolate the charging supply.

4. WIRE COUNT any external wires connected to the existing cell or battery to the wiring diagram.

5. Check any external wires connected to the existing cell or battery are correctly labelled.

6. Check existing wiring has safe insulation.

7. Check circuits to/from the existing cell/battery are isolated from the supply.

AFTER INSTALLATION WORK

8. Check replacement cell/battery is correctly installed.

9. Check correct conductors are on the correct cell or battery terminals.

10. Check any external wires connected to the replacement cell or battery are replaced as labelled.

11. Reconnect the charging supply.

12. WIRE COUNT any external wires connected to the replacement cell or battery to the wiring diagram.

13. Check any links and red dome nuts, or equivalent, are correctly replaced and secure.

* 14. Check setting of battery charger by checking the charge current.

* 15. Test output voltage and polarity with the output disconnected.

16. Test voltage with the circuits restored.

17. Where earthed circuits are not used, carry out NR/SMS/PartB/Test/053 (Earth Leakage Detector (ELD): Testing and Calibration) or NR/SMS/PartB/Test/051 (Busbar Earth Test).

18. Check or arrange for correct labelling of unit.

Track Feed Sets Only

19. Test the track circuit concerned (Voltage, current, drop shunt, pick-up shunt). See NR/SMS/PartB/Test/251 (DC Track Circuit Test), Full Test.

Signal Lamps Only

20. Test the signal lamp (Lamp voltage, auxiliary filament). See NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/CE02		
Replace a Primary Cell or Battery		
Issue No: 08	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

***** NO RECORD OF TEST REQUIRED *****

Includes:	Primary cells used singly or as part of battery
Excludes:	Telecoms cells or batteries

BEFORE INSTALLATION WORK

1. Check replacement cell/battery is not damaged and is correct type and that the total number of cells remains unaltered.

2. Carry out a WIRE COUNT on any external conductors connected to the existing cell/battery to the wiring diagram.

3. Check existing wiring has safe insulation.

AFTER INSTALLATION WORK

4. Check replacement cell or battery is correctly installed.

5. Check correct conductors are on the correct cell or battery terminals.

6. Carry out a WIRE COUNT on any external conductors connected to the replacement cell/battery to the wiring diagrams.

* 7. Test output voltage and polarity with the output disconnected.

* 8. Test voltage with the circuits restored.

9. Carry out a EARTH TEST (DC) or EARTH TEST (AC) on supplies where earthed circuits are not used.

* 10. **For Track Feeds Only**: Carry out NR/SMS/PartB/Test/251 (DC Track Circuit Test), Full Test.

* 11. **For Signal Feeds Only:** Carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests),

* 12. **For TCAID Units Only:** Carry out NR/SMS/PartB/Test/043 (TCAID Test)

***NOTE**: TCAID Batteries fitted before 2019 are rated at 8v and all batteries fitted since 2020 are rated at 7.2v.*

13. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/DE01		
Replace a Detonator Placer		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Mechanical parts of detonator placer
Excludes:	All other types of detonator placer

It is the responsibility of the Signaller to provide detonators and to check that they are installed in the detonator placer correctly.

Replacement of the drive unit for power operated detonator placers is covered by the appropriate Electric Motor/Hydraulic Power Pack Maintenance Test Plan.

BEFORE INSTALLATION WORK

1. Check replacement detonator placer is not damaged and is correct type.

AFTER INSTALLATION WORK

2. Check replacement detonator placer is correctly installed.

3. Check new split pins are correctly installed.

4. Check lever is free to operate and correctly places detonators on railhead.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL01		
Replace a Fuse Holder		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	All types of fuse, link or arrestor holders
Excludes:	No exclusions

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Check replacement holder is not damaged and is correct type.
3. Check existing holder is isolated from supply.
4. WIRE COUNT existing holder to the wiring diagram.
5. Check existing wiring has safe insulation.
6. Check existing wiring is correctly labelled.

AFTER INSTALLATION WORK

7. Check replacement holder is correctly installed.
8. Check wiring is replaced as labelled.
9. WIRE COUNT replacement holder to the wiring diagram.
10. Check correctly rated fuse, link or arrestor is inserted.
11. Carry out an EARTH TEST (DC) or EARTH TEST (AC) where the circuit is designed to be earth free.
12. Check with the Maintenance Test Plan for the item of equipment fed via the holder and carry out steps marked with an asterisk "*".

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL02		
Replace a Barrelled or Clip in Component		
Issue No: 07	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Fuses, links, and clip in arrestors
Excludes:	SSI security fuses

General

This Maintenance Test Plan is not required when disconnecting and reconnecting a fuse or link for isolation purposes.

BEFORE INSTALLATION WORK

1. Check for any evidence of wiring or component damage, short circuits, scorching, strong smells or unusual amounts of moisture which might require attention.

2. Check replacement component is not damaged and is correct type.

AFTER INSTALLATION WORK

3. Check replacement component is correctly installed.

4. Check the fuse remains intact whilst operating each item of equipment fed by the fuse **(FUSES ONLY).**

5. Test circuit current with the maximum number of functions fed by the fuse energised **(FUSES ONLY).**

6. Check at least one item of equipment fed via the component operates correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL03		
Replace a Wire Ended Component		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Two wired component, resistor, capacitor, choke, track resistor, track capacitor, track rectifier, track diode, track tuning cards
Excludes:	All other types of component.

BEFORE INSTALLATION WORK

1. Check replacement component is not damaged and is correct type.
2. WIRE COUNT existing component terminals to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring is correctly labelled.
5. Check existing component is Isolated from the supply.

AFTER INSTALLATION WORK

6. Check replacement component is correctly installed.
7. Check wiring is replaced as labelled.
8. WIRE COUNT replacement component terminals to the wiring diagram.
9. Check any links, and red dome nuts or equivalent, are secure and correctly replaced.
10. Test voltage with input and output circuits restored.
11. EARTH TEST (DC) or EARTH TEST (AC) circuits and supplies where designed to be earth free.
12. Check or arrange for correct labelling of unit.
13. Check with the Maintenance Test Plan for the item of equipment fed via the component and carry out steps marked with an asterisk "✱ ".

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL04		
Replace a Filament Lamp		
Issue No: 09	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	All filament lamps fitted signals
Excludes:	Filament Panel Lamps. Signal Light Modules (SLM)

***** INDEPENDENCE EXEMPT *****

***** NO RECORD OF TEST REQUIRED *****

GENERAL

Do not touch Quartz Halogen lamps with your bare hands. If this occurs, the glass shall be cleaned with methylated spirits.

When replacing Halogen Lamp 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.

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check replacement lamp is not damaged and is correct type.

3. Check lamp holder is not damaged.

4. Carry out INSULATION TEST replacement lamp (minimum 2M ohms terminals to base), **(LEVEL CROSSING FILAMENT LAMPS ONLY).**

AFTER INSTALLATION WORK

5. Check replacement lamp is correctly installed.

* 6. Check lamp illuminates.

7. Carry out EARTH TEST (DC) or EARTH TEST (AC) barrier supply **(LEVEL CROSSING FILAMENT LAMPS ONLY).**

Signal Lamps Only

* 8. Test signal lamp NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests) and record the test measurements on the appropriate NR/SMS record card, together with the reason for the test.

9. Test that lamp proving is effective NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) and record the test measurements on the appropriate NR/SMS record card, together with the reason for the test.

10. Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check) **(MECHANICAL SEARCHLIGHT SIGNAL LAMPS ONLY).**

11. Check signal head door fits correctly (door seal intact, no case damage, no extraneous light enters).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL05		
Replace a Filament Lamp Holder and/or Springs		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Pre-focused filament lamp holder assembly, Filament lamp holder alone (for signals that do not require critical focusing, such as position light signals and alphanumeric indicators), Individual springs within a filament lamp holder
Excludes:	Lamp holder alone, for signals that require critical focusing, such as long range signals and most position light junction indicators, Signal Light Modules (SLM)

Removal and replacement of the lamp is covered by Maintenance Test Plan NR/SMTH/Part04/EL04 (Replace a Filament Lamp) which shall be used to replace it into the holder.

For signals with pre-focused lamp holder assemblies, the complete optical assembly including lens holder and lamp holder shall be replaced, with seals intact.

BEFORE INSTALLATION WORK

1. Check replacement item is not damaged and is correct type.
2. WIRE COUNT existing holder to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring is correctly labelled.

AFTER INSTALLATION WORK

5. Check replacement item is correctly installed and lamp springs correctly tensioned (The insertion of the lamp shall produce a visible movement on the springs).
6. Check correct filter colour **(INTEGRAL OPTICAL ASSEMBLY ONLY).**
7. Check that the red notches on the lamp holder and optical unit are aligned **(ANSALDO SD 321 SIGNALS ONLY).**
8. Check wiring is replaced as labelled.
9. WIRE COUNT holder to the wiring diagram.
10. Check inserted lamp is correct type.
11. Check lamp illuminates.
12. Check for correct alignment of holder.
13. Check that no extraneous light enters signal head **(SIGNAL LAMP HOLDERS/SPRINGS ONLY).**

14. Carry out an EARTH TEST (DC) or EARTH TEST (AC) where supplies are designed to be earth free.

* 15. Test signal lamp NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests) and record the test measurements on the record card, together with the reason for the test (**SIGNAL LAMP HOLDERS/SPRINGS ONLY).**

16. Test that lamp proving is effective NR/SMS/PartB/Test/022 (Signal Lamp and Light Module Proving Tests) and record the test measurements on record card, together with the reason for the test **(SIGNAL LAMP HOLDERS/SPRINGS ONLY).**

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL06		
Replace a Terminal Block		
Issue No: 07	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	All BA style terminal blocks, clamp type terminations, chocolate strip, binding post, terminal blocks in disconnection boxes.
Excludes:	Replacement of BA style terminal blocks with clamp type terminations.

BEFORE INSTALLATION WORK

1. Check replacement terminal block is not damaged and is correct type.
2. Check position of any affected links, and red dome nuts or equivalent, is recorded in the record of test (see guidelines on links in NR/L3/SIG/10064/B002 (Disconnections).
3. WIRE COUNT existing terminal block to the wiring diagram.
4. Check cable core numbers to the wiring diagram.
5. Check existing wiring has safe insulation (intact around crimps or precisely stripped for clamp type terminations).
6. Check existing wiring is correctly labelled.
7. Check existing terminal block is Isolated from the supply.

AFTER INSTALLATION WORK

8. With the wiring disconnected INSULATION TEST replacement terminal block (minimum 2M ohms terminals to earth).
9. Check replacement terminal block is correctly installed.
10. Check wiring is replaced as labelled.
11. WIRE COUNT replacement terminal block to the wiring diagram.
12. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
13. Check terminations are secure and suitably protected.
14. CABLE FUNCTION TEST the affected circuits (terminal blocks for multicore signalling cables only).
15. Check with the Maintenance Test Plan for the item of equipment fed via the terminal block and carry out steps marked with an asterisk "*".
16. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL07		
Replace a Non Plug in Unit		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Earth fault detector, shelf type relay (with non-detachable top), metal clad relay, shelf type/metal clad lamp proving relays, block relay unit, timing relay, polar bias relay, polar stick relay, neutral polar relay, contactor, AC vane relay, FDM equipment, signal flashing aspect unit, wicket gate solenoid
Excludes:	Inverter, converter, track circuit relay, relay with detachable top, code follower relay, code transmitter, panel switches, ATP equipment, TPWS FIU

BEFORE INSTALLATION WORK

1. Check replacement unit is not damaged and is correct type and free of internal contamination.

   Extra care should be taken when checking Polar relays, as there are occasions when the same catalogue number applies to a number of “Types” (ie 2/3 position, N/C/R bias, coil resistance, etc).

   The bias might be determined by examining the de-energised position of the contact arm. Centre biased relays are 3 position (See the relay equipment standard for details).

2. Check that any transportation locking mechanism has been removed.

3. WIRE COUNT existing unit to the wiring diagram.

4. Check existing wiring has safe insulation.

5. Check existing wiring is correctly labelled.

6. Check existing unit is isolated from the supply.

7. Check replacement unit is correctly sealed.

8. Check replacement relay is magnetically latched in same position as the one to be replaced **(LATCHED RELAYS AND POLAR STICK RELAYS ONLY).**

   Such relays shall only be changed one at a time.

9. Note and record the jumper settings W1, W2, W3 and W4 – any replacement ICDR unit requires a jumper adding, using a wire wrapping tool, to the same setting (refer to the Ansaldo O&M manual for more information). **(TRACK CIRCUIT MONITORING UNIT (ICDR) ON ANSALDO SIGNALLED AREAS ONLY).**

AFTER INSTALLATION WORK

10. Check replacement unit is correctly installed (Unit is level).

11. Check replacement unit has shrouds fitted to all vertical terminals and no metallic debris in the vicinity.

12. Check wiring is replaced as labelled.

13. WIRE COUNT replacement unit to the wiring diagram.

14. Check wire wrap jumpers on either W1, W2, W3 or W4 have been correctly installed (**TRACK CIRCUIT MONITORING UNIT (ICDR) ON ANSALDO SIGNALLED AREAS ONLY).**

15. EARTH TEST (DC) or EARTH TEST (AC) supply where designed to be earth free.

* 16. Test signal lamp whilst both flashing and steady. NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests) and record the test measurements on the record card, together with the reason for the test **(SIGNAL LAMP PROVING RELAYS AND SIGNAL FLASHING ASPECT UNITS ONLY).**

* 17. Check replacement unit operates correctly.

Polar relays shall have both the normal and reverse operation checked (and the centre position, where applicable).

Check correct operation means observing the correct operation of the unit itself and confirming correct operation of one function operated by the unit. For example, a route can be set, points operated normal and reverse, etc.

It also includes checking that any timing mechanism which is contained within the circuits of the replacement unit or associated with it continues to operate within its design specification as shown on the circuits and control tables.

* 18. Check unit de-energises when the correct number of illuminated lamps are removed and the unit becomes energised when the correct number of lamps are fitted. **(LAMP PROVING RELAYS ONLY).**

* 19. **FDM EQUIPMENT ONLY:** Measure and record, voltages, TX level and RX levels, on the record card, together with the reason for the test.

* 20. BLOCK CONTROLS TEST replacement unit **(BLOCK RELAY UNITS AND BLOCK REPEAT RELAYS ONLY).**

* 21. BLOCK RECOVERY TEST replacement unit **(BLOCK RELAY UNITS AND BLOCK REPEAT RELAYS ONLY).**

* 22. Test for correct time delay according to the wiring diagram **(TIMING RELAYS ONLY).**

* 23. Check replacement unit is correctly sealed **(TIMING RELAYS ONLY).**

24. Test for each polarity **(POLARISED CIRCUITS ONLY).**

25. Check sensitivity of unit **(EARTH FAULT DETECTOR ONLY).**

26. Check wicket gate cannot be opened when locked **(WICKET GATE SOLENOID ONLY).**

27. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL08		
Replace a Plug in Unit		
Issue No: 09	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	***** INDEPENDENT EXEMPT *****
	Earth fault detector, converter, transformer rectifier, neutral relay, AC vane relay, timing relay, FDM units, individual geographical unit relays, lamp proving relays, Londex pulse generator, 5P point contactor units.
	***** NOT INDEPENDENT EXEMPT *****
	Latched relay, polarised magnetic stick relay, DC polarised moving iron relay. Shelf type relays with detachable tops (Remax).
Excludes:	Lamp, track circuit relay, panel switches, ATP equipment, SSI modules, TPWS Modules, Westlock modules, Westplex modules

GENERAL

During relay replacement, record the information required in accordance with NR/L2/SIG/11129, to enable the SM(S) to update the relay database.

For “Londex pulse generators” (when no spare is available) check pins 11 & 12 (P & R on later units) on the disconnected plug have been linked using red jumper wire labelled at both ends.

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check replacement plug-in unit is not damaged (contact spring alignment, internal contamination including zinc flakes, relay comb alignment, loose object) and is correct type.

3. Check any wiring between the bottom half of the detachable top and the relay terminals has safe insulation **(DETACHABLE TOP RELAYS ONLY).**

4. Test any wiring between the bottom half of the detachable top and the relay terminals is correct **(DETACHABLE TOP RELAYS ONLY).**

5. Check plugboard is free of contamination.

6. Check signal box controlling device, relays, and either equipment on the ground or the state of any detection, are in correspondence.

7. Check replacement plug-in unit is correctly sealed.

8. Check replacement relay is latched in the correct position (see wiring diagram) **(LATCHED RELAYS & POLARISED MAGNETIC STICK RELAYS ONLY).**

Latched and polarised magnetic stick relays shall only be changed one at a time.

AFTER INSTALLATION WORK

9. Check spades are locked in the plugboard (this might not be practicable on some geographical relay units).

10. Check any replacement plug-in unit is correctly installed and the retaining clip is in place.

11. Check replacement plug-in unit operates correctly.

NOTE: *Check correct operation means observing the correct operation of the unit itself and confirming correct operation of one function operated by the unit. For example, a route can be set, points operated normal and reverse, etc. It also includes checking that any timing mechanism which is contained within the circuits of the replacement unit, or associated with it, continues to operate within its design specification as shown on the circuits and control tables.*

12. Check or test sensitivity of unit **(EARTH FAULT DETECTOR ONLY).**

13. Test input voltage, output voltage and polarity **(TRANSFORMER/RECTIFIER & CONVERTER ONLY).**

14. Test for correct time delay according to the wiring diagram. **(TIMING RELAYS ONLY).**

15. Check replacement plug-in unit is correctly sealed **(TIMING RELAYS ONLY).**

16. Check replacement plug-in unit de-energises when the correct number of illuminated lamps are removed and becomes energised when the correct number of lamps are refitted **(LAMP PROVING RELAYS ONLY).**

17. Test FDM equipment for Voltage, TX level, RX level, background and record the test measurements on the record card, together with the reason for the test **(FDM EQUIPMENT ONLY).**

18. Test for each polarity **(POLARISED CIRCUITS ONLY).**

19. Test pulse ring circuits for correct timing according to the wiring diagrams **(LONDEX PULSE GENERATORS ONLY).**

20. BLOCK CONTROLS TEST **(DC POLARISED MOVING IRON RELAY ONLY).**

21. POINT DETECTION AND CORRESPONDENCE TEST equipment **(5P POINT CONTACTOR UNITS ONLY).**

22. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL09		
Remove and Replace a Plug in Unit - Relay		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Earth fault detector, converter, transformer rectifier, neutral relay, AC vane relay, track circuit relay, timing relay, FDM units, individual geographical unit relays, lamp proving relays, latched relay, polarised magnetic stick relay, DC polarised moving iron relay, TPWS Modules and FS2600 receiver units.
Excludes:	Lamp, panel switches, ATP equipment, SSI modules, Westlock modules, Westplex modules, Londex pulse generator, 5P point contactor units and geographical relay units/sets

This test plan is only to be used when the same plug in unit/relay is being removed & re-fitted within a short space of time for the following purposes:

a) Testing of contacts.

b) Checking the front of a relay base for silver migration/contamination.

c) Checking the front of spades for security/integrity.

Relays/plug in units shall only be removed & refitted one at a time when using this test plan.

***** INDEPENDENCE EXEMPT *****

***** NO RECORD OF TEST REQUIRED *****

BEFORE REMOVAL WORK

1. Check rear of the plug board is free of contamination.

2. Check signal box controlling device, relays, and either equipment on the ground or the state of any detection, are in correspondence.

3. Check latched position of end relay to verify it is replaced in the same position. **(LATCHED RELAYS & POLARISED MAGNETIC STICK RELAYS ONLY).**

AFTER REPLACEMENT WORK

4. Check spades are locked in the plug board (this may not be practicable on some geographical relay units).

5. Check plug-in unit/relay is correctly installed and the retaining clip/pin is in place.

6. Check latched position of relay to ensure it has been installed in the same position. **(LATCHED RELAYS & POLARISED MAGNETIC STICK RELAYS ONLY).**

7. Check plug-in unit/relay operates correctly.

8. Check correct operation means observing the correct operation of the unit itself and confirming correct operation of one function operated by the unit.

For example, a route can be set, points operated normal and reverse, etc.

It also includes checking that any timing mechanism which is contained within the circuits of the replacement unit, or associated with it, continues to operate within its design specification as shown on the circuits and control tables.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL10		
Replace an Audible Unit		
Issue No: 07	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Yodalarm, Annunciator, Box alarm, Barrier bell
Excludes:	Block bells

BEFORE INSTALLATION WORK

1. Check replacement audible unit is not damaged and is correct type.
2. WIRE COUNT existing audible unit to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring is correctly labelled.

AFTER INSTALLATION WORK

5. Check replacement audible unit is correctly installed (Unit is facing in correct direction).
6. Check wiring is replaced as labelled.
7. WIRE COUNT replacement audible unit to the wiring diagram.
8. For devices fitted to emit voice messages, confirm the jumper on the circuit board is fitted in the correct position (see Appendix A).
9. Check terminations are secure and suitably protected.
10. Check any cable is secured.
11. Carry out EARTH TEST (DC) or EARTH TEST (AC) on circuits and supplies, where designed to be earth free.
12. Check audible unit operates correctly (Another Train Coming feature) and is meets the requirements of the site-specific assessment that determine the levels at each location.
13. For devices fitted to emit voice messages, confirm the correct message is being given for both the normal passage of a train and the “Another Train Coming” warning.
14. Check night-time sound output meets the requirements of the site-specific assessment **(INDEPENDENT DAY/NIGHT SETTINGS ONLY).**

APPENDIX A - Voice Message Audible Warning Units

1. There are considerable differences between the circuit feeding an existing Yodalarm and the new unit. Instead of adjusting sound levels by resistor on the audible warning control unit, the new units have individual volume controls for day and night settings internal to the units.

2. The change between day and night is achieved by reducing the supply voltage to 12V. The new unit recognises the lower voltage and switches to the night volume level.

3. As supplied, the new units are set for an output of 80dB by day and 70dB at night, (measured at 3m on axis). If required to adjust the sound levels to better suit local conditions, then the internal volume controls can be adjusted. Set the day level first as it also sets the maximum night level. Then adjust the night level to finish.

4. When used at automatic crossings with ATC circuits, a jumper shall be removed from the circuit board (see Figure 1). In this form the voice message only occurs on the ATC tone. 4 seconds of standard ATC tone are followed by a 4 second voice message “WARNING – ANOTHER TRAIN IS APPROACHING”, then repeats the sequence continually.

5. This unit can also be used at MSL type crossings that have no ATC circuits. In this case the jumper shall be retained (see Figure 1), and the voice message occurs on the “first train” tone. 4 seconds of tone are followed by a 4 second voice message “WARNING – MORE THAN ONE TRAIN MAY BE APPROACHING”, then repeats the sequence continually.

6. For the positions of terminals and the volume controls see the local diagrams.

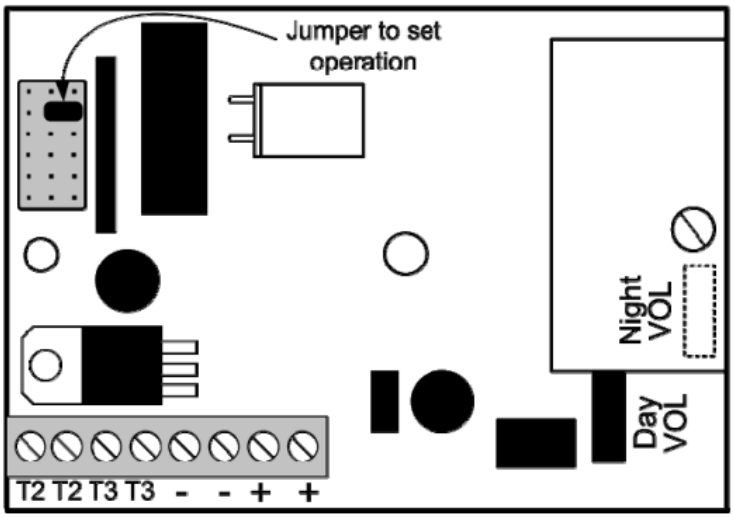


Figure 1 – Jumper and Day and Night Volume Control Positions

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/EL11		
Replace a Push Button or Switch Unit		
Issue No. 06	Issue Date: 01/09/18	Compliance Date: 01/12/18

Includes:	Emergency replacement switch, Absent switch, Train ready to start switch (TRTS), Axle counter switch, Barrier limit switch, Barrier door microswitch, Barrier boom microswitch, Level crossing operators control switches.
Excludes:	Domino panel switch, Point microswitch, Block switch, Time switch, Sealed releases.

BEFORE INSTALLATION WORK

1. Check replacement unit is Not Damaged and is Correct Type.
2. WIRE COUNT existing unit to the wiring diagram.
3. Check existing wiring has Safe Insulation.
4. Check existing wiring is Correctly Labelled.
5. Check existing unit is Isolated from supply.

AFTER INSTALLATION WORK

6. Check replacement unit is Correctly Installed.
7. Check replacement unit is secure and locating pin is engaged. **(SQUARE D EMERGENCY REPLACEMENT SWITCH ONLY)**
8. Check wiring is replaced as labelled.
9. WIRE COUNT replacement unit to the wiring diagram.
10. Check any links, and red dome nuts or equivalent, affected by the work (or testing) are correctly replaced and secure.
11. EARTH TEST (DC) or EARTH TEST (AC) circuit where designed to be earth free.
12. Test that the affected micro-switch only makes and breaks in the appropriate positions as specified in the wiring diagrams. (**BARRIER LIMIT SWITCH ONLY)**
13. Check circuit operates correctly for all positions of the replacement unit.
14. Check or arrange for Correct Labelling of unit.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL12		
Replace a Plugboard		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Plugboard for all plug-in components
Excludes:	

BEFORE INSTALLATION WORK

1. Check replacement plugboard is not damaged and is correct type (pin code) and is of a non-phenolic type where applicable.

2. Check replacement plugboard and capacitor assembly is not damaged and is correct type (Pin code) and capacitor is correct value **(PLUGBOARD AND TRACK CIRCUIT VITAL DETECTION CIRCUIT CAPACITOR (TH) ASSEMBLY ON ANSALDO SIGNALLED AREAS ONLY).**

3. Check detection circuit capacitor is secure **(PLUGBOARD AND TRACK CIRCUIT VITAL DETECTION CIRCUIT CAPACITOR (TH) ASSEMBLY ON ANSALDO SIGNALLED AREAS ONLY).**

4. WIRE COUNT existing plugboard to the wiring diagram.

5. Check existing wiring has safe insulation.

6. Check existing wiring is correctly labelled.

7. Check and Record the position of the relay **(REDUNDANT CIRCUITRY ONLY, EITHER PERMANENTLY ENERGISED OR PERMANENTLY DE-ENERGISED RELAYS).**

AFTER INSTALLATION WORK

8. Check replacement plugboard is correctly installed.

9. Check wiring is replaced as labelled.

10. Check connections are securely locked in the plugboard.

11. WIRE COUNT the replacement plugboard to the wiring diagram.

12. Check item of equipment fitted to the plugboard is correctly installed and the retaining clips in place.

13. Check with the Maintenance Test Plan for the item of equipment fitted to this plugboard and carry out steps marked with an asterisk "*" **(EXCLUDING PERMANENTLY DE-ENERGISED RELAYS).**

14. Check for correct operation of each back contact carrying a working circuit by partially withdrawing each back contact relay spade in turn. At the end of this test, repeat the WIRE COUNT to the wiring diagram **(PERMANENTLY DE-ENERGISED RELAYS ONLY).**

15. Check for correct voltage and polarity across the coil. Check for correct operation of each relay contact carrying a working circuit by isolating the relay coil **(PERMANENTLY ENERGISED RELAYS ONLY).**

16. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL13		
Re-allocate a Contact		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Relay contacts
Excludes:	Replacing a contact

General

If a relay is removed, a Maintenance Test Plan shall be used to replace it into the plugboard.

BEFORE INSTALLATION WORK

1. Check replacement contact is on the correct item of equipment.
2. Check replacement contact is correct type (Arm, front, back, bottom).
3. Check replacement contact is spare and not damaged.
4. Check all other contacts of the affected item of equipment are not damaged.
5. WIRE COUNT existing contact to the wiring diagram.
6. Check existing wiring has safe insulation.
7. Check that replacement contacts make and break in the correct positions as specified in the wiring diagrams.
8. Check existing wiring is correctly labelled for both the original contact position and temporary re-allocation.
9. Check existing contact is Isolated from the supply.

AFTER INSTALLATION WORK

10. Check terminations are secure and suitably protected.
11. Check wiring is replaced as temporarily labelled.
12. Check wiring diagrams show the alteration.
13. WIRE COUNT re-allocated contact to the amended wiring diagram.
14. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
15. Test that the function performed by the contact replaced operates correctly.
16. The Maintenance Test Plan/s for the equipment fed by the reallocated contact should be checked and any requirement marked with an asterisk "*"carried out.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL14		
Replace a Geographical Relay Unit		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	All types of geographical units
Excludes:	Individual relays within geographical units

BEFORE INSTALLATION WORK

1. Check replacement geographical unit is not damaged (contact spring alignment, internal contamination, loose object) and is correct type.

2. Check ball bearing is not loose **(WESTPAC MK.1 EQUIPMENT ONLY).**

3. Check relays in replacement geographical unit are latched in the correct position **(LATCHED RELAYS ONLY).**

AFTER INSTALLATION WORK

4. Check replacement geographical unit is correctly installed (Relays, external connections).

5. Check replacement geographical unit operates correctly.

   Check correct operation means observing the correct operation of the unit itself and confirming correct operation of each relay within the unit. For example, a route can be set, points operated normal and reverse, etc.

6. Test relays in replacement geographical unit for correct time delay according to the wiring diagram (TIMING RELAYS ONLY).

7. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL15		
Replace a Contact		
Issue No: 07	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Individual contacts in: point machines, Electrical point detectors, Hand crank cut-out assemblies, Signal heads, Signal machines, Signal arm contact box, Detonator placers, Electro-mechanical banner signals and Barrier equipment
Excludes:	Mechanical treadles

BEFORE INSTALLATION WORK

1. Check replacement contact is not damaged and is correct type.
2. Wire count existing contact to wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring is correctly labelled.
5. Check existing contact is Isolated from the supply.

AFTER INSTALLATION WORK

6. Check replacement contact is correctly installed.
7. Check wiring is replaced as labelled.
8. Wire count replacement contact to the wiring diagram.
9. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
10. Check terminations are secure and suitably protected.
11. Check wires and cables are secure and clear of moving parts.
12. Carry out an EARTH TEST (DC) or EARTH TEST (AC) on the supplies and circuits, if designed to be earth free. (For point detection circuits this shall be done for both Normal and Reverse power operations).
13. Test that the replacement contact only makes and breaks in the correct positions as specified in the wiring diagram.
14. Carry out a Point Detection Test NR/SMS/Test/010 to 013 and record the results on the record card, together with the reason for the test **(HAND CRANK CUT-OUT CONTACTS IN DETECTION CIRCUITS ONLY).**
15. Check function operated by the replacement contact operates correctly.

16. The Maintenance Test Plan/s for the equipment fed by the renewed contact should be checked and any requirement marked with an asterisk * carried out.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL16		
Replace a Panel Tile		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Domino panel switch/push button
Excludes:	All other panel tiles

***** INDEPENDENCE EXEMPT *****

BEFORE INSTALLATION WORK

1. Check replacement tile is not damaged and is correct type.
2. Check replacement tile detail to faceplate drawing.

AFTER INSTALLATION WORK

3. Check replacement tile is correctly installed.
4. Check tiles are correctly positioned to the fascia plate diagram **(WHEN MORE THAN ONE TILE REMOVED).**
5. Check switches and buttons operate correctly for all positions.
6. Check that the replacement tile displays the correct indications.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/EL17		
Replace an Electromagnetic Lock		
Issue No. 02	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Armature, Lock body, Cables, Fixings, Brackets.

BEFORE INSTALLATION WORK

1. Check replacement part is Not Damaged and is Correct Type.
2. WIRE COUNT terminals to existing wiring diagram.

AFTER INSTALLATION WORK

3. Check the replacement part is Correctly Installed.
4. Check the armature and lock body are aligned correctly.
5. The armature requires to have some movement to allow it to mate cleanly with the lock. Check this movement is adequate for correct mating.
6. Check cable is not liable to be damaged mechanically in normal operation.
7. WIRE COUNT the replacement part to the wiring diagram.
8. Carry out SMS Test 210 Electromagnetic Lock Test.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL18		
Remove and Refit a Contact Bank		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

***** INDEPENDENCE EXEMPT *****

Includes:	Complete contact banks associated with signal arm contact boxes, Barrier equipment and Lever contact boxes, where no wires are disconnected and no re-tensioning of contacts is carried out.
Excludes:	All other types of Contact Bank.

BEFORE INSTALLATION WORK

1. Check position of contact bank seating, marking position if required.
2. Check existing contact bank has safe insulation.
3. Check existing contact bank is correctly labelled.

AFTER INSTALLATION WORK

4. Check contact bank is correctly installed.
5. Check wires and cables are secure and clear of moving parts.
6. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL19		
Replace a Printed Circuit Board (PCB) in an Ansaldo T72 Point Machine Junction Box		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Ansaldo T72 point machine junction box with integral PCB only
Excludes:	Any other type of PCB

BEFORE INSTALLATION WORK

1. Arrange protection of the particular points with the Signaller.

2. Check replacement PCB assembly is not damaged and is correct type.

3. WIRE COUNT existing PCB terminations to the wiring diagram.

4. Note position of plug couplers and ‘dummy‘ plug coupler(s) (i.e. no cable attached), if fitted.

5. Check existing wiring has safe insulation.

6. Check PCB point heater supply cable (2 core) and point control/detection cable (3 core) are isolated.

AFTER INSTALLATION WORK

7. Check replacement PCB assembly is correctly installed.

8. Check plug couplers and ‘dummy‘ plug coupler(s), if applicable, have been correctly installed.

9. WIRE COUNT replacement PCB terminations to the wiring diagram.

10. Check in conjunction with the Signaller, the lie of points is detected and indicated correctly for both positions of point.

* 11. Carry out a POINT DETECTION AND CORRESPONDENCE TEST on the affected ends.

12. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL20		
Removing Dim resistor associated with LED signal head/signal module		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Replacement of a filament head with an LED head and a like for like replacement of a SL35 filament lamp with a LED SL35 module when the Signal can display a flashing aspect
Excludes:	Planned alterations to signals undertaken with design

General

The 'dim' resistor is provided to increase the life of a filament lamp but can prevent an LED unit from displaying a flashing aspect.

The exact details of the circuit can be different to those shown in Appendix A. If this is the case the new circuit shall be drawn out and passed to your SM(S).

BEFORE WORK BEGINS

1. Identify whether the signal is controlled from SSI or from relays.
2. Identify whether the signal is capable of displaying a flashing aspect and whether this is a flashing single, flashing double yellow or flashing green.
3. Check that the wiring associated with the feed to the signal matches the available wiring diagrams.
4. Apply temporary label to the wire(s) to be removed and insulated or through crimped.
5. Isolate the feed to the signal head either by powering down the TFM or removing the fuse to the signal head circuits.

AFTER REPLACING SIGNAL HEAD

6. Check that the wires identified in step 4 have either been insulated (bombed) or through crimped.
7. Check the site records have been amended to show the changed wiring.
8. Undertake a wire count.
9. Remove temporary labels.
10. Reconnect power to the signal head.
11. ASPECT TEST the signal for all aspects including flashing aspects.
12. Record details of wiring change and pass this information to your SM(S) to allow master drawings to be amended.

APPENDIX A - Wiring Diagrams

Examples show circuits for flashing yellow, similar changes required for double yellow and where flashing green is provided.

Diagram A - extract from T28333

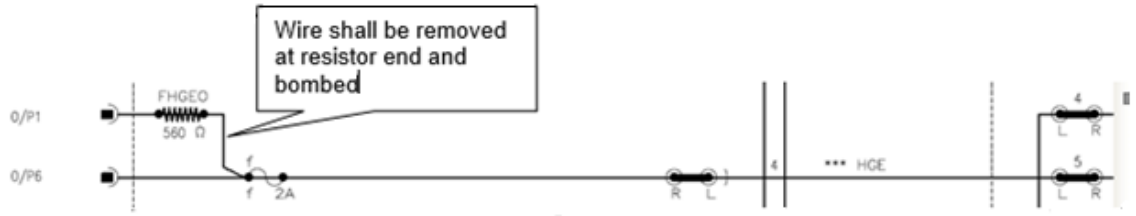


Diagram B – extract from T28330

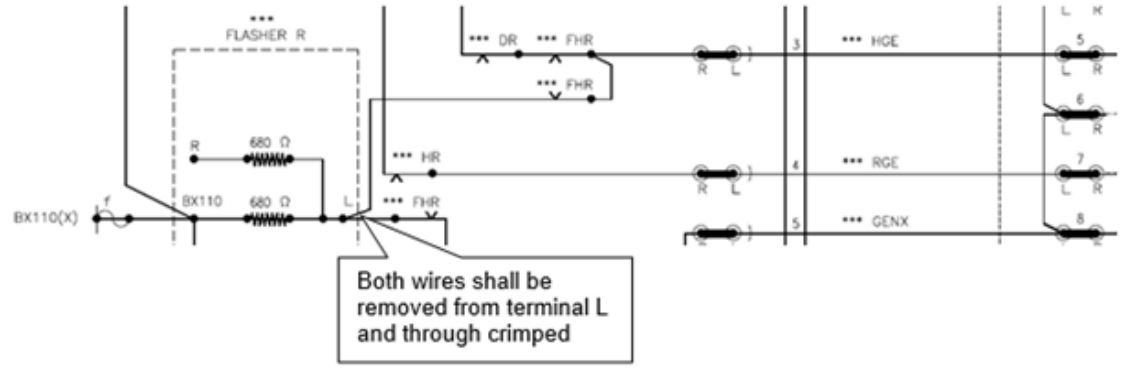


Figure 1 – Circuit Examples

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL21		
Replace a Light Emitting Diode (LED) Signal Light Module (SLM)		
Issue No: 07	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Individual LED SLMs
Excludes:	Complete signals fitted with LED SLMs

BEFORE INSTALLATION WORK

1. Note whether the existing 'on' aspect has two red lights or one red and one white. (POSITION LIGHT SIGNALS ONLY).

2. Check replacement SLM is not damaged and is correct type.

   Different types of SLMs are provided for mounting below and above the driver's eye level.

3. WIRE COUNT existing SLM to the wiring diagram.

4. Check existing wiring has safe insulation.

5. Check existing wiring is correctly labelled.

AFTER INSTALLATION WORK

6. Check replacement SLM is correctly orientated for its application.

7. Check that hood is correctly installed and is correct type.

8. Check wiring is replaced as labelled.

9. WIRE COUNT SLM to the wiring diagram.

10. Check that the SLM correctly illuminates.

11. EARTH TEST (DC) or EARTH TEST (AC) supplies where designed to be earth free.

* 12. Test LED SLM. Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Test) and record the test measurements on the record card, together with the reason for the test.

13. Check for correct beam alignment, carry out NR/SMS/PartC/SG00 (Signals: General) - Beam Alignment.

* 14. ASPECT TEST signal.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL22		
Replace a Howells LED SL35 Light Engine		
Issue No. 04	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Howells LED SL35 Light Engine
Excludes:	Conventional SL35, other types of LED Signal Module

***** NOT INDEPENDENCE EXEMPT *****

GENERAL

When changing LED units, check the correct colour LED unit is placed in the correct aspect aperture. Each LED unit is designed to fit in place of an SL35 or SL18 filament lamp.

The LED colours are indicated by a coloured sleeve fitted to the Main and Common wires extending from the unit. Green shall only be fitted to a Green Aspect.

A white LED unit shall only be fitted to a white aspect.

MK2 LED SL35 Light Engines are not compatible with smooth DC power supply.

These units become hot during service. A cool down period is required before removing the unit.

BEFORE INSTALLATION WORK

1. Check LED SL35 light engine is not damaged, is correct type, free of contamination.
2. Check the colour of the module light engine corresponds to the colour of the aspect it is being fitted to.

   NOTE: *(Colour coding of the light engine is denoted by the colour of the sleeve on the Main (M) and Common (C) unit wiring).*

3. WIRE COUNT existing wiring.
4. Check existing wiring is correctly labelled.
5. Check lamp holder is not damaged.
6. Check that the aspect to be replaced is isolated from the supply.

AFTER INSTALLATION WORK

7. Check LED SL35 light engine is correctly installed and orientated, and the lamp springs are holding the unit in the correct position.

8. WIRE COUNT LED SL35 light engine.

9. Check LED SL35 light engine colour corresponds to the colour of the aspect.

   NOTE: *(Colour coding of the light engine is denoted by the colour of the sleeve on the Main (M) and Common (C) unit wiring and on colour plate on rear of PCB).*

10. Check terminations are secure and suitably protected.

11. Check aspect illuminates and displays correct colour.

* 12. Test each LED SL35 light engine voltage NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests – Voltage Test. Values are recorded in NR/SMS/PartZ/Z01 (Signal – Reference Values).

13. Record the test measurements on the record card together with the reason for the test.

* 14. Test that lamp proving is effective for each LED SL35 light engine that has been replaced NR/SMS/PartB/Test/022 (Signal Lamp and Light Module Proving Tests). Record on the record card together with the reason for the test.

15. Check the correspondence of each aspect (or test correspondence of each SSI telegram) to its associated signal box indication or aspect repeat relay.

16. Check signal head door fits correctly (door seal intact, no case damage, no extraneous light enters, and cable entry sealed).

17. Check for correct beam alignment NR/SMS/PartC/SG00 (Signals General).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL23		
Replace a Dispatch Interface Unit		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Dispatch Interface Unit (DIU) as shown in the identification images below
Excludes:	All other types or styles of Dispatch Interface Unit

GENERAL

Asset Identification Image

Figure 1 – Dispatch Interface Units

BEFORE INSTALLATION WORK

1. Check replacement Interface Unit is not damaged, is correct type.
2. If the fascia plate is to be replaced, check the replacement has the correct markings and is the correct fascia colour. If the fascia plate is not being replaced, remove it and set it to one side for reuse.
3. The unit sighting/alignment shall be confirmed, and witness marks installed if required.
4. Isolated all wiring to the unit.
5. WIRE COUNT existing unit to the wiring diagram.
6. Check existing wiring has safe insulation.
7. Check existing wiring is correctly labelled.

AFTER INSTALLATION WORK

8. Check the fascia plate has the correct markings and is the correct colour.
9. Check replacement unit is securely mounted and correctly sighted/aligned.
10. Check all terminations are secure and tight.
11. WIRE COUNT replacement unit to the wiring diagram.

12. Reconnect all wiring to the unit.

13. Carry out a correspondence test between the dispatcher's activation unit and the replaced indicator.

14. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL24		
Replace an Encapsulated LED Indicator		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

***** INDEPENDENCE EXEMPT *****

Includes:	Encapsulated LED Indicator
Excludes:	All other types of LED Indicator or light unit

GENERAL

Asset Identification Images

Figure 1 – Encapsulated LED Indicators

BEFORE INSTALLATION WORK

1. Check replacement Indicator is not damaged, correct colour and is correct type.
2. WIRE COUNT existing unit to the wiring diagram.
3. Disconnect the power supply.
4. Check existing wiring has safe insulation.
5. Check existing wiring is correctly labelled.
6. Check existing unit is isolated from supply.

AFTER INSTALLATION WORK

7. Check replacement unit is correctly installed.
8. Check replacement unit is securely mounted
9. WIRE COUNT replacement unit to the wiring diagram.
10. Check wiring is replaced as labelled.
11. Reconnect the power supply.
12. Carry out a correspondence test between the system controlling the illumination of the LED and the replaced LED indicator.
13. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/EL25		
Replace an Automatic Gate Closer		
Issue No. 1	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Gate closer tube, Clamp plate, Chassis and Brackets.
Excludes:	All other Gate closer and Gate fittings

Equipment Identification

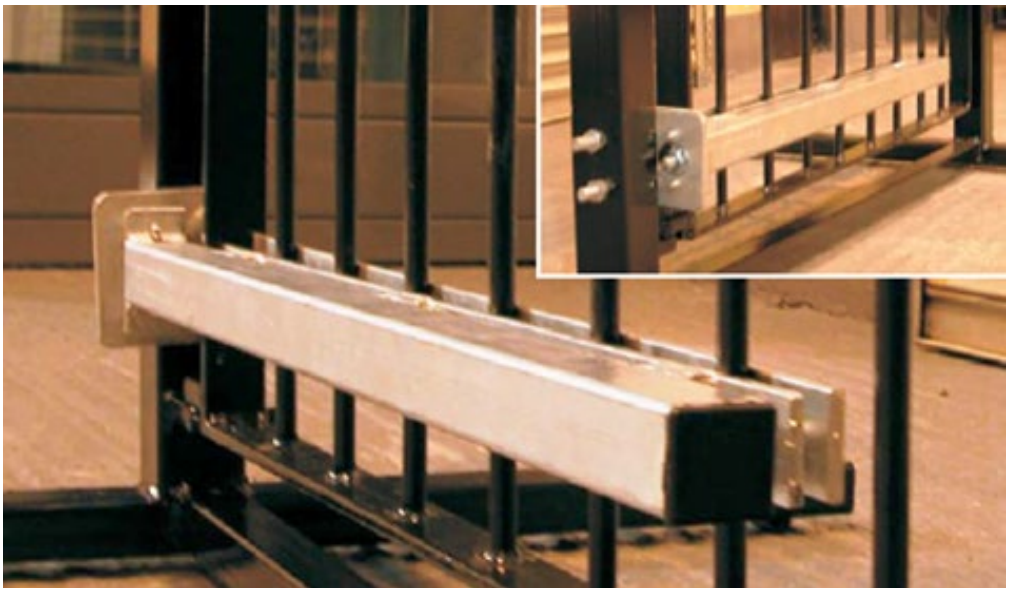


Figure 1 - Automatic Gate Closer

BEFORE INSTALLATION WORK

1. Check replacement part is Not Damaged and is Correct Type.

2. Check Clamp plate and Chassis is Not Damaged and is aligned correctly.

3. Insert locking pin in the articulated joint to stop the closer tube retracting into the chassis housing during the removal process (Figure 2).

Figure 2 – Locking Pin Insertion

AFTER INSTALLATION WORK

4. Check the replacement part is Correctly Installed.

5. Check the Clamp plate and Chassis are aligned correctly.

6. Check the gate completes it travel and locks from the following points:

    a) From a fully open.

    b) From a mid-swing.

    c) From quarter-swing.

    d) From 50mm from the closed position.

7. Carry out closing speed test of the gate closer, from fully open to the closed and locked position of 10 seconds (+/- 2 seconds).

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL26		
Replace an ABB Power Switch		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	ABB Power Switch OT16F3
Excludes:	All other Power Switches

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 - ABB Power Switch OT16F3

BEFORE INSTALLATION WORK

1. Check that the replacement Power Switch is of the Correct Type and is Not Damaged.
2. Check the replacement is the correct version (modification level).
3. Verify the location of the faulty Power Switch.
4. Switch the Power Switch to the off position
5. Isolate the supply to the Power Switch and verify this by using a volt meter on the input terminals.
6. WIRE COUNT the Power Switch and check the wires have safe insulation and are correctly labelled.

7. Remove the wires from the Power Switch and insulate them.

8. Remove the Power Switch from the DIN rail and label it as faulty.

AFTER INSTALLATION WORK

9. Check that the replaced Power Switch is securely mounted on the DIN rail.

10. WIRE COUNT the Power Switch and check all cables are correctly installed and secure.

11. Reconnect the power supply and check the input voltage.

12. Switch the Power Switch to the ON position and check the output voltage.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL27		
Replace an Intelligent Infrastructure Busbar Monitor		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 06/06/2021

Includes:	All types of Intelligent Infrastructure Signalling Busbar Monitor (II-BMD)
Excludes:	All other types of Busbar or Earth Leakage Monitoring

***** INDEPENDENCE EXEMPT *****

BEFORE INSTALLATION WORK

1. Check the replacement unit is the correct type, not damaged and correctly sealed and where GPRS comms is required the SIM card has been activated.
2. Inform the remote monitoring system operator of the site details and the device serial number.
3. Confirm the Identity of the unit to be replaced.
4. WIRE COUNT the II-BMD plug couplers to the wiring diagram.
5. Check existing wiring has safe insulation.
6. Check existing wiring is correctly labelled.
7. Check existing unit is isolated from the supply.

AFTER INSTALLATION WORK

8. Check the device is correctly installed and securely mounted.
9. WIRE COUNT the II-BMD plug couplers to the wiring diagram and verify all wiring is secure.
10. Check the antenna or Ethernet cable is securely connected.
11. Reconnect the power supply.
12. Visually check the unit has powered up and is displaying the correct indications, including the run light flashing

The following steps require use of the manufacturers' II-BMD diagnostic application:

13. Check the diagnostic display site specific information correlates with the wiring diagram.
14. Check the value of earth loop resistance is less than 40 ohms. Where the value is greater than 40 ohms refer to II-BMD installation and maintenance instructions.

15. Test the voltage of each monitored busbar in turn with a digital multi-meter (150k shunt fitted) and simultaneously check the associated channel voltage is within a tolerance of + / - 5%.

16. Check the display value for each busbar leg is > 50KΩ. Connect a 47KΩ test resistor between an earth terminal and each busbar leg in turn for 10 seconds; observe the displayed value for the associated input falls to <50KΩ. (Where the value for either leg of a busbar is <=50KΩ do not proceed with the test for the affected busbar).

17. Report any values of resistance to earth below the reportable level in accordance with earth fault management procedures.

18. Check the data from the unit is being received correctly in the II system.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL28		
Replace a CHINFA DRP20 Redundancy Unit		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	CHINFA DRP20 Redundancy Unit (20A)
Excludes:	All other types of CHINFA Redundancy Unit

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 - CHINFA DRP20 Redundancy Unit

BEFORE INSTALLATION WORK

1. Check that the replacement Redundancy unit is of the Correct Type and is Not Damaged.
2. Check the replacement is the correct version (modification level).
3. Verify the location of the faulty Redundancy unit.
4. Isolate the supply to the Redundancy Unit and verify this by using a volt meter on the input terminals.
5. WIRE COUNT the Redundancy Unit and check all the wires have safe insulation and are correctly labelled.

6. Remove the wires from the Redundancy Unit and insulate them.

7. Remove the Redundancy Unit from the DIN rail and label it as faulty.

AFTER INSTALLATION WORK

8. Check that the replaced Redundancy Unit is securely mounted on the DIN rail.

9. WIRE COUNT the Redundancy Unit and check all cables are correctly installed and secure.

10. Reconnect the power supply and check the input and output voltages.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL29		
Replace a Furse Surge or Lightning Protector		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	Furse ESP 120-5A Surge Protectors and Furse ESP CCTV/B Video Lightning Protector
Excludes:	All other Surge / Lightning Protectors

Appropriate electrostatic precautions shall be taken when handling boards. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Images

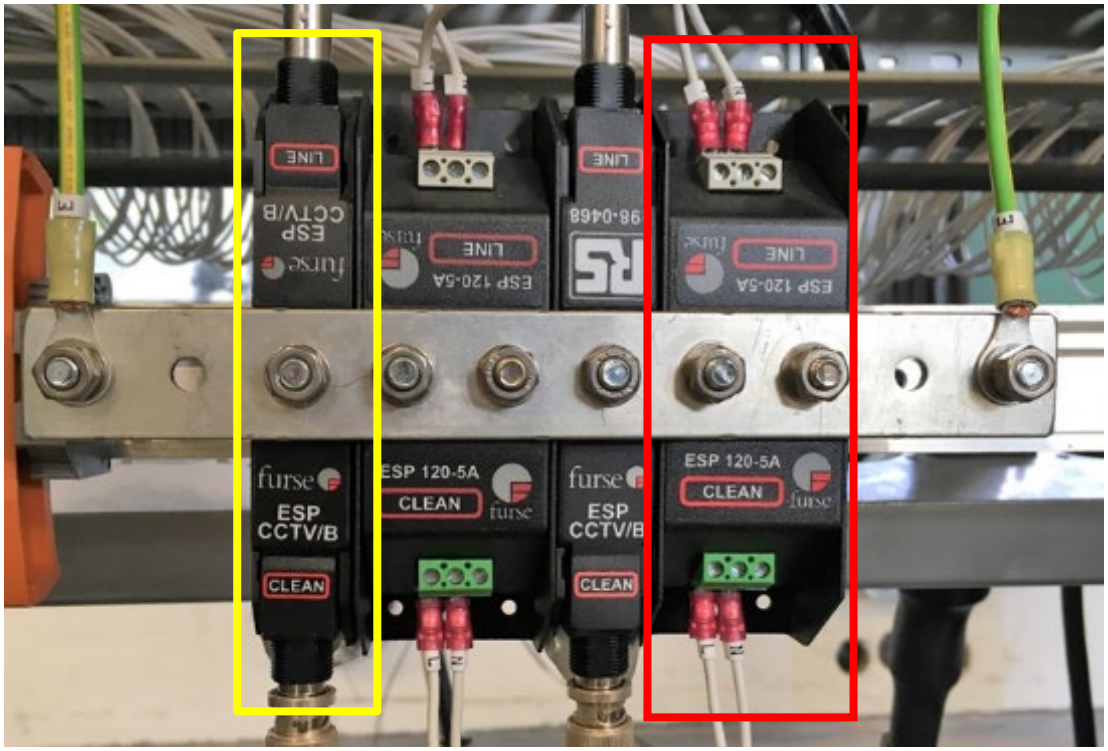


Figure 1 - A Furse ESP CCTV/B Video Lightning Protector and a Furse ESP 120-5A Surge Protector

BEFORE INSTALLATION WORK

1. Check that the replacement Protector is of the Correct Type and is Not Damaged.

2. Verify the location of the faulty Protector.

3. WIRE COUNT the Protector and check the wires have safe insulation and are correctly labelled.

4. Remove the wires / coaxial cables from the Protector and insulate them.

5. Remove the Protector from the Earth Bar and label it as faulty.

AFTER INSTALLATION WORK

6. Check that the replaced Protector is securely mounted.

7. WIRE COUNT the Surge Protector and check all cables / coaxial cables are correctly installed and secure.

8. Check the input and outputs are within the acceptable range.

    - 90 – 150 VAC

9. Observe or ask the Signaller to observe the CCTV Monitor is displaying the correct picture.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL30		
Replace a GE UPS Inverter Module		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	GE UPS Inverter Module
Excludes:	All other types of Invertor Module

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 - GE UPS Inverter Module

BEFORE INSTALLATION WORK

1. Check that the replacement Inverter Module is of the Correct Type and Version (modification level).
2. Check the replacement is Not Damaged.
3. Verify the location of the faulty Inverter Unit.
4. Remove the Inverter Module and label it as faulty.

This Module does not require powering down or disconnection as it is a plug-in unit

AFTER INSTALLATION WORK

5. Check that the replaced Inverter Module is securely mounted.
6. Verify the Green LED in the top left of the unit is lit.
7. Reset module count via GE UPS Inverter Monitor webpage.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL31		
Replace a GE UPS Inverter Monitor Module		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	GE UPS Inverter Monitor Module
Excludes:	All other types of Invertor Monitor Module

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 - Inverter Monitor Module

BEFORE INSTALLATION WORK

1. Check that the replacement Inverter Monitor Module is of the Correct Type and Version (modification level).
2. Check the replacement is Not Damaged.
3. Verify the location of the faulty Module.
4. Remove the ethernet cable.
5. Remove the Inverter Monitor Module and label it as faulty.

This Monitor Module does not require powering down

AFTER INSTALLATION WORK

6. Check that the replaced Inverter Monitor Module is securely mounted.
7. Check the Ethernet cable are secure.
8. Configure GE UPS Inverter Monitor Module as shown in the ASM Configuration Documentation.
9. Verify the Green LED is lit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL32		
Replace a GE UPS Rectifier Controller Module		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	GE UPS Rectifier Controller Module
Excludes:	All other types of Rectifier Controller Module

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 - Rectifier Controller Module

Figure 2 - Alarm Configuration Jumpers

BEFORE INSTALLATION WORK

1. Check that the replacement Rectifier Controller Module is of the Correct Type and Version (modification level).

2. Check the replacement is Not Damaged.

3. Verify the location of the faulty Module.

4. Remove the Rectifier Controller Module and label it as faulty.

   This Controller Module does not require powering down.

5. Confirm that the Configuration Jumpers (Figure 2) on the new module are in the same positions as the old module.

AFTER INSTALLATION WORK

6. Check that the replaced Rectifier Controller Module is securely mounted and the control screen is illuminated.

   Scroll through the menu to verify it is responding.

7. Configuration as shown in ASM Configuration Documentation.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL33		
Replace a GE UPS Rectifier Module		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	GE UPS Rectifier Module
Excludes:	All other types of Rectifier Module

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 - Rectifier Module

BEFORE INSTALLATION WORK

1. Check that the replacement Rectifier Module is of the Correct Type and Version (modification level).

2. Check the replacement is Not Damaged.

3. Verify the location of the faulty Module.

4. Remove the Rectifier Module and label it as faulty.

   This Rectifier Module does not require powering down

AFTER INSTALLATION WORK

5. Check that the replaced Rectifier Module is securely mounted.

6. Verify the Green LED is illuminated.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL34		
Replace a Miniature Circuit Breaker		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Hager Miniature Circuit Breakers (MCB), Schneider Miniature Circuit Breakers (MCB)
Excludes:	All other types Miniature Circuit Breakers (MCB)

Equipment Identification Image

Figure 1 - Hager type MCB

Figure 2 - Schneider type MCB

BEFORE INSTALLATION WORK

1. Check that the replacement MCB is of the correct type and is not damaged.
2. Verify the location of the faulty MCB.
3. Switch the MCB to the off position
4. Isolate the supply to the MCB and verify this by using a volt meter on the input terminals.
5. WIRE COUNT the MCB and check the wires have safe insulation and are correctly labelled.
6. Remove the wires from the MCB and insulate them.
7. Remove the MCB and label it as faulty.

AFTER INSTALLATION WORK

8. Check that the replaced MCB is securely mounted.
9. WIRE COUNT the MCB and check all cables are correctly installed and secure.
10. Reconnect the power supply.
11. Switch the MCB ON position and check the final function operates.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL35		
Replace a SIPLUS LOGO Power Supply		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	SIPLUS LOGO Power supply unit 24v 1.3A
Excludes:	All other types of Power supply

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 - SIPLUS LOGO Power Supply Unit

BEFORE INSTALLATION WORK

1. Check that the replacement Power Supply Unit is of the Correct Type and Version (modification level).
2. Check the replacement is Not Damaged.
3. Verify the location of the faulty Power Supply Unit.
4. Isolate the supply to the Power Supply Unit and verify this by using a volt meter on the input terminals.
5. WIRE COUNT the Power Supply Unit and check the wires have safe insulation and are correctly labelled.
6. Remove the Power Supply Unit and label it as faulty.

AFTER INSTALLATION WORK

7. Check that the replaced Power Supply Unit is securely mounted.

8. WIRE COUNT the Power Supply Unit and check all cables are correctly installed and secure.

9. Reconnect the supply and test the incoming and outgoing supply.

END

Includes:	A PULS CPS20.241 or CP10.241 Power Supply
Excludes:	All other types of Power Supply

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 - CP10.241 Power Supply

Figure 2 - CPS20.241 Power Supply

BEFORE INSTALLATION WORK

1. Check that the replacement Power Supply Unit is of the Correct Type and Version (modification level).
2. Check the replacement is Not Damaged.
3. Verify the location of the faulty Power Supply Unit.
4. Isolate the supply to the Power Supply Unit and verify this by using a volt meter on the input terminals.

5. WIRE COUNT the Power Supply Unit and check the wires have safe insulation and are correctly labelled.

6. Remove the Power Supply Unit and label it as faulty.

AFTER INSTALLATION WORK

7. Check that the replaced Power Supply Unit is securely mounted.

8. WIRE COUNT the Power Supply Unit and check all cables are correctly installed and secure.

9. Reconnect the supply and test the incoming and outgoing supply.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL37		
Replace a PULS Redundancy Unit		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	PULS 12-28Vdc Redundancy Unit
Excludes:	All other types of Redundancy Unit

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 - Redundancy Unit

BEFORE INSTALLATION WORK

1. Check that the replacement Redundancy Unit is of the Correct Type and Version (modification level).
2. Check the replacement is Not Damaged.
3. Verify the location of the faulty Power Supply.
4. Isolate the supply to the Redundancy Unit and verify this by using a volt meter on the input terminals.
5. WIRE COUNT the Redundancy Unit and check the wires have safe insulation and are correctly labelled.
6. Remove the Redundancy Unit and label it as faulty.

AFTER INSTALLATION WORK

7. Check that the replaced Redundancy Unit is securely mounted.

8. WIRE COUNT the Redundancy Unit and check all cables are correctly installed and secure.

9. Reconnect the supply and test the incoming and outgoing supply.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL38		
Replace a Powerone AC-DC Converter		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	Powerone AC-DC Converter (PSU)110/24v 14A
Excludes:	All other types of Power Converter

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 - Powerone AC-DC Converter

BEFORE INSTALLATION WORK

1. Check that the replacement AC-DC Converter is of the Correct Type and Version (modification level).
2. Check the replacement is Not Damaged.
3. Verify the location of the faulty AC-DC Converter.
4. Isolate the supply to the AC-DC Converter and verify this by using a volt meter on the input terminals.
5. WIRE COUNT the AC-DC Converter and check the wires have safe insulation and are correctly labelled.
6. Remove the AC-DC Converter and label it as faulty.

AFTER INSTALLATION WORK

7. Check that the replaced AC-DC Converter is securely mounted.

8. WIRE COUNT the AC-DC Converter and check all cables are correctly installed and secure.

9. Reconnect the supply and check the incoming and outgoing supply are within tolerances.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL39		
Replace a Schneider Relay		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	Schneider 90 – 240VAC Relay
Excludes:	All other types of relay

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 - Schneider Relay

BEFORE INSTALLATION WORK

1. Check that the replacement Schneider Relay is of the Correct Type and is Not Damaged.
2. Check the replacement is the correct version (modification level).
3. Verify the location of the faulty Schneider Relay.
4. Isolate the supply to the Schneider Relay and verify this by using a volt meter on the input terminals.
5. WIRE COUNT the Schneider Relay and check the wires have safe insulation and are correctly labelled.
6. Remove the wires from the Schneider Relay and insulate them.
7. Remove the Schneider Relay and label it as faulty.

AFTER INSTALLATION WORK

8. Check that the replaced Schneider Relay is securely mounted.

9. WIRE COUNT the Schneider Relay and check all cables are correctly installed and secure.

10. Reconnect the power supply and check the input voltage.

11. Verify the Green LED is lit

12. Check the final function operates correctly.

END

Includes:	Unipart Rail Standard Shunt
Excludes:	All other types of relay

Equipment Identification Image

Figure 1 – Standard Shunt

BEFORE INSTALLATION WORK

1. Check that the replacement Standard Shunt is of the Correct Type and is Not Damaged.

   These units are now colour coded to aid identification

2. Check the replacement is the correct version (modification level).

3. Verify the location of the faulty Standard Shunt.

4. Remove the plug couplers from the Standard Shunt.

5. Remove the Standard Shunt and label it as faulty.

AFTER INSTALLATION WORK

6. Check that the replaced Standard Shunt is securely mounted.

7. Reconnect the plug couplers, checking correctly installed and secure.

8. Confirm the module output for the replaced shunt is working correctly.

END

Includes:	Siemens SITOP PSU200M
Excludes:	All other SITOP Power Supply Units

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 – SITOP PSU200M

BEFORE INSTALLATION WORK

1. Check that the replacement Power Supply Unit is of the Correct Type and Version (modification level).
2. Check the replacement is Not Damaged.
3. Verify the location of the faulty Power Supply Unit.
4. Isolate the supply to the Power Supply Unit and verify this by using a volt meter on the input terminals.
5. WIRE COUNT the Power Supply Unit and check the wires have safe insulation and are correctly labelled.
6. Remove the Power Supply Unit and label it as faulty.

AFTER INSTALLATION WORK

7. Check that the replaced Power Supply Unit is securely mounted.

8. WIRE COUNT the Power Supply Unit and check all cables are correctly installed and secure.

9. Reconnect the supply and test the incoming and outgoing supply.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL43		
Replace a Siemens SITOP UPS1600 UPS Unit		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	Siemens SITOP UPS1600 UPS Unit
Excludes:	All other SITOP UPS's

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 - SITOP UPS 1600

BEFORE INSTALLATION WORK

1. Check that the replacement UPS Unit is of the Correct Type and Version (modification level).

2. Check the replacement is Not Damaged.

3. Verify the location of the faulty UPS Unit.

4. Isolate the supply to the UPS Unit and verify this by using a volt meter on the input terminals.

5. WIRE COUNT the UPS Unit and check the wires have safe insulation and are correctly labelled.

6. Remove the UPS Unit and label it as faulty.

AFTER INSTALLATION WORK

7. Check that the replaced UPS Unit is securely mounted.

8. WIRE COUNT the UPS Unit and check all cables are correctly installed and secure.

9. Reconnect the supply and configure as shown in the ASM Configuration Documentation

10. Test the incoming and outgoing supply.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL44		
Replace a Phoenix Contact - Battery Management Module Unit		
Issue No: 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Phoenix Contact Battery Management Module Unit
Excludes:	All other types of Battery Management Module Unit

GENERAL

Electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 – QUINT Battery Management Module

BEFORE INSTALLATION WORK

1. Check that the replacement Battery Management Module Unit is of the correct type and version.
2. Check the replacement is not damaged.
3. Verify the location of the faulty Battery Management Module Unit.
4. Switch the UPS from mains operation to service mode (press and hold service button >6 seconds).
5. Check UPS has entered Service Mode by checking indications.
6. Remove all the fuses from the Battery Management Module.
7. WIRE COUNT the Battery Management Module Unit and check the wires have safe insulation and are correctly labelled.
8. Disconnect the UPS and battery connections to the Battery Management Module Unit.
9. Remove the Battery Management Module Unit and label it as faulty.

AFTER INSTALLATION WORK

10. Check that the replaced Battery Management Module Unit is securely mounted.

11. Reconnect the UPS and battery connections to the Battery Management Module Unit.

12. WIRE COUNT the Battery Management Module Unit and check all cables are correctly installed and secure.

13. Replace all the fuses from the Battery Management Module Unit.

14. Switch the UPS from service mode back to mains operation (press and hold service button >1 seconds).

15. Check UPS has entered Normal Mode by checking indications.

END

Includes:	Phoenix Contact Power Supply QUINT4-PS/1AC/24DC/10 PSU
Excludes:	All other Phoenix Contact Power Supply Unit

GENERAL

Electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 – QUINT PSU (Unpowered / Powered)

BEFORE INSTALLATION WORK

1. Check that the replacement Power Supply Unit is of the correct type and version (modification level).

2. Check the replacement is not damaged.

3. Verify the location of the faulty Power Supply Unit.

4. Isolate the supply to the Power Supply Unit and verify this by using a voltmeter on the input terminals.

5. WIRE COUNT the Power Supply Unit and check the wires have safe insulation and are correctly labelled.

6. Remove the Power Supply Unit and label it as faulty.

AFTER INSTALLATION WORK

7. Check that the replaced Power Supply Unit is securely mounted.

8. WIRE COUNT the Power Supply Unit and check all cables are correctly installed and secure.

9. Reconnect the supply and test the incoming and outgoing supply.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL46		
Replace a Phoenix Contact - Quint DC-UPS Unit		
Issue No: 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Phoenix Contact Quint DC-UPS/24DC/24DC/10/USB Unit
Excludes:	All other Quint DC-UPS's

GENERAL

Electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

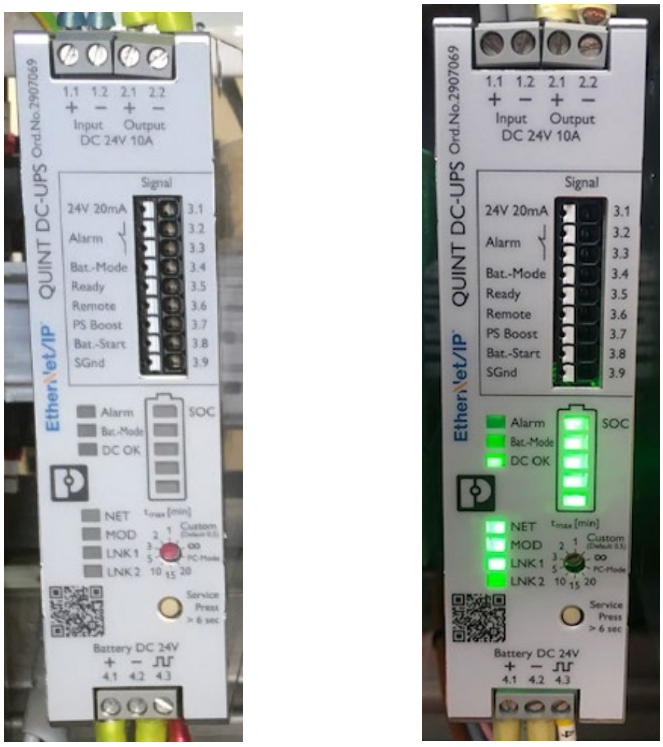


Figure 1 – QUINT DC-UPS (Unpowered / Powered)

BEFORE INSTALLATION WORK

1. Check that the replacement UPS Unit is of the correct type and version (modification level).

2. Check the replacement is not damaged.

3. Verify the location of the faulty UPS Unit.

4. Isolate the supply to the UPS Unit and verify this by using a voltmeter on the input terminals.

5. Remove all the fuses from the Battery Management Module.

6. WIRE COUNT the UPS Unit and check the wires have safe insulation and are correctly labelled.

7. Remove the UPS Unit and label it as faulty.

AFTER INSTALLATION WORK

8. Check that the replaced UPS Unit is securely mounted.

9. WIRE COUNT the UPS Unit and check all cables are correctly installed and secure.

10. Replace all the fuses from the Battery Management Module Unit.

11. Reconnect the supply and configure as shown in the ASM Configuration Documentation

12. Test the incoming and outgoing supply.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL48		
Replace a Meanwell - Power Supply Unit		
Issue No: 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Meanwell 230-110Vac/12Vdc 1.25A Power Supply Unit
Excludes:	All other Meanwell Power Supply Units

GENERAL

Electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 – Meanwell PSU (Unpowered / Powered)

BEFORE INSTALLATION WORK

1. Check that the replacement Power Supply Unit is of the correct type and version (modification level).
2. Check the replacement is not damaged.
3. Verify the location of the faulty Power Supply Unit.
4. Isolate the supply to the Power Supply Unit and verify this by using a volt meter on the input terminals.
5. WIRE COUNT the Power Supply Unit and check the wires have safe insulation and are correctly labelled.
6. Remove the Power Supply Unit and label it as faulty.

AFTER INSTALLATION WORK

7. Check that the replaced Power Supply Unit is securely mounted.

8. WIRE COUNT the Power Supply Unit and check all cables are correctly installed and secure.

9. Reconnect the supply and test the incoming and outgoing supply.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL49		
Replace a Lineside Disconnection Box		
Issue No. 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Disconnection boxes, and terminal blocks within disconnection boxes, that contain tail cables only
Excludes:	All other Disconnection boxes

GENERAL

Where an incorrectly labelled cable core/wire is encountered and is causing a fault, see **DEFINED CHECK A6**, correct labelling of cables and wires, for how to proceed.

BEFORE REPLACEMENT

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check replacement disconnection box is not damaged and is correct type.

   NOTE: *This might be contained in the wiring diagrams.*

3. WIRE COUNT existing disconnection box to the wiring diagram.

4. Check supply is isolated.

5. Check any existing wiring has safe insulation.

6. Check any existing wiring is correctly labelled.

7. INSULATION TEST the existing cable/s if reused.

AFTER REPLACEMENT

8. INSULATION TEST the terminal block(s) in replacement disconnection box(es) (minimum 2M ohms terminals to earth with wiring disconnected).

9. Check replacement disconnection box and wiring is correctly installed.

10. Check wiring is replaced as labelled.

11. WIRE COUNT replacement disconnection box to the wiring diagram.

12. Check terminations are secure and suitably protected.

13. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.

14. Check with the Maintenance Test Plan for the item of equipment fed via the component and carry out steps marked with an asterisk "*".

15. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL50		
Upgrade a TRTS Push Button		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Train ready to start switch (TRTS)
Excludes:	All other types of Push Buttons (Domino panel switch, Point micro switch, Block switch, Time switch, Sealed releases etc)

GENERAL

BEFORE INSTALLATION WORK

1. Check replacement unit is not damaged and is correct type.

   Each replacement kit contains:

   a) Complete Push Button

   b) Front Gasket

   c) Light Shield

   d) Bag of Fixings

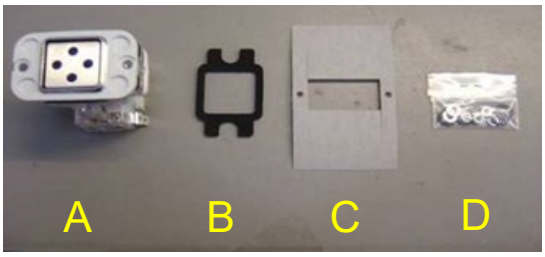


Figure 1 – Replacement Kit

2. Remove the two 3mm A/F Allen key "faceplate" retaining screws.

Figure 2 – Face Plate

3. WIRE COUNT existing unit to the wiring diagram.

4. Check existing wiring has safe insulation.

5. Check existing wiring is correctly labelled as applicable

6. Check existing unit is isolated from supply as required.

METHOD OF REPLACEMENT

7. Identify the button to be replaced.

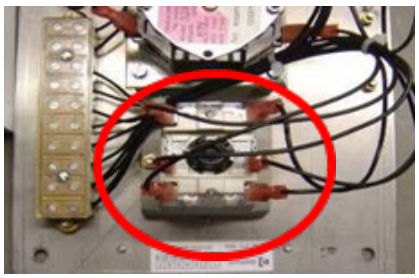


Figure 3 – Rear of Button

8. Remove 2 off M4 nuts and washers using a 7mm A/F nut spinner to remove M4 nuts.

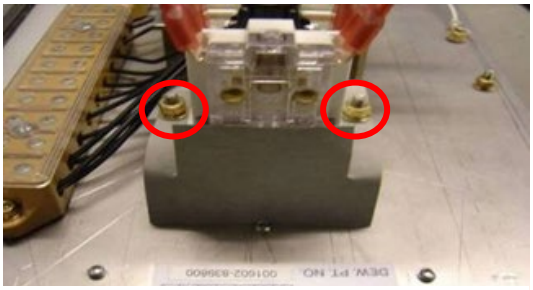


Figure 4 – Retaining Bolts

9. Once the nuts and spring washers are removed, lift of the contact block leaving the wires connected.

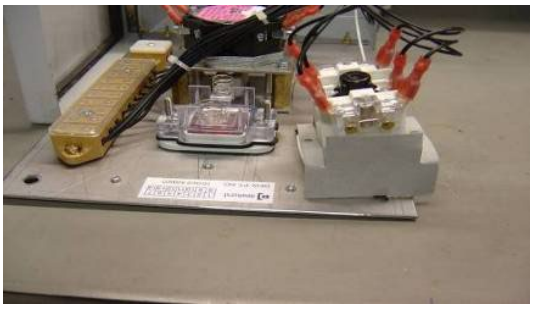


Figure 5 – Contact block removed

10. Remove the button carrier, surround and gasket from the faceplate.

Check that the spacers are not sitting on the head of the weld studs.

Figure 6 – Button carrier removed

11. Place the gasket over the weld studs ensuring that the gasket fits evenly around the pressel hole.

Figure 7 – New gasket fitted

12. Remove the elastic bands from each side of the assembly. Important (the button needs to be held together from this point).

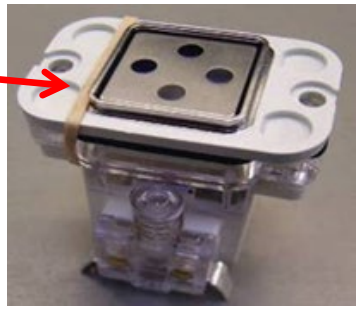


Figure 8 – New button unit

13. Holding the button assembly together, slide the assembly on to the weld studs.

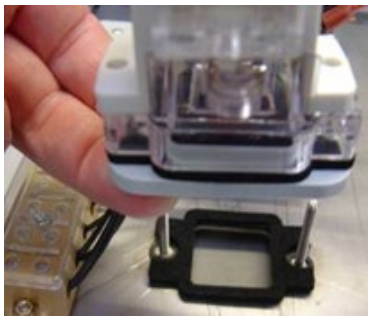


Figure 9 – Aligning Button unit

14. Place the light shield on to the weld studs as shown and replace the flat washer, spring washer and nut on to the weld studs.

    Tighten nuts using 7mm A/F nut spinner.

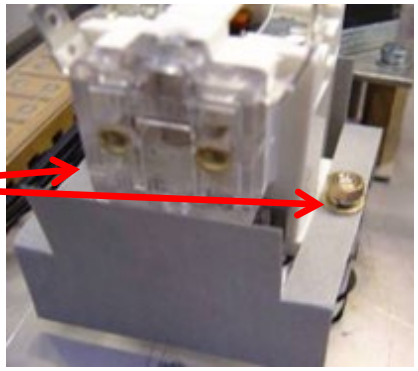


Figure 10 – Securing button in place

15. Remove wires from old contact block and place them in the same position on the new contact block.

16. Check wiring is replaced as labelled

17. WIRE COUNT replacement unit to the wiring diagram

18. Once all wires have been transferred to the new contact block, replace the faceplate ensuring no wires are trapped.

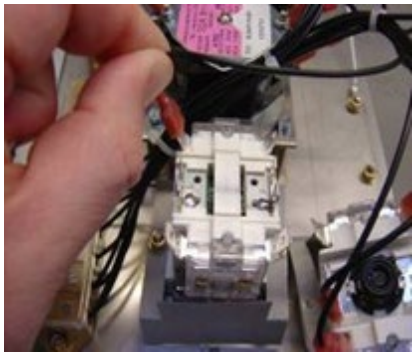


Figure 11 – Swapping Wiring to new contact block

19. Replace the two 3mm A/F Allen key “faceplate” retaining screws.

AFTER INSTALLATION WORK

20. Check replacement unit is correctly installed.

21. Check circuit operates correctly for all positions of the replacement unit (despatching trains).

Figure 12 – Illuminated button

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL51		
Replacing a Missing Link		
Issue No. 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

GENERAL

This Test Plan is for “Missing Links” but not links which have been slipped.

Where an incorrectly labelled cable core/wire is encountered and is causing a fault, see DEFINED CHECK A6, correct labelling of cables and wires, for how to proceed.

A note of all disconnections shall be recorded as a reference.

BEFORE INSTALLATION

1. Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check replacement link is not damaged and is correct type.

NOTE: *This information might be contained in the wiring diagrams.*

3. Check supply circuit from the link is isolated.

AFTER INSTALLATION

4. Check replacement link is correctly installed.

5. Check with the Maintenance Test Plan for the item of equipment fed via the component and carry out steps marked with an asterisk “*“.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL52		
Replace a STEGO Heater		
Issue No: 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	STEGO CS 060 series of touch safe heaters without built in thermostat
Excludes:	All other types of Heater

Equipment Identification Image

Figure 1 - STEGO CS 060 Heater

BEFORE INSTALLATION WORK

1. Check the replacement heater is not damaged and is the correct type.
2. Isolate the power supply to the heater and check the heater is cool before handling.
3. WIRE COUNT the heater and check that the wires have safe insulation and are correctly labelled.
4. Remove the heater and label as faulty.

AFTER INSTALLATION WORK

5. Check the replacement heater is correctly installed and secure.
6. WIRE COUNT the heater.
7. Restore the power supply to heater.
8. Note the temperature setting on the external thermostat, then adjust the thermostat to 0°C and check the heater starts to warm.
9. Re-adjust the thermostat to the setting noted in the previous step.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL53		
Replace a Hygrotherm		
Issue No: 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	STEGO ETF 012 series Electronic Hygrotherm
Excludes:	All other Hygrotherm

Equipment Identification Image

Figure 1 - STEGO ETF 012 Hygrotherm

BEFORE INSTALLATION WORK

1. Check the replacement hygrotherm is not damaged and the correct type.
2. Note the temperature and humidity setting.
3. Isolate the power supply to the hygrotherm.
4. WIRE COUNT the hygrotherm and check that the wires have safe insulation and are correctly labelled.
5. Remove the hygrotherm and label as faulty.

AFTER INSTALLATION WORK

6. Check the replacement hygrotherm is correctly installed.
7. Adjust the temperature and humidity setting to those shown on the replaced hygrotherm.
8. WIRE COUNT the hygrotherm.
9. Restore the power supply to hygrotherm.
10. Note the hygrotherm temperature setting, then adjust to 0°C and check the external heater starts to warm.
11. Re-adjust the temperature to the setting noted in the previous step.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/EL54		
Replace a Remote Disconnection Device (RDD)		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	All types of Voestalpine Remote Disconnection Devices (RDD)
Excludes:	Any other type of Remote Disconnection Switch (RSS)

GENERAL

NOTE: The magnetically latched disconnection relay is released when RDD protection is active and energised when RDD protection is removed.

BEFORE INSTALLATION WORK

1. Check the replacement unit is the correct type, not damaged, correctly sealed and where GPRS comms is required the SIM card has been activated.
2. Inform the RDD Administrator of the site details and the new device Globally Unique Identifier (GUID).
3. Confirm the identity of the unit to be replaced.
4. **For Missing Equipment Only**: Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence found stop and consult your SM(S).
5. WIRE COUNT the RDD plug couplers to the wiring diagram.
6. Check existing wiring has safe insulation.
7. Check existing wiring is correctly labelled.

AFTER INSTALLATION WORK

8. Check the device is correctly installed and securely mounted.
9. WIRE COUNT the RDD plug couplers to the wiring diagram.
10. Check the plug couplers are securely connected.
11. Check the antenna or ethernet cable is securely connected.
12. Visually check the unit has powered up and is displaying the correct indications, including the “REC” LED flashing.
13. Check the RDD configuration is loaded and correct.
14. Check the device is communicating with the RDD web-based management system.
15. Check for correct operation of the RDD and correspond the display to its associated disconnection relay.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part4/HD01		
Remove and Refit the Phoenix MB HABD Equipment (for Tamping Work)		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Phoenix HABD
Excludes:	All other HABD Systems

GENERAL

These tests shall be followed in the correct order so that no damage occurs to the HABD equipment when tamping works are scheduled within the limits of the HABD site.

To reduce the down time of the HABD system the disconnection and reconnection shall be planned as close to the tamping works as reasonably practicable.

All washers, spacers etc are to be accounted for during removal so that during reinstallation sensors are correctly affixed to their mountings in the correct position.

REMOVAL - SENSOR MODULE

1. Inform the Signaller which HABD site is to be disconnected and for what duration.
2. Save data to disk, before shutting down the SCT program.
3. Isolate the power to the cabinet.
4. Switch off the UPS.
5. Record the serial numbers or label the sleeper-mounted sensor modules with regards to their respective positions within the sleepers.
6. Lift out the sensor module and disconnect the plug coupler.
7. Check the plug coupler is protected with an end cap and has been replaced in the sleeper.
8. Confirm the sensor and sensor covers are safely stored in the HABD equipment room.
9. Confirm the protecting cover plate has been fitted to the sensor mounting frame to cover the hole.
10. Repeat the above steps for all sensors.
11. Label each cable, and confirm it has been withdrawn from the sleeper and protection has been fitted over the plug coupler.

REMOVAL - RAIL SENSOR

12. Note the serial numbers or label the rail sensor with regards to their respective positions mark the exact position of the rail contacts on the rail.

13. Disconnect the rail sensor from its cable and fit the cable end with a protecting end cap.

14. Disconnect and remove the rail sensor, including the clamp and cable from the vicinity of the rails. Store within the equipment rooms.

15. Repeat the above for all rail sensors.

REFIT - RAIL SENSOR

16. Check the position of the rail sensors with respect to the installation diagrams or rail markings.

17. Check the rail clamp and its sensor are fitted correctly and secure.

18. Check that all spacers, washers and spring washers are installed in the correct order (APPENDIX A).

19. Carry out NR/SMS/PartC/AX40 - Frauscher Advanced Axle Counter - Periodic Task 3 - Rail Sensor Height Check.

20. Carry out NR/SMS/PartB/Test/082 - Frauscher: RSR 123 Wheel Sensor Adjustment - associated with IMC & ACB Boards - Section 1 only.

REFIT – SENSOR MODULE

21. Check that the interior of the sleeper is free from gravel.

22. Confirm each sensor is in the correct sleeper.

23. Check the sensor cable is reconnected and secure.

24. Check the sensor is correctly refitted and the sensor fastening components are not damaged, paying particular attention to the rubber dampers.

25. Check that the all the sensors face into the centre of the 4 foot.

26. Check the clearances of the sensors. There shall be a small gap of between 1mm to 3mm between the front edge of the scanner cover and the front edge of the chair steel piece.

FINAL CHECKS

27. Reconnect the power to the cabinet.

28. Switch the UPS on.

29. Check that the system auto-configures and starts working.

30. Carry out NR/SMS/PartB/Test/212 (Phoenix MB Accuracy Test).

    If any of the recorded values recorded in step 28 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/PartB/Test/211 (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 1 – Nominal Values

31. Check cables have been replaced into ducts and guides, using fasteners and clips. Replace lids.

32. **If practicable:** Observe system operation the passage of a train.

APPENDIX A - Order of Sensor Components

The following is a checklist on the order of re-application of the sensor mounting components. The correct order of their re-application is critical so that the optical geometry of the sensor is maintained.

a) 2 X Bodywork washers (First Applied).

b) 1X Spacer.

c) 1 X Lower rubber buffer.

d) Sensor.

e) 1X Upper rubber buffer.

f) 1 X Bodywork washer.

g) 1 X Spring washer.

h) 1 X M10 nut (Last Applied) Then tighten to 50NM.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/HD02		
Remove and Refit EPOS HABD Equipment (for Tamping Work)		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	EPOS - Hot Axle Box Detector (HABD)
Excludes:	All other Hot Axle Box Detector (HABD) Systems

GENERAL

These tests shall be followed in the correct order so that no damage occurs to the HABD equipment when tamping works are scheduled within the limits of the HABD site.

To reduce the down time of the HABD system the disconnection and reconnection shall be planned as close to the tamping works as reasonably practicable.

All washers, spacers etc are to be accounted for during removal so that during reinstallation sensors are correctly affixed to their mountings in the correct position.

To replace the EPOS-Units it is not necessary to shut down the “Control and Evaluation Unit

REMOVAL - SENSOR MODULE

1. Inform the Signaller which HABD site is to be disconnected and for what duration.
2. Record the serial numbers or label the sleeper-mounted sensor modules with regards to their respective positions within the sleepers.
3. Lift out the sensor module and disconnect the plug coupler.
4. Check the plug coupler is protected with an end cap and has been replaced in the sleeper.
5. Confirm the sensor and sensor covers are safely stored in the HABD equipment room.
6. Confirm the protecting cover plate has been fitted to the sensor mounting frame to cover the hole.
7. Repeat the above steps for all sensors
8. Label each cable, and confirm it has been withdrawn from the sleeper and protection has been fitted over the plug coupler.

REMOVAL - WHEEL SENSOR

9. Note the serial numbers or label the wheel sensor with regards to their respective positions. Mark the exact position of the wheel sensors on the rail.

10. Disconnect the wheel sensor from its cable and fit the cable end with a protecting end cap.

11. Disconnect and remove the wheel sensor, including the clamp and cable from the vicinity of the rails. Store within the equipment rooms.

12. Repeat the above for all rail sensors.

REFIT - WHEEL SENSOR

13. Check the position of the wheel sensors with respect to the installation diagrams or rail markings.

14. Check the rail clamp and its sensor are fitted correctly and secure.

15. Check that all spacers, washers and spring washers are installed in the correct order.

16. Carry out NR/SMS/PartE/HO14 (Hot Axle Box Detector - Wheel Sensor) – The Wheel Sensor Height Check).

17. Carry out NR/SMS/PartB/Test/184 (EPOS - RSR123 Wheel Sensor Voltage Adjustment).

REFIT – SENSOR MODULE

18. Check that the interior of the sleeper is free from gravel/ballast/debris.

19. Confirm each sensor is in the correct sleeper.

20. Check the sensor cable is reconnected and secure.

21. Check the sensor is correctly refitted and the sensor fastening components are not damaged paying particular attention to the rubber dampers.

22. Check that the all the sensors face into the centre of the 4 foot.

23. Check the clearances of the sensors. There shall be a small gap of between 1mm to 3mm between the front edge of the scanner cover and the front edge of the chair steel piece.

FINAL CHECKS

24. Carry out NR/SMS/PartB/Test/180 (EPOS - Manual Post Calibration Test).

25. Carry out NR/SMS/PartB/Test/182 (EPOS - Verification of Measurement Accuracy).

26. Check cables have been replaced into ducts and guides, using fasteners and clips. Replace lids.

27. Observe system operation the passage of a train.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/HD03		
Remove and Replace an EPOS HABD - Wheel Sensor		
Issue No: 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	EPOS - Hot Axle Box Detector (HABD)
Excludes:	EPOS - Hot Axle Box Detector (HABD) when removing and refitting for Tamping Work. All other Hot Axle Box Detector (HABD) Systems

GENERAL

These tests shall be followed in the correct order so that no damage occurs to the HABD equipment when tamping works are scheduled within the limits of the HABD site.

To reduce the down time of the HABD system the disconnection and reconnection shall be planned as close to the tamping works as reasonably practicable.

All washers, spacers etc are to be accounted for during removal so that during reinstallation sensors are correctly affixed to their mountings in the correct position.

To replace the EPOS-Units it is not necessary to shut down the “Control and Evaluation Unit.

BEFORE INSTALLATION WORK

1. Note the serial numbers, or label the wheel sensor, with their respective positions. Mark the exact position of the wheel sensors on the rail.

2. Disconnect the wheel sensor from its cable and fit the cable end with a protecting end cap.

3. Disconnect and remove the wheel sensor, including the clamp and cable from the vicinity of the rails. Store within the equipment rooms.

4. Repeat the above for all rail sensors.

AFTER INSTALLATION WORK

5. Check the position of the wheel sensors with respect to the installation diagrams or rail markings.

6. Check the rail clamp and its sensor are fitted correctly and secure.

7. Check that all spacers, washers and spring washers are installed in the correct order.

8. Carry out NR/SMS/PartE/HO14 (Hot Axle Box Detector - Wheel Sensor) - Wheel Sensor Height Check.

9. Carry out NR/SMS/PartB/Test/184 (EPOS - RSR123 Wheel Sensor Voltage Adjustment).

FINAL CHECKS

10. Carry out NR/SMS/PartB/Test/180 (EPOS - Manual Post Calibration Test).

11. Carry out NR/SMS/PartB/Test/182 (EPOS - Verification of Measurement Accuracy).

12. Check cables have been replaced into ducts and guides, using fasteners and clips. Replace lids.

13. Observe system operation the passage of a train.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/HD04		
Remove and Replace an EPOS HABD - Sensor Module		
Issue No: 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	EPOS - Hot Axle Box Detector (HABD)
Excludes:	EPOS - Hot Axle Box Detector (HABD) when removing and refitting for Tamping Work. All other Hot Axle Box Detector (HABD) Systems

GENERAL

These tests shall be followed in the correct order so that no damage occurs to the HABD equipment when tamping works are scheduled within the limits of the HABD site.

To reduce the down time of the HABD system the disconnection and reconnection shall be planned as close to the tamping works as reasonably practicable.

All washers, spacers etc are to be accounted for during removal so that during reinstallation sensors are correctly affixed to their mountings in the correct position.

To replace the EPOS-Units it is not necessary to shut down the “Control and Evaluation Unit.

BEFORE INSTALLATION WORK

1. Inform the Signaller which HABD site is to be disconnected and for what duration.
2. Lift out the sensor module and disconnect the plug coupler.
3. Check the plug coupler is protected with an end cap and has been replaced in the sleeper.
4. Confirm the sensor and sensor covers are safely stored in the HABD equipment room.
5. Confirm the protecting cover plate has been fitted to the sensor mounting frame to cover the hole.
6. Repeat the above steps for all sensors.

AFTER INSTALLATION WORK

7. Check that the interior of the sleeper is free from gravel/ballast/debris.
8. Check the sensor cable is reconnected and secure.
9. Check the sensor is correctly refitted and the sensor fastening components are not damaged.

FINAL CHECKS

10. Carry out NR/SMS/PartB/Test/180 (EPOS - Manual Post Calibration Test).

11. Carry out NR/SMS/PartB/Test/182 (EPOS - Verification of Measurement Accuracy).

12. Check cables have been replaced into ducts and guides, using fasteners and clips. Replace lids.

13. Observe system operation the passage of a train.

END

NR/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/IE02		
Cambrian ERTMS: Replace a Vital Single Programmable Printed Circuit Board and/or associated Dongle		
Issue No. 02	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	RBC CLAP board, CGL, CIC and CIRS boards plus any associated dongle. Note: "x" indicates there is more than one programme for this device.
Excludes:	All other components

***** INDEPENDENCE EXEMPT *****

Before handling any electronic equipment observe ESD precautions.

Observe board specific programming schedule, these are described in local instructions.

Programming can take place prior to or post Installation

BEFORE INSTALLATION WORK

1. Check the replacement board or dongle is of the Correct Type, Not Damaged and that any links or PCB mounted switches are in the correct position.

2. Isolate the power supply to the board being replaced.

AFTER INSTALLATION WORK

3. Check the board is secure and Correctly Labelled.

   When to restore the power supply is specified by the programming schedule for the item of equipment.

BEFORE PROGAMMING

4. Refer to the programming schedule for the specific item of equipment.

5. Check the software to be installed is the current version.

6. Install the software.

AFTER PROGRAMMING

7. Check the software has been correctly installed by comparing the displayed check sum and version with the details contained in the relevant etq file.

8. Print and attach the software version label to the front of the PCB.

9. Check any LEDs on the replaced board are indicating correctly. Refer to NR/SMS/IE00 for LED information.

10. **MTOR ONLY:**
Function Test the replacement MTOR by observing the correct functioning of one control and one indication circuit managed by the replaced MTOR.

11. Check the TT or SILAM indicate the replacement is working correctly.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE03		
Cambrian ERTMS: Replace a Non Programmable Printed Circuit Board		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Non programmable boards
Excludes:	Programmable PCB, Dongle or CRCD

***** INDEPENDENCE EXEMPT *****

Before handling any electronic equipment observe ESD precautions.

Use the caps provided to protect fibre optic connectors, sockets and the ends of patch cords.

BEFORE INSTALLATION WORK

1. Check the replacement board is of the correct type and not damaged.
2. Check that any board mounted links or switches are correctly configured.
3. Isolate the power supply to the board being replaced.

AFTER INSTALLATION WORK

4. Check the board is secure and correctly labelled.
5. Clean the end of the fibre optic patch cord using an approved fibre optic wipe before insertion into the board connector.
6. Restore the power supply.
7. Check the board status LEDs indicate the replaced board is functioning correctly. Refer to NR/SMS/PartC/IE00 (Cambrian ERTMS: General) for LED information.
8. Check using the TT or SILAM indicate the replacement is working correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE06		
Cambrian ERTMS: Replace an Item of Plug and Play Equipment		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Visual Display Unit (VDU), Keyboard, Mouse, USB extender, Printers, Speakers, Non-programmable Printed Circuit Boards and fans in Personal Computers, Modem, CATS Cabinet. "x" indicates there is more than one programme for this device
Excludes:	Programmable equipment

***** INDEPENDENCE EXEMPT *****

GENERAL

Before handling any electronic equipment observe ESD precautions.

BEFORE INSTALLATION WORK

1. Check the replacement item is of the correct type and not damaged.
2. Check that any board mounted links or switches are correctly configured.
3. Isolate the power supply where required.

AFTER INSTALLATION WORK

4. Check the equipment is correctly installed and labelled.
5. Restore the power supply.
6. Check the replaced item functions correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE07		
Cambrian ERTMS: Replace a Non-Vital Programmable Device		
Issue No: 03	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	RCCS; Database Server, Signalling Server, Automatic Server, GEST Server, Signallers Workstation and Maintainer Workstation. SAM; SICAM Server and SILAM PC. SEI; TT Server, TTD and TTC. Other; KMC PC, CATS Cabinet, Terminal Server, Ethernet Switch, Modem and Multiplexer
Excludes:	RBC; PAPR Equipment, SEI; PAP and PES2 Equipment

***** INDEPENDENCE EXEMPT *****

GENERAL

Before handling any electronic equipment observe ESD precautions.

BEFORE INSTALLATION WORK

1. Check the replacement is of the correct type and not damaged.
2. Check that any board mounted links or switches are correctly configured.
3. Isolate the power supply to the equipment being replaced.

AFTER INSTALLATION WORK

4. Restore the power supply.

BEFORE PROGRAMMING

5. Check the software to be installed is the current version.
6. Configure the IP Address where applicable.
7. Install the software as described in the relevant system maintenance manual.

AFTER PROGRAMMING

8. Check the software has been correctly installed.
9. Check network connections are active.
10. Check the replacement operates correctly. This shall be carried out in liaison with the Signaller.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE08		
Replace a PVF rack (Ansaldo Interlocking)		
Issue No: 3	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	PVF rack
Excludes:	All other racks

***** INDEPENDENCE EXEMPT *****

This task will require the PVF rack to be powered off.

BEFORE RE-INSTALLATION WORK

1. Check the replacement rack is the Correct Type and is Not Damaged.

AFTER RE-INSTALLATION WORK

2. Check the replacement rack is correctly fitted.

The corresponding PFV rack can now be powered back up.

3. Check the fans have correctly started and the front panel shows a steady green LED.

For PVF2 only (Cambrian), Observe the green LED on the rack is illuminated and that the correct indications are displayed on the TT.

4. Check the TT that all systems are showing healthy (excluding the racks at the ROC).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE09		
Cambrian ERTMS: Replace a Plug in Power Supply		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Rack mounted plug in power supply units in the RBC, SEI, SILAM and Remote Object Controller
Excludes:	Other PSUs

***** INDEPENDENCE EXEMPT *****

GENERAL

Before handling any electronic equipment observe ESD precautions.

BEFORE INSTALLATION WORK

1. Check the replacement unit is of the correct type and not damaged.
2. Isolate the power supply.

AFTER INSTALLATION WORK

3. Check the unit is secure and correctly labelled.
4. Restore the power supply.
5. Check the outputs from the power supply are within tolerance and of the correct polarity.
6. Check the status of the system LEDs and that the correct indications are displayed on the Technicians Terminal or SILAM.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE12		
Replace an Ansaldo Eurobalise Mounting Bracket		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Ansaldo Eurobalise Mounting Bracket
Excludes:	Any other Balise Mounting Bracket

BEFORE INSTALLATION WORK

1. Check the replacement bracket is of the correct type and not damaged.

2. Check the longitudinal position of the bracket is in accordance with the Signalling Plan. N_PIG 0 is the reference Balise therefore it shall be placed first and N-PIG1 etc. are positioned relative to N_PIG 0. N_PIG 0 has a tolerance of +/- 30cm approximately half sleeper interval.

3. Check the ID BOA of the existing bracket and the Balise are identical.

   When a Balise is programmed the ID BOA is written on the end of the Balise, if this has become illegible the ID BOA shall be rewritten before removal.

4. When installing a sleeper mounted bracket, it shall be installed centrally between the rails.

   All mounting brackets are designed to position the Balise centrally between the rails and at the correct height in relation to the rail head. (except for the sleeper mounted style).

5. Where the Balise is a “Calibration Balise” a marker is positioned independently from the track to indicate the required centre line position of the Balise.

AFTER INSTALLATION WORK

6. Check the replacement bracket is securely attached to the rail, sleeper or sleeper housing. When the bracket is attached to the foot of the rail the securing bolts shall be tightened to 20nm.

7. Check when a sleeper mounted bracket is used it is located centrally between the rails +/- 10mm.

8. Check that a Calibration Balise bracket is longitudinally aligned with the Balise centre line marker +/- 100mm.

9. Check the ID BOA bracket label is securely installed and correct type.

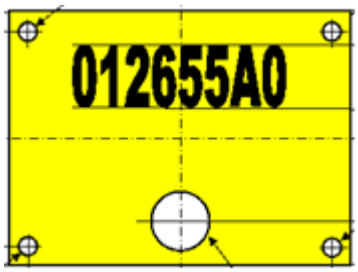


Figure 1 - Example of the ID BOA Label

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE14		
Replace a CRCD Board (Ansaldo Interlocking)		
Issue No: 3	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	CRCD board
Excludes:	All other boards

***** INDEPENDENCE EXEMPT *****

The MTOR ES 48 module shall be powered down during this task.

Powering off a MTOR ES 48 affects the section controlled by the module.

BEFORE RE-INSTALLATION WORK

1. Check the replacement board is the Correct Type and is Not Damaged.

AFTER RE-INSTALLATION WORK

2. Check the replacement board is correctly fitted.

The EMC protection panel can now be fitted.

The MTOR ES 48 module can now be powered back up.

3. Observe the LEDs of the MTOR2 boards are in OK state after initialisation (approximately 40 sec):

(lit)	CG	⊗	⊗ ER	(unlit)
(lit)	V1	⊗	⊗ V2	(lit)
(flashing)	1	⊗	⊗ 2	(unlit)

4. Check the TT that all systems are showing healthy.

During initialisation of the MTOR ES48 module, all the other LEDs of the module are lit up. Even though the indicators seem to be indicating that the outputs are in the permissive state and the inputs high, the inputs are in fact in the restrictive state.

END

Includes:	V24 Converter (Used as an interface between the AzLM axle counter equipment and the FTN Network to Machynlleth SCC)
Excludes:	V24 Converters used for any other purpose and locations

GENERAL

Possession of the relevant axle counter section

The removal of a serial card might affect one or more sections depending on the detection points served by it, the removal of a parallel card only affects one section.

Disconnection of the output of the evaluator to the signalling system.

The output of the evaluator shall not be reconnected to the signalling system and possession given up unless the equipment has passed all tests and is fit for use.

Electrostatic precautions shall be taken when handling boards. Where provided electrostatic discharge points (ESD) shall be used.

The V24converter is produced in five versions, the original which is configurable as a TX or RX and later TX or RX units. These later TX or RX units are interchangeable with the original TX and RX versions and may be used as a like for like replacement.

3CR 31036 AAAA Converter ISDN/V24 Configurable
3CR 31036 BAAA Converter ISDN/V24 LT/LT
3CR 31036 BBAA Converter ISDN/V24 NT/NT (Not used on Cambrian)
3CR 31036 BCAA Converter ISDN/V24 LT/NT (Not used on Cambrian)
3CR 31036 BDAA Converter ISDN/V24 NT/NT

BEFORE INSTALLATION WORK

1. Check replacement V24 Converter is correct type and is not damaged.
2. WIRE COUNT the existing V24 Converter to wiring diagram.
3. Check that existing wiring has safe insulation.
4. Check that existing wiring is correctly labelled.
5. Check existing V24 Converter is isolated from the supply.

AFTER INSTALLATION WORK

6. Check replacement V24 Converter is correctly installed and positioned.
7. WIRE COUNT the replacement V24 Converter to the wiring diagram.

8. Check the correct LED indications on the converter are illuminated.

9. Check the affected axle counters sections operate correctly.

10. Check the affected axle counters sections operate correctly.

ISDN/V24 CONVERTER INDICATIONS

LED Name	Colour	Meaning		
POWER	Green	Power supply present	On - Okay	Off - Fault
B1 TX	Yellow	Logical state of the interface	On - High	Off - Low
B1 RX	Green	Logical state of the interface	On - High	Off - Low
B2 TX	Yellow	**Not used**		
B2 RX	Green	**Not used**		
+	Red	Remote power supply condition	Off - Okay	On -Fuse ruptured
-	Red	Remote power supply condition	Off - Okay	On -Fuse ruptured

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE16		
Cambrian ERTMS: Replace a Fibre Optic or LAN Patch Cord		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Single and Dual Core Fibre-Optic Patch Cords with Plug – in or Screw type connectors, Copper 8 way LAN patch Cords, pre – manufactured with fitted moulded plugs
Excludes:	All other types of Fibre Optic Cables, Multi core cables that are NOT Manufacturer fitted with Moulded on Plugs

GENERAL

Beware of Laser Light when replacing a Fibre Optic patch cord. Do not look into the open socket or end of the fibre optic patch cord. Use the caps provided to protect fibre optic sockets and the ends of patch cords.

BEFORE INSTALLATION WORK

1. Check identity of existing patch cord by physically tracing or alternative methods.
2. Check labelling is correct at both ends of the cord.
3. Check that the replacement cord is not damaged and is of the correct length and type.
4. For fibre optic cords only, clean the connector mating faces (where possible) using a proprietary fibre optic cleaning kit.

AFTER INSTALLATION WORK

5. Check the replacement cord is not damaged, is correctly installed and protected to the standards, and that both ends are correctly labelled.
6. Check all physical connections, ensuring that patch cord ends are correctly seated and locked in their receptacles.
7. Check for correct operation of equipment.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE18		
Replace a CALMS2 Board (Ansaldo Interlocking)		
Issue No: 2	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	CALMS2 board
Excludes:	All other boards

***** INDEPENDENCE EXEMPT *****

The MTOR ES48 Module shall be powered down during this task.

Powering off a MTOR ES 48 affects the section controlled by the module.

BEFORE RE-INSTALLATION WORK

1. Check the replacement board is the Correct Type and is Not Damaged.

AFTER RE-INSTALLATION WORK

2. Check the replacement board is correctly fitted.

The EMC protection panel can now be fitted.

The MTOR ES 48 module can now be powered back up.

3. Observe that the LEDs of the CALM2 board are all lit.

4. Observe the LEDs of the MTOR2 boards are in OK state after initialisation (approximately 40 sec):

(lit)	CG	⊗	⊗ ER	(unlit)
(lit)	V1	⊗	⊗ V2	(lit)
(flashing)	1	⊗	⊗ 2	(unlit)

During initialisation of the MTOR ES48 module, all the other LEDs of the module are lit up. Even though the indicators seem to be indicating that the outputs are in the permissive state and the inputs high, the inputs are in fact in the restrictive state.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE19		
Replace a CALS Board (Ansaldo Interlocking)		
Issue No: 2	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	CALS board
Excludes:	All other boards

***** INDEPENDENCE EXEMPT *****

The corresponding PAP shall be powered down during this task.
In order to keep the SEI operational while a component is being replaced, the following conditions shall be observed:

- At least two of the three PAP1, PAP2 and PAP3 shall be operational and running.
- At least one of the two Ethernet switches A and B shall be operational and running.

If PAP1 or one of the CVO or CIER2 boards in PAP1 are not running, do not disconnect or switch off Ethernet switch B.

This will cause a loss of communication from the interlocking to trackside equipment.

If PAP2 or one of the CVO or CIER2 boards in PAP2 are not running, do not disconnect or switch off Ethernet switch A.

This will cause a loss of communication from the interlocking to trackside equipment.

PAP3 is not affected by this condition.

BEFORE RE-INSTALLATION WORK

1. Check the replacement board is the Correct Type and is Not Damaged.

AFTER RE-INSTALLATION WORK

2. Check the replacement board is correctly fitted.

The corresponding PAP can now be powered back up.

3. Check the replacement board has correctly initialised (approximately 40 sec):

- On the TT: CIER2 board is green.
- All LEDs on the CALS board are steady green.

- LEDs of CVO board are:

(lit)	W ⊗	⊗ H (unlit)
(pulsating)	M ⊗	⊗ E (unlit)
(flashing)	1 ⊗	⊗ 2 (unlit)

4. Using a multimeter, check the voltage on the inspection points of the replacement board (See SMS Appendix 21).

A flashing LED “2” on the CVO board means a fault on another PAP-CSD rack.

A lit LED “2” means a fault on both of the other PAP-CSD racks.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE20		
Replace a CAP Board (Ansaldo Interlocking)		
Issue No: 2	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	CAP board
Excludes:	All other boards

***** INDEPENDENCE EXEMPT *****

The corresponding PAP shall be powered down during this task.
In order to keep the SEI operational while a component is being replaced, the following conditions shall be observed:

- At least two of the three PAP1, PAP2 and PAP3 shall be operational and running.
- At least one of the two Ethernet switches A and B shall be operational and running.

If PAP1 or one of the CVO or CIER2 boards in PAP1 are not running, do not disconnect or switch off Ethernet switch B.

This will cause a loss of communication from the interlocking to trackside equipment.

If PAP2 or one of the CVO or CIER2 boards in PAP2 are not running, do not disconnect or switch off Ethernet switch A.

This will cause a loss of communication from the interlocking to trackside equipment.

PAP3 is not affected by this condition.

BEFORE RE-INSTALLATION WORK

1. Check the replacement board is the Correct Type and is Not Damaged.

2. Check the battery on the replacement board is in date and record.

3. Check the replacement board has the correct software version.

AFTER RE-INSTALLATION WORK

4. Check the replacement board is correctly fitted and secured.

The corresponding PAP can now be powered back up.

DO NOT press the ABT/RST button

5. Check the replacement board has correctly initialised (approximately 40 sec):

   - On the TT: CAP board is green.
   - The LEDs of CAP board are:

     (flashing) BFL ⊗
     (flashing) CPU ⊗

   - LEDs of CVO board are:

     lit) W ⊗ ⊗ H (unlit)
     (pulsating) M ⊗ ⊗ E (unlit)
     (flashing) 1 ⊗ ⊗ 2 (unlit)

   A flashing LED “2” on the CVO board means a fault on another PAP-CSD rack.

   A lit LED “2” means a fault on both of the other PAP-CSD racks.

6. Check the TT that all systems are showing healthy.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE21		
Replace a CAP Dongle (Ansaldo Interlocking)		
Issue No: 02	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	CAP Dongle
Excludes:	All other Dongles

***** INDEPENDENCE EXEMPT *****

The corresponding PAP shall be powered down during this task.
In order to keep the SEI operational while a component is being replaced, the following conditions shall be observed:

- At least two of the three PAP1, PAP2 and PAP3 shall be operational and running.
- At least one of the two Ethernet switches A and B shall be operational and running.

If PAP1 or one of the CVO or CIER2 boards in PAP1 are not running, do not disconnect or switch off Ethernet switch B.

This will cause a loss of communication from the interlocking to trackside equipment.

If PAP2 or one of the CVO or CIER2 boards in PAP2 are not running, do not disconnect or switch off Ethernet switch A.

This will cause a loss of communication from the interlocking to trackside equipment.

PAP3 is not affected by this condition.

The dongle is not read in normal use mode, it is only read when the board reinitialises

BEFORE RE-INSTALLATION WORK

1. Check the replacement dongle has the correct software version.

There are different dongles fitted to the interlocking.

2. Check the replacement CAP dongle is the Correct Type and is Not Damaged.

AFTER RE-INSTALLATION WORK

3. Check the replacement dongle is correctly fitted.

The corresponding PAP can now be powered back up.

4. Check the replacement board has correctly initialised (approximately 40 sec):

- On the TT: CAP board is green
- The LEDs of CAP board are:

(flashing) BFL ⊗
(flashing) CPU ⊗

- LEDs of CVO board are:

lit)	W ⊗	⊗ H (unlit)
(pulsating)	M ⊗	⊗ E (unlit)
(flashing)	1 ⊗	⊗ 2 (unlit)

A flashing LED “2” on the CVO board means a fault on another PAP-CSD rack.

A lit LED “2” means a fault on both of the other PAP-CSD racks.

5. Check the TT that all systems are showing healthy.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE22		
Replace a CIER2 Board (Ansaldo Interlocking)		
Issue No: 02	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	CIER2 board
Excludes:	All other boards

***** INDEPENDENCE EXEMPT *****

The corresponding PAP shall be powered down during this task.
In order to keep the SEI operational while a component is being replaced, the following conditions shall be observed:

- At least two of the three PAP1, PAP2 and PAP3 shall be operational and running.
- At least one of the two Ethernet switches A and B shall be operational and running.

If PAP1 or one of the CVO or CIER2 boards in PAP1 are not running, do not disconnect or switch off Ethernet switch B.

This will cause a loss of communication from the interlocking to trackside equipment.

If PAP2 or one of the CVO or CIER2 boards in PAP2 are not running, do not disconnect or switch off Ethernet switch A.

This will cause a loss of communication from the interlocking to trackside equipment.

PAP3 is not affected by this condition.

BEFORE RE-INSTALLATION WORK

1. Check the replacement board is the Correct Type and is Not Damaged.

2. Check the battery on the replacement board is in date and record.

3. Check the replacement board has the correct software version.

AFTER RE-INSTALLATION WORK

4. Check the replacement board is correctly fitted.

Re-insert the Ethernet cable into its previous slot.

The corresponding PAP can now be powered back up.

5. Check the replacement board has correctly initialised (approximately 40 sec):

- On the TT: CIER2 board is green.
- On the CIER2 board: Check that the LEDs are flashing green.
- LEDs of CVO board are:

(lit)	W ⊗	⊗ H (unlit)
(pulsating)	M ⊗	⊗ E (unlit)
(flashing)	1 ⊗	⊗ 2 (unlit)

A flashing LED “2” on the CVO board means a fault on another PAP-CSD rack.

A lit LED “2” means a fault on both of the other PAP-CSD racks.

The “CONSOLE” port of the CIER board is inactive if it is connected after the board initialisation.

6. Check the TT that all systems are showing healthy.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE23		
Replace a CME+ Board (Ansaldo Interlocking)		
Issue No: 02	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	CME+ board
Excludes:	All other boards

***** INDEPENDENCE EXEMPT *****

The corresponding PAP shall be powered down during this task.
In order to keep the SEI operational while a component is being replaced, the following conditions shall be observed:

- At least two of the three PAP1, PAP2 and PAP3 shall be operational and running.
- At least one of the two Ethernet switches A and B shall be operational and running.

If PAP1 or one of the CVO or CIER2 boards in PAP1 are not running, do not disconnect or switch off Ethernet switch B.

This will cause a loss of communication from the interlocking to trackside equipment.

If PAP2 or one of the CVO or CIER2 boards in PAP2 are not running, do not disconnect or switch off Ethernet switch A.

This will cause a loss of communication from the interlocking to trackside equipment.

PAP3 is not affected by this condition.

BEFORE RE-INSTALLATION WORK

1. Check the replacement board is the Correct Type and is Not Damaged.

AFTER RE-INSTALLATION WORK

2. Check the replacement board is correctly fitted.

The corresponding PAP can now be powered back up.

3. Check the replacement board has correctly initialised (approximately 40 sec):

- On the TT: CME+ board is green.

- LEDs on the front face of the CME+ board are in their nominal state:

	V A	V A
(Unlit) E ⊗	(Flashing) ⊗ ⊗ (steady)	(Flashing) ⊗ ⊗ (steady)
	Rx	Tx
(Unlit) E ⊗	(Flashing) ⊗ ⊗ (steady)	(Flashing) ⊗ ⊗ (steady)
	V A	V A

LEDs on the front face of the CVO board are as follows:

lit)	W ⊗	⊗ H (unlit)
(pulsating)	M ⊗	⊗ E (unlit)
(flashing)	1 ⊗	⊗ 2 (unlit).

A flashing LED “2” on the CVO board means a fault on another PAP-CSD rack.

A lit LED “2” means a fault on both of the other PAP-CSD racks.

4. Check the TT that all systems are showing healthy.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMTH/Part 04/IE24		
Replace a CP module (Ansaldo Interlocking)		
Issue No. 01	Issue Date: 03/03/2018	Compliance Date: 31/05/2018

Includes:	CP module
Excludes:	All other modules

***** INDEPENDENCE EXEMPT *****

BEFORE RE-INSTALLATION WORK

1. Check the replacement module is the Correct Type and is Not Damaged.

AFTER RE-INSTALLATION WORK

2. Check the replacement module is correctly fitted.
3. Check the TT that all systems are showing healthy.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE26		
Replace a CVO Board (Ansaldo Interlocking)		
Issue No: 02	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	CME+ board
Excludes:	All other boards

***** INDEPENDENCE EXEMPT *****

The corresponding PAP shall be powered down during this task.
In order to keep the SEI operational while a component is being replaced, the following conditions shall be observed:

- At least two of the three PAP1, PAP2 and PAP3 shall be operational and running.
- At least one of the two Ethernet switches A and B shall be operational and running.

If PAP1 or one of the CVO or CIER2 boards in PAP1 are not running, do not disconnect or switch off Ethernet switch B.

This will cause a loss of communication from the interlocking to trackside equipment.

If PAP2 or one of the CVO or CIER2 boards in PAP2 are not running, do not disconnect or switch off Ethernet switch A.

This will cause a loss of communication from the interlocking to trackside equipment.

PAP3 is not affected by this condition.

BEFORE RE-INSTALLATION WORK

1. Check the replacement board is the Correct Type and is Not Damaged.

2. Check the replacement board has the correct software version.

AFTER RE-INSTALLATION WORK

3. Check the replacement board is correctly fitted.

The corresponding PAP can now be powered back up.

4. Check the replacement board has correctly initialised (approximately 40 sec):

   - On the TT: CVO board is green.
   - LEDs on the front face of the CVO board are as follows:

lit)	W ⊗	⊗ H (unlit)
(pulsating)	M ⊗	⊗ E (unlit)
(flashing)	1 ⊗	⊗ 2 (unlit).

   A flashing LED “2” on the CVO board means a fault on another PAP-CSD rack.

   A lit LED “2” means a fault on both of the other PAP-CSD racks.

5. Check the TT that all systems are showing healthy.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMTH/Part 04/IE27		
Replace a CVO Dongle (Ansaldo Interlocking)		
Issue No. 01	Issue Date: 03/03/2018	Compliance Date: 31/05/2018

Includes:	CVO dongle
Excludes:	All other dongles

The corresponding PAP shall be powered down during this task.

In order to keep the SEI operational while a component is being replaced, the following conditions shall be observed:

- At least two of the three PAP1, PAP2 and PAP3 shall be operational and running.
- At least one of the two Ethernet switches A and B shall be operational and running.

If PAP1 or one of the CVO or CIER2 boards in PAP1 are not running, do not disconnect or switch off Ethernet switch B.

This will cause a loss of communication from the interlocking to trackside equipment.

If PAP2 or one of the CVO or CIER2 boards in PAP2 are not running, do not disconnect or switch off Ethernet switch A.

This will cause a loss of communication from the interlocking to trackside equipment.

PAP3 is not affected by this condition.

The dongle is not read in normal use mode, it is only read when the board reinitialises.

BEFORE RE-INSTALLATION WORK

1. Check the replacement CVO dongle is the Correct Type and is Not Damaged.

AFTER RE-INSTALLATION WORK

2. Check the replacement dongle is correctly fitted.

   The corresponding PAP can now be powered back up.

3. Check the CVO board has correctly initialised (approximately 40 sec):

   - On the TT: CAP board is green.
   - LEDs on the front face of the CVO board are :

(lit)	W ⊗	⊗ H (unlit)
(pulsating)	M ⊗	⊗ E (unlit)
(flashing)	1 ⊗	⊗ 2 (unlit)

A flashing LED “2” on the CVO board means a fault on another PAP-CSD rack.

A lit LED “2” means a fault on both of the other PAP-CSD racks.

4. Check the TT that all systems are showing healthy.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE29		
Replace a IOM-AG module (Ansaldo Interlocking)		
Issue No: 2	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	IOM-AG modules
Excludes:	All other modules

***** INDEPENDENCE EXEMPT *****

The MTOR ES48 Module shall be powered down during this task by isolating the Power and CTRL trips.

BEFORE RE-INSTALLATION WORK

1. Check the replacement module is the Correct Type and is Not Damaged.

AFTER RE-INSTALLATION WORK

2. Check the replacement module is correctly fitted.

3. Re-insert the associated trips (figure 1) and power back up the MTOR.

Figure 1 - Power and Ctrl Trips

4. Observe the LEDs of the MTOR2 boards are in OK state after initialisation (approximately 40 sec):

(lit)	CG	⊗	⊗ ER	(unlit)
(lit)	V1	⊗	⊗ V2	(lit)
(flashing)	1	⊗	⊗ 2	(unlit)

5. Check the TT that all systems are showing healthy.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE30		
Replace a IOM-SX module (Ansaldo Interlocking)		
Issue No: 2	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	IOM-SX modules
Excludes:	All other modules

***** INDEPENDENCE EXEMPT *****

The MTOR ES48 Module shall be powered down during this task by isolating the Power and CTRL trips.

BEFORE RE-INSTALLATION WORK

1. Check the replacement module is the Correct Type and is Not Damaged.

AFTER RE-INSTALLATION WORK

2. Check the replacement module is correctly fitted.

3. Re-insert the associated trips (Figure 1) and power back up the MTOR.

Figure 1 – Power and Ctrl Trips

4. Observe the LEDs of the MTOR2 boards are in OK state after initialisation (approximately 40 sec):

(lit)	CG	⊗	⊗ ER	(unlit)
(lit)	V1	⊗	⊗ V2	(lit)
(flashing)	1	⊗	⊗ 2	(unlit)

5. Check the TT that all systems are showing healthy.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE31		
Replace a MTOR Dongle (Ansaldo Interlocking)		
Issue No: 02	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	MTOR dongle
Excludes:	All other dongles

The MTOR ES48 Module shall be powered down during this task.

The dongle is not read in normal use mode, it is only read when the board reinitialises.

The dongles are identified by a label (one master and one slave). The “master” dongle is inserted in the “master” position and the “slave” dongle in the “slave” position.

BEFORE RE-INSTALLATION WORK

1. Check the replacement dongle is labelled, the correct type and is not damaged.

2. Check the replacement dongle has the correct software version.

AFTER RE-INSTALLATION WORK

3. Check the dongle is correctly fitted.

The MTOR ES48 module can now be powered back up.

4. Observe the LED’s on the rear of the dongles light up.

During re-initialisation (40 sec) loss of the zone of the section controlled by the MTOR ES48 module (approximately 40 sec). The SEI considers all inputs to be in the restrictive state.

5. Observe the LED’s of the mtor2 boards are in ok state after initialisation (approximately 40 sec):

(lit)	CG	⊗	⊗ ER	(unlit)
(lit)	V1	⊗	⊗ V2	(lit)
(flashing)	1	⊗	⊗ 2	(unlit)

6. Check the TT that the correct MTOR is showing healthy.

During initialisation of the MTOR ES48 module, all the other LED’s of the module are lit up.

Even though the indicators seem to be indicating that the outputs are in the permissive state and the inputs high, the inputs are in fact in the restrictive state.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE32		
Replace a MTOR2 Board (SEI-CLSS)		
Issue No: 2	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	MTOR2 board
Excludes:	All other boards

The MTOR ES48 Module shall be powered down during this task.

Powering off a MTOR ES 48 affects the section controlled by the module.

BEFORE RE-INSTALLATION WORK

1. Check the replacement board is the Correct Type and is Not Damaged.

2. Check the replacement board has the correct software version.

AFTER RE-INSTALLATION WORK

3. Check the replacement board is correctly fitted.

The EMC protection panel can now be fitted.

The MTOR ES48 module can now be powered back up.

4. Observe the LEDs of the MTOR2 boards are in OK state after initialisation (approximately 40 sec):

(lit)	CG	⊗	⊗ ER	(unlit)
(lit)	V1	⊗	⊗ V2	(lit)
(flashing)	1	⊗	⊗ 2	(unlit)

5. Check the TT that all systems are showing healthy.

During initialisation of the MTOR ES48 module, all the other LEDs of the module are lit up.

Even though the indicators seem to be indicating that the outputs are in the permissive state and the inputs high, the inputs are in fact in the restrictive state.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMTH/Part 04/IE33		
Replace a RIF computer (Ansaldo Interlocking)		
Issue No. 01	Issue Date: 03/03/2018	Compliance Date: 31/05/2018

Includes:	RIF computer
Excludes:	All other computers

***** INDEPENDENCE EXEMPT *****

The RIF computer shall be powered down during this task. If one RIF computer is switched off, the other shall be running otherwise all control will be lost.

BEFORE RE-INSTALLATION WORK

1. Check the replacement RIF is the Correct Type and is Not Damaged.
2. Check certificate of conformity is provided and correct, with the replacement RIF.

AFTER RE-INSTALLATION WORK

3. Check the replacement RIF is correctly fitted.

    The replacement RIF can now be powered back up.

4. Check the TT that all systems are showing healthy.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IE34		
Replace a VSS or 24VP fuse (Ansaldo Interlocking)		
Issue No: 2	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	VSS and 24VP fuse
Excludes:	All other fuses

MTOR ES48 modules associated with the faulty fuse shall be powered down before carrying out this task.

Powering off a MTOR ES 48 affects the section controlled by the module.

BEFORE RE-INSTALLATION WORK

1. Check the replacement fuse is the Correct Type and are Not Damaged.

AFTER RE-INSTALLATION WORK

2. Check the replacement fuse is correctly fitted.

The MTOR ES 48 module can now be powered back up.

3. Observe the LEDs of the MTOR2 boards are in OK state after initialisation (approximately 40 sec):

(lit)	CG	⊗	⊗	ER	(unlit)
(lit)	V1	⊗	⊗	V2	(lit)
(flashing)	1	⊗	⊗	2	(unlit)

4. Check the TT that all systems are showing healthy.

During initialisation of the MTOR ES48 module, all the other LEDs of the module are lit up.

Even though the indicators seem to be indicating that the outputs are in the permissive state and the inputs high, the inputs are in fact in the restrictive state.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IF01		
Replace an Atlas 200 ETCS Network Transmission Gateway LRU		
Issue No: 03	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Atlas 200 Network Transmission Gateway (NTG) Cooling Fans, CPU Boards, Diagnostic Board, Switch Boards, PSU Boards
Excludes:	All other Atlas 200 Network Transmission Gateway Components

GENERAL

When removing or handling any NTG modules, check that an ESD wrist strap is connected to the ESD bonding point on the left-hand side of the cubicle; this wrist strap shall be worn on the wrist of personnel prior to the removal and handling of any NTG modules.

All NTG LRUs are hot swappable.

BEFORE INSTALLATION WORK

1. Check the replacement LRU is not damaged and is correct type.

2. Disconnect any cables and note their positions.

If replacing a cooling fan, do not remove more than one fan tray at the same time, as this could cause the NTG to overheat.

DURING THE WORK

For CPU Board

3. Synchronise the configuration from another board using the NMT.

4. Take a copy of the configuration parameters and then reboot the NTG via NMT.

AFTER INSTALLATION WORK

5. Check that replacement LRU is correctly installed.

6. Reconnect any cables that have been disconnected checking they are correctly seated and match the positions noted in Step 2.

7. Observe that the Diagnostic Board LEDs and chassis LEDs are showing normal indications.

For Cooling Fans

8. Observe that the ‘FAN’ LED on the Diagnostic Board is UNLIT.

For Switch Board

9. Observe that the chassis LED relating to the replaced board is GREEN.

For Main CPU Board

10. Connect to the board and use the NMT to set the “RBC Daemon Port” and “RBC Disc. Timeout [sec]” parameters referring to the copy taken in Step 4. Save the changes and reboot the board.

11. Observe that the chassis LED relating to the replaced board is GREEN.

For a Diagnostic Board

12. Observe that the ‘Diag’ LED on the Diagnostic Board is flashing GREEN.

For PSU Board

13. Observe that the Diagnostic Board ‘PSU’ LED is UNLIT.

14. Observe that the PSU board ‘POWER’ LED is lit GREEN and the ‘FAULT’ LED is UNLIT.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IF02		
Replace an Atlas 200 RBC Computing Subsystem Module		
Issue No: 03	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	MPU, HSCU and REDMAN Modules, Computing Channel PSU, RBC Computing Channel Identity Device and USB Key
Excludes:	All other types

GENERAL

Repair or replacement of the sealed safety fuse located on the circuit board of a Redman module in the RBC shall not be carried out by first line maintenance under any circumstances as this might mask an unsafe condition.

When removing or handling any RBC modules, check that an ESD wrist strap is connected to the ESD Bonding Point on the left-hand side of the Cubicle; this wristband shall be worn on the wrist of personnel prior to the removal and handling of any RBC modules.

Spare modules should be stored in the same ambient conditions as the operational RBC to prevent any adverse effect to the performance of the modules, when unpacked and powered up.

When running the RBC in 2-out-of-2 mode, switching off either of the two Operational Channels will rupture the security fuse of the remaining Channel and cause the RBC to shut down. The rear circuit breakers shall always be used to power down an RBC.

When there is a faulty board in a computing channel (MPU, HSCU or REDMAN board), all three boards shall be replaced together.

Unless only the USB Key has failed, once it is inserted into its MPU it shall be considered as captive to the MPU and shall remain inserted, even when the MPU is removed and returned for repair.

If the system is fully functional, but running in degraded mode, it is recommended that failure reports are completed before attempting repairs to allow correct recording of indicators.

If more than one computing channel has failed the RBC is non-operational. It shall be powered down and all failed channels replaced before restarting using the RBC Start Up procedure. In this situation Education (Step 8) is not required.

BEFORE INSTALLATION WORK

1. Check the replacement module is not damaged and is correct type.

2. For USB Keys and Identity Devices, check that the correct channel specific replacement is selected from the available spares.

3. Check for the correct working of the other two computing channels. Use the switch to power off the computing channel in which a faulty module has been identified.

4. Check the labelling of any cable connected to the equipment, noting the connector positions, before disconnecting any cable.

AFTER INSTALLATION WORK

5. Check replaced modules and boards are correctly installed.

6. Plug the Ethernet cables (RJ45) into the MPU board.

7. Use the front panel switch to turn on the power of the computing channel into which the new boards have been inserted.

8. Educate the module by logging on to the MSS HMI and applying RBC education.

9. After 2 minutes, check the LED indications (Table 1):

Board Name	LED	State in Normal Operation	Note
PSU	In OK	Steady ON	
	Out OK	Steady ON	
MPU	BFL	Steady OFF	
HSCU	CHANNEL A OK	Flashing every 0.5s	
	CHANNEL B OK	Flashing every 0.5s	
REDMAN	FIE	Steady ON	
	FI	Steady ON	

Table 1 – LED Indications

$ For diagnostic use only by Alstom

10. Check the REDMAN display for correct details.

During normal operation, a text including the RBC software version, application SHA, maximum cycle time and mode is shown in a loop on the REDMAN display. For example:

"RBC Rt.r.k.vv,,SHAD=bbbbbbbbbbbbbbbbbbbb, Cycle duration is xxx ms / yyy ms, Mode is zzzz".

Where:

a) "Rt.r.k.vv" is a software version number, e.g. "R8.1.0.03"

b) "bbbbbbbbbbbbbbbbbbbb" is the SHA database of the channel.

c) "xxx ms" is the maximum channel cycle time since the display was last updated.

d) "yyy ms" is the maximum channel cycle time since the channel was powered on.

e) "zzzz" indicates whether the cubicle is running in 3oo3 or 2oo2 mode.

Any other behaviour indicates a faulty RBC channel.

11. On the MSS HMI, check that the previously reported alarms have become inactive (grey) and clear them from the display. If the failure is still present or if one of the previous checks failed, refer to the Alstom Maintenance Service.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IF03		
Replace an Atlas 200 RBC Fan Unit		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Atlas 200 Radio Block Centre (RBC) Fan Unit
Excludes:	All other types of Fan Unit

The RBC can run satisfactorily without any fans for a limited period, 15 minutes maximum, at room temperature between 0 – 40 °C. This is not normally an issue, as one of the two fan trays will normally be working during maintenance of the other tray.

BEFORE INSTALLATION WORK

1. Check the replacement Fan Unit is not damaged and is correct type.

2. Turn the fan switch, for the unit to be removed, at the rear of the RBC to the ‘off’ position, this should power off the fan tray.

3. Disconnect the plug on the rear of the Fan Unit.

AFTER INSTALLATION WORK

4. Re-connect the plug on the rear of the Fan Unit.

5. Check that replaced Fan Unit is correctly installed.

6. Turn the fan switch at the rear of the RBC to the ‘on’ position. This will power up the fan tray.

7. Confirm that the three fans are running by checking the airflow with your hand, and check that the three fan indicators on the new unit are lit.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IF04		
Replace an Atlas 200 RBC Front Panel Fuse		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Atlas 200 Radio Block Centre (RBC) Front Panel Fuses
Excludes:	All other front panel fuses

When running the RBC in 2oo2 mode, switching off either of the two operational Computing Channels will cause the RBC to shut down.

Switching off both I/O groups will also remove power from the Computing Subsystem and cause the RBC to shut down.

BEFORE INSTALLATION WORK

1. Check the replacement fuse is not damaged and is correct type.

2. When a fuse is identified as faulty or has to be checked, use the related Computing Channel switch or I/O Group to power down the Computing Channel or I/O Group, thus removing power from the fuse.

AFTER INSTALLATION WORK

3. Use the related front panel switch to turn on the power of the related Computing Channel or I/O Group.

4. If the replaced fuse is related to a Computing Channel, check that all four PSU green LEDs called “In OK” and “Out OK” of the Computing Channel are lit and steady.

5. If the replaced fuse is related to an I/O Group, check that the green LEDs called “In OK” and “Out OK” of the I/O Group are lit and steady.

6. On the MSS HMI, check that the previously reported alarms have become inactive (grey) and clear them from the display.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IF05		
Replace an Atlas 200 RBC I/O Subsystem Module		
Draft No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	EAU and I/O Power Supply Module (PSU)
Excludes:	All other types Power Supply Module

When removing or handling any RBC modules, check that an ESD wrist strap is connected to the ESD Bonding Point on the left hand side of the Cubicle; this wristband shall be worn on the wrist of personnel prior to the removal and handling of any RBC modules.

Switching off both I/O groups will also remove power from the Computing Subsystem and cause the RBC to shut down.

Spare modules should be stored in the same ambient conditions as the operational RBC to prevent any adverse effect to the performance of the modules, when unpacked and powered up.

If the system is fully functional, but running in degraded mode, it is recommended that failure reports are completed before attempting repairs to allow correct recoding of indicators.

BEFORE INSTALLATION WORK

1. Check the replacement module is not damaged and is correct type.

2. Check for the correct working of the other I/O group. Use the appropriate I/O Group switch to power off the I/O group in which a faulty module has been identified.

3. Remove the faulty module from the I/O Group and place it within an anti- static container.

AFTER INSTALLATION WORK

4. Check replaced Module is correctly installed.

5. Use the appropriate front panel I/O Group switch to turn on the power of the I/O group into which the new board has been inserted.

6. On the related I/O Group PSU, check that the green LEDs called “In OK” and “Out OK” are lit and steady.

7. On each EAU, after approximately 5 to 10 seconds, check that both orange LEDs called “R” flash at a rate of approximately once per second.

8. On the MSS HMI, check that the previously reported alarms have become inactive (grey) and clear them from the display.

Communications between the RBC and MSS can take several minutes to start following replacement of an EAU due to address caching in the network equipment.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IF06		
Replace an Atlas 200 RBC Main PSU		
Issue No: 02	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Atlas 200 Radio Block Centre Main Power Supply Unit (PSU)
Excludes:	All other Power Supply Unit's

GENERAL

Switching off the incorrect circuit breaker when operating on a single Main Power Supply causes the RBC to shut down.

Check that CB1 is OFF before removing or attaching any Main PSU #1 plug, and that CB2 is OFF before removing or attaching any Main PSU #2 plug.

BEFORE INSTALLATION WORK

1. Check the replacement module is not damaged and is correct type.

2. Use the correct circuit breaker at the rear of the RBC cubicle to power off the failed Main PSU.

AFTER INSTALLATION WORK

3. Check that replaced PSU is correctly installed.

4. Use the correct circuit breaker at the rear of the RBC cubicle to turn on the power to the Main PSU which has been replaced.

5. Observe that the green "System" and "Uo" indicators on the new PSU are lit, and the red Error indication is not lit.

6. On the MSS HMI, check that the previously reported alarms have become inactive (grey) and clear them from the display.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IF07		
Replace an RBC Maintenance Supervision System (MSS) Gateway PC / Wyse Terminal		
Issue No: 03	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	MSS Client Gateway PCs and Wyse Terminals
Excludes:	All other MSS sub-components

GENERAL

You should try to clear MSS Client faults by re-booting the device before resorting to replacement.

BEFORE INSTALLATION WORK

1. Check the replacement unit is not damaged and is the correct type.

MSS Client Gateway Only

2. Shut down through the Windows menu. If this is not possible, shut down using the power switch on the equipment.

Wyse Terminal Only

3. Shut down the Wyse Terminal using the power switch on the equipment.

4. Note the position of the cables connected to the MSS Client Gateway / Wyse terminal before carrying out any disconnections.

5. Disconnect all cables to the MSS Client Gateway / Wyse Terminal.

DURING THE WORK

For MSS Client Gateway

6. The replacement MSS Client Gateway shall be pre-configured for the same role as the removed one. The labelling of the two machines shall match:

    a) The machine shall be for the same MSS, have the same unit name and scheme name, e.g. MSS1 CG 1 GWML

    b) The MSS software baseline is the same, e.g. 3.1.0.15266

    c) The S2K version is the same, e.g. 8.3

    d) The HMI version is the same, e.g. v1.0

    e) The two IP addresses (LAN1 and LAN2) are the same.

AFTER INSTALLATION WORK

7. Re-connect all cables to the MSS Client Gateway/Wyse Terminal in the positions noted at step 3.

8. Check that replaced MSS Client Gateway/Wyse Terminal is correctly installed.

9. Where necessary, power on the replacement components.

10. Spare Wyse Terminals shall be configured to match the identity of the unit that was removed. Spare MSS Client Gateways are pre-configured.

11. After booting has completed, check that the new MSS Client Gateway/Wyse Terminal is working correctly by exercising the MSS HMI.

12. Check that the previously reported alarms have become inactive (grey) and clear them from the display.

END

Includes:	MSS Server, LAN switches, NTP server KVM and Console
Excludes:	MSS Client Gateways Wyse Terminals and Firewalls

BEFORE INSTALLATION WORK

1. Check the replacement unit is not damaged and is correct type.

2. For replacement of the MSS Server, first power down the unit using the switch found on the front.

All Sub-Component's

3. Disconnect power supply, as required.

4. Note the position of the cables connected to the unit being replaced.

5. Disconnect the cables.

6. Remove the failed equipment and label it as failed.

DURING THE WORK

For MSS Server

7. The replacement unit shall be pre-configured for the same role as the removed MSS Server. The hardware shall be of a compatible type, and the installed software and configuration shall be the same as for the removed unit. The labelling of the two machines shall match:

    a) The machine shall be for the same MSS, have the same unit name and scheme name, e.g. MSS1 Server 1 GWML.

    b) The MSS software baseline is the same, e.g. 3.1.0.15266.

    c) The S2K version is the same, e.g. 8.3.

    d) The Server version is the same, e.g. v0_2_5.

    e) The three IP addresses are the same.

For LAN Switch

8. Insert a spare LAN Switch (from the approved Atlas 200 spares list) in the MSS cubicle. This shall be pre-configured and labelled with the cabinet name (e.g. MSS1) and either 'Switch A' or 'Switch B'.

AFTER INSTALLATION WORK

9. Check that replaced sub-component is correctly installed.

10. Reconnect all disconnected cables from the front and rear of the equipment and check the connector positions.

11. Where necessary, power up the replacement component.

For MSS Server replacement

12. Observe the start-up screen for error messages.

13. After booting has completed, check that the new MSS Server is working by observing the status of the server on a MSS HMI.

NOTE: *A re-boot can take up to 10 minutes.*

For NTP Server replacement

14. Check after a few minutes that the new NTP Time Server has reported that the antenna is functioning correctly.

15. Check after a few minutes that the new NTP Time Server is synchronised. If not, check the radio signal is available (Radio Antenna LED blinks), connections etc.

For KVM Switch replacement

16. Check that the switch is operating correctly by selecting each of the MSS Servers and MSS Client Gateways in turn.

For Console Replacement

17. Check the new console display is operating by selecting each channel on the KVM switch.

The keyboard and trackpad can be checked by logging in to the MSS client which is accessible when the Client Gateway is selected via the KVM switch."

All Sub-Component's

18. Check the status of every connection by looking at the associated LED indications.

19. On an MSS HMI, check that any previously reported alarms have become inactive (grey) and clear them from the display.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IF10		
Replace an Atlas 200 LEU COBALT Micro-Coder		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Atlas 200 Lineside Electronic Unit (LEU) COBALT Micro-Coder
Excludes:	All other types of Micro-Coder

BEFORE INSTALLATION WORK

1. Check replacement Micro-Coder is Correct Type and is Not Damaged.
2. Check the replacement Micro-Coder software version label is correct to the system baseline.
3. Isolate MIPS from main power supply at circuit breaker.

AFTER INSTALLATION WORK

4. Check replacement Micro-Coder is Correctly Installed.
5. Check the Configuration Key is Correctly Installed.
6. Check the local earth cable is Correctly Installed.
7. Check the balise cables, supply and current sensing inputs are Correctly Installed.
8. Reinstate power to MIPS via the circuit breaker.
9. Check replacement Micro-Coder power supply status lamp is on.
10. After allowing time to start up check replacement Micro-Coder indications are as follows:
    - OUT1 and OUT2: off or flashing green (for unused output).
    - ERR: off.
    - OK: Flickering green.
    - ETH1 TX and ETH2 TX: off.
    - ETH1 LNK and ETH2 LNK: off.
11. Using the BEPT, Correspond the messages transmitted by the balise and signal aspects / route indicators with the LEU parameterisation sheet for all aspects & routes.
12. Transfer label from faulty Micro-Coder (or use replacement as necessary).

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IF11		
Replace an Atlas 200 LEU Configuration Key		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Atlas 200 LEU Configuration Key
Excludes:	All other Configuration Keys

BEFORE INSTALLATION WORK

1 Check replacement Configuration Key is Correct Type and is Not Damaged.

2 Isolate MIPS from main power supply at circuit breaker.

AFTER INSTALLATION WORK

3 Check replacement Configuration Key is Correctly Installed.

4 Reinstate power to MIPS via the circuit breaker.

5 Check replacement Micro-Coder indications after allowing time to start up – if are as follows, then the Micro-Coder has started up correctly:

- OUT1 and OUT2: off or flashing green (for unused output).
- ERR: off.
- OK: Flickering green.
- ETH1 TX and ETH2 TX: off.
- ETH1 LNK and ETH2 LNK: off.

6 Using the Balise & Encoder Programming and Testing Tool (BEPT), correspond the messages transmitted by the balise with the LEU parameterisation sheet for all aspects & routes.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IF12		
Replace an Atlas 200 LEU MIPS200 Power Supply		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Atlas 200 LEU MIPS200 Power Supply
Excludes:	All other Power Supplies

BEFORE INSTALLATION WORK

1 Check replacement MIPS200 Power Supply is Correct Type and is Not Damaged.

2 Check existing MIPS200 is Isolated from supply at circuit breaker.

AFTER INSTALLATION WORK

3 Check replacement MIPS200 is Correctly Installed.

4 Reconnect the supply to the MIPS200 Power Supply.

* 5 Check replacement MIPS200 24V output voltage status indication is lit.

* 6 After allowing time for start up check replacement Micro-Coder indications are as follows:

- OUT1 and OUT2: off or flashing green (for unused output).
- ERR: off.
- OK: Flickering green.
- ETH1 TX and ETH2 TX: off.
- ETH1 LNK and ETH2 LNK: off.

7 Check or arrange for correct labelling of MIPS200 Power Supply

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/IG10		
Replace a Futur 2500 Radio Block Centre (RBC) System – Vital Printed Circuit Board and Associated Dongle		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Futur 2500 Radio Block Centre (RBC) System and Stratus TCC FTS
Excludes:	All other Futur 2500 & Stratus TCC FTS equipment

When removing or handling any boards the ESD wrist strap shall always. Prior to use check that an ESD wrist strap is connected to the ESD bonding point

RBC & STRATUS TCC

In normal operation, the Maintenance Elements are not used and all connections shall be disconnected from the Trainguard Futur 2500 RBC

During Maintenance task, the Maintenance Elements are used and shall be connected from the Trainguard Futur 2500 RBC

BEFORE INSTALLATION WORK

This can be prior to or post programming

1 Check the replacement board is of the correct type and not damaged and that any links or PCB mounted switches are in the correct position

2 Every cable shall be marked with a label with the name of the module and the connector to which it is connected

3 Isolate the power supply to the RBC processor before replacing a board

AFTER INSTALLATION WORK

This can be prior to or post programming

4 Before Switch ON the circuit breakers of the Trainguard Futur 2500, the power voltage shall be measured at the corresponding connector points.

5 Check that the voltage is in the permitted margins:

- (90 – 264V AC).

6 Verify that the Trainguard Futur 2500 RBC has been properly mounted and earthed.

7 Verify that all the cables are correctly connected.

8 Check that the LED of the “PSU A” and of the “PSU B” is green.

9 Check that the three LEDs in the back of the RBC Processor MKII are green.

10 Check the TCC Software version.

11 Check the data and code version of every card (MPM, SIOM, DPM and TBS LAN).

12 Check that LEDs in the “PSU A” and in the “PSU B” are green.

13 Check that the three LEDs in the back of the RBC Processor MKII are green.

14 Check the ISDN Communication link of the TCC through the CTF.

15 Check the communication with every interlocking through the CTF.

16 Check the communications through the CTF (only If the Trainguard Futur 2500 RBC is connected with a ERTMS Manager equipment).

17 Check the communications through the CTF (only if the Trainguard Futur 2500 RBC is connected with others RBC equipment).

18 Check in CTF that there are no RBC Alarms

19 Record all values.

BEFORE PROGRAMMING

Radio Block Centre (RBC)

Incorrect RBC Processor MKII programming can cause a critical failure has occurred on that lane and that lane will be shut down

20 Refer to the programming schedule of specific item of equipment.

21 Check the software is installed in the correct version.

22 Install the software.

23 MPM Data corresponding to each specific RBC Processor MKII shall be recorded

24 DPM Data corresponding to each specific RBC Processor MKII shall be recorded

STRATUS TCC

25 Each piece of network configuration equipment for the different TCC should have network configuration data (IP address, network mask, and gateway)

AFTER PROGRAMMING

26 Check the software has been correctly installed by comparing the displayed check sum and version with the details contained in the relevant DNA file

27 Print and attach the software version label to the front of the CCB

28 Check any LEDs on the replaced board are indicating correctly

29 Final MPM Data corresponding to each specific RBC Processor MKII shall be recorded

30 Final DPM Data corresponding to each specific RBC Processor MKII shall be recorded

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/IG11		
Replace a Moviola – Vital Printed Circuit Board and Associated Dongle		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Moviola - Vital Printed Circuit Board and Associated Dongle
Excludes:	All other Moviola equipment

When removing or handling any boards, the ESD wrist strap shall always be worn and connected to the ESD bonding point.

MOVIOLA

The Installation Tool shall be executed by an administrator user. In this way, the Installation Tool will create MoviolaW Administrator user and the MoviolaW user groups.

BEFORE INSTALLATION WORK

The installation shall be performed in the correct order from Step 1 to Step 7

1 Check that the PC has Window XP SP3 Operating System.

2 Check there is no other specific tool that is required to be installed to run the SAM Configuration tool.

3 Check the replacement board is of the correct type and not damaged and that any links or PCB mounted switches are in the correct position.

4 Isolate the power supply to the equipment being replaced.

AFTER INSTALLATION WORK

5 Restore the power supply.

BEFORE PROGRAMMING

6 Check the IP address.

7 Follow the procedures as described in the MoviolaW Installation manual to set up the MoviolaW Installer Setup Wizard and the Maintenance Tool.

AFTER PROGRAMMING

8 Check the software has been correctly installed.

9 Check network connections are active.

10 Check that the replacements operate correctly. This shall be done in liaison with the signaller.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/IG12		
Replace a Reliable Data Storage – Vital Printed Circuit Board and Associated Dongle		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Reliable Data Storage - Vital Printed Circuit Board and Associated Dongle
Excludes:	All other Reliable Data Storage equipment

> **When removing or handling any boards, the ESD wrist strap shall always be worn and connected to the ESD bonding point.**

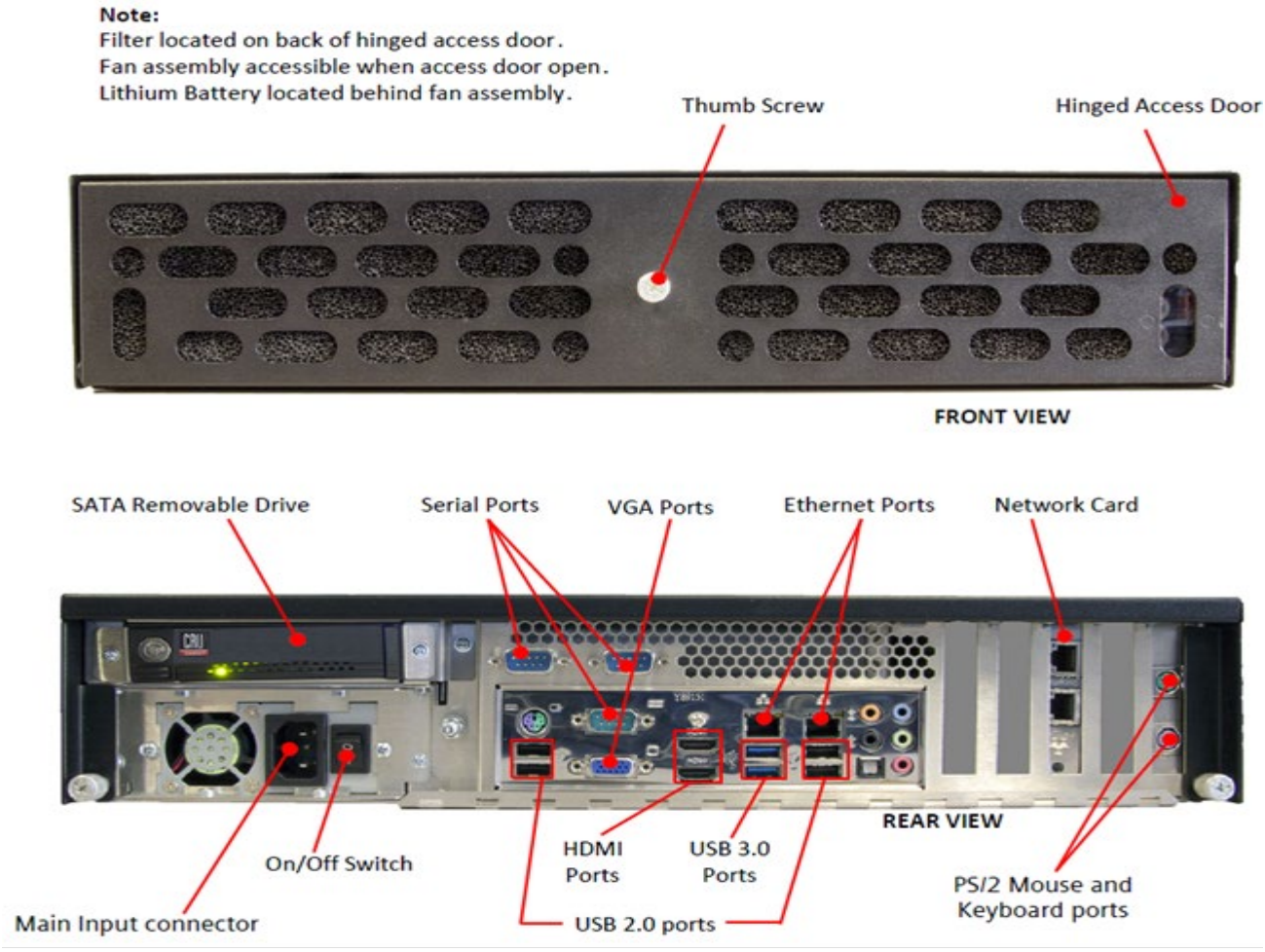
RDS – Blue Chip C110 PC

> Observe only the board programming/installation schedule; these are described in Blue Chip C110 Installation & Configuration Guide and Maintenance Guide

> To install the RDS -Blue Chip C110 PC, the user shall have the administration rights with a protected, non-expiry password.

> The password shall be added to the PC BIOS. The BIOS is to be configured to restart the machine after power-up, following shutdown.

Identification of Components



NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/IG12		
Replace a Reliable Data Storage – Vital Printed Circuit Board and Associated Dongle		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

BEFORE INSTALLATION WORK

1. The installation shall be performed in the correct order.
2. Check that PC has Window XP SP3 Operating System.
3. Check that the replaced PC is of the correct type and not damaged. This should include a check of the Mod state to check it is the same or later.
4. Record the serial number of the replacement unit.
5. Isolate the power supply using the Main Circuit Breaker (MCB).
6. Note the positions of all cables and which ports they are connected to.
7. Check the cables and wires are correctly labelled.
8. Unplug the cables from the PC.
9. Remove and retain the SATA Removable Drives.
10. Remove and retain the fixing securing the PC to the bracket and withdraw the PC.

AFTER INSTALLATION WORK

11. Insert the retained SATA Removable Drives into the replacement PC.
12. Secure the PC in position using the retained fixings.
13. Check the cables are in the correct position and then re-connect.
14. Re-apply the power supply using the associated MCB.
15. Check the replacement PC is correctly installed.
16. Perform the required test to ensure the system is operational.
17. Check or arrange for correct labelling of unit.
18. Restore the power supply.
19. Copy the configuration files to C:\RDS. After re-booting the operating system, the RDS will start.
20. Inform the SM(S) that the unit has been changed and of the replacement unit's serial number.

BEFORE PROGRAMMING

21. Check the IP address.

22. Follow the procedures as described in the Reliable Data Storage Installation and Configuration Guide for to install and configure the RDS.

AFTER PROGRAMMING

23. Check the software has been correctly installed.

24. Check network connections are active.

25. Check that the replacements operate correctly. This shall be done in liaison with the signaller.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/IG13		
Replace a Thameslink RBC System – RBC Processor Mk2		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Thameslink Radio Block Centre (RBC) System - RBC Processor Mk2 only
Excludes:	All other Thameslink Radio Block Centre (RBC) System equipment

When removing or handling any boards, the ESD wrist strap shall always be worn and connected to the ESD bonding point.

BEFORE INSTALLATION WORK

1. Check the replacement RBC Processor Mk2 is not damaged and is correct type.
2. Check that all the cables both front and back have Safe Insulation and are Correctly Labelled.
3. Disconnect and secure all connections to the RBC Processor.
4. Isolate the RBC Processor from the supply.

AFTER INSTALLATION WORK

5. Check the replaced Processor is securely mounted.
6. Reconnect and check that all cables and the plugs are securely locked in place.
7. Reconnect the power supply.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/IG14		
Replace a Thameslink RBC System - RBC Processor Mk2 Card		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Thameslink Radio Block Centre (RBC) System - RBC Processor Mk2 Card.
Excludes:	All other types of Thameslink Radio Block Centre (RBC) System equipment

When removing or handling any boards, the ESD wrist strap shall always be worn and connected to the ESD bonding point.

Where an RBC Processor card has to be extracted from the Processor, the Processor shall be powered down first or otherwise the card will be damaged.

BEFORE INSTALLATION WORK

1. Check the replacement RBC Card is not damaged and is correct type.
2. Check that all the cables both front and back have Safe Insulation and are Correctly Labelled.
3. Isolate the RBC Processor Mk2 Unit from the supply.

AFTER INSTALLATION WORK

4. Check that all cables connected correctly and the plugs are securely locked in place.
5. Reconnect the power supply.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/IG15		
Replace a Thameslink RBC System - STRATUS TCC FTS		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Thameslink Radio Block Centre (RBC) System - STRATUS TCC FTS.
Excludes:	All other Thameslink Radio Block Centre (RBC) System equipment

When removing or handling any boards, the ESD wrist strap shall always be worn and connected to the ESD bonding point.

BEFORE INSTALLATION WORK

1. Check the replacement STRATUS TCC FTS is not damaged and is correct type.
2. Check that all the cables both front and back have Safe Insulation and are Correctly Labelled.
3. Disconnect the VGA and USB Cables from the KVM switch (These connections are only used for Maintenance tasks).
4. Disconnect and secure all connections to the CPUA.
5. Isolate the CPUA from the supply.
6. Disconnect and secure all connections to the CPUB.
7. Isolate the CPUB from the supply.

AFTER INSTALLATION WORK

8. Check the replaced STRATUS TCC FTS is securely mounted.
9. Reconnect and check that all cables and the plugs are securely locked in place.
10. Reconnect the power supply to both CPUA and CPUB.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/IG16		
Replace a Thameslink RBC System – ISDN Unit		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Thameslink Radio Block Centre (RBC) System - ISDN Unit.
Excludes:	All other ISDN Units

When removing or handling any boards, the ESD wrist strap shall always be worn and connected to the ESD bonding point.

BEFORE INSTALLATION WORK

1. Check the replacement ISDN Unit is not damaged and is correct type.
2. Check that CPUA & CPUB and CPU-RJ48 cables have Safe Insulation and are Correctly Labelled.
3. Isolate the ISDN Unit from the supply.

AFTER INSTALLATION WORK

4. Check both CPUA & CPUB and CPU-RJ48 cables are connected correctly and the plugs are securely locked in place.
5. Reconnect the power supply.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IG17		
Replacement of Printed Circuit Cards (PCCs) – SIOM, LAN and DPM Cards (Thameslink Only)		
Issue No: 02	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Thameslink Radio Block Centre (RBC) System - Printed Circuit Cards (PCCs) – SIOM, LAN and DPM Cards.
Excludes:	All other types of Radio Block Centre (RBC) - PCCs

GENERAL

When removing or handling any boards, the ESD wrist strap shall always be worn and connected to the ESD bonding point.

Where an RBC Processor card has to be extracted from the Processor, the Processor shall be powered down first or otherwise the card will be damaged.

BEFORE INSTALLATION WORK

1. Check the replacement RBC Printed Circuit Card is not damaged and is correct type.
2. Isolate the RBC Processor Unit from the power supply.

AFTER INSTALLATION WORK

3. Check that Printed Circuit card is securely pushed home and locked in place.
4. Reconnect the power supply.
5. Check that the front LEDs of the MPM and SIOM cards are displaying a green or yellow light in the three channels.
6. To verify that the RBC processor works correctly, confirm that the LEDs on the rear of the processor unit are lit and displaying a steady green light.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IG18		
Replace an NCL RBC System – RBC Processor Mk2		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	NCL Radio Block Centre (RBC) System - RBC Processor Mk2 only
Excludes:	All other NCL Radio Block Centre (RBC) System equipment

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.

BEFORE INSTALLATION WORK

1. Check the replacement RBC Processor Mk2 is not damaged and is correct type.

2. Check that all the cables both front and back have safe insulation and are correctly labelled.

3. Disconnect and secure all connections to the RBC Processor. All working shall be carried out in accordance with general instructions for staff working on S&T equipment.

4. Isolate the RBC Processor from the supply.

AFTER INSTALLATION WORK

5. Check the replaced Processor is securely mounted.

6. Reconnect and check that all cables and the plugs are locked in place.

7. Reconnect the power supply.

NOTE: *When the RBC is powered down, the ETCS Enable button should 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 Startup Process - 156905-SIR-NOT-ESG-000001.*

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IG19		
Replace an NCL RBC System - RBC Processor Mk2 Card		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	NCL Radio Block Centre (RBC) System - RBC Processor Mk2 Card
Excludes:	All other types of NCL Radio Block Centre (RBC) System equipment

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.

Where an RBC Processor card has to be extracted from the Processor, the Processor shall be powered down first or otherwise the card will be damaged.

BEFORE INSTALLATION WORK

1. Check the replacement RBC Card is not damaged and is correct type.

2. Check that all the cables both front and back have safe insulation and are correctly labelled.

3. Isolate the RBC Processor Mk2 Unit from the supply.

All working shall be carried out in accordance with general instruction for staff working on S&T Equipment.

AFTER INSTALLATION WORK

4. Check that all cables connected correctly, and the plugs are securely locked in place.

5. Reconnect the power supply.

NOTE: *When the RBC is powered down, the ETCS Enable button should 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 Startup Process - 156905-SIR-NOT-ESG-000001.*

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IG20		
Replace an NCL RBC System – TCC		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	NCL Radio Block Centre (RBC) System - TCC
Excludes:	All other NCL Radio Block Centre (RBC) System equipment

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.

NOTE: *TCC is designed to be replaced as a complete unit (both CPU's). As a combined unit to include both PC's and chassis it is a 19kg two-person lift. It can either be removed in this way, or split down and removed as individual CPU's.*

BEFORE INSTALLATION WORK

1. Inform the Signaller before undertaking any work on this unit.
2. Check the replacement TCC unit is not damaged and is correct type.
3. Check that all the cables both front and back have safe insulation and are correctly labelled
4. Disconnect the VGA and USB Cables from the KVM switch (These connections are only used for Maintenance tasks).
5. Isolate the CPUA from the supply All working shall be carried out in accordance with general instruction for staff working on S&T Equipment.
6. Disconnect and secure all connections to the CPUA.
7. Isolate the CPUB from the supply. All working shall be carried out in accordance with general instruction for staff working on S&T equipment.
8. Disconnect and secure all connections to the CPUB.

AFTER INSTALLATION WORK

9. Check the replaced TCC is securely mounted.
10. Reconnect and check that all cables and the plugs are securely locked in place.
11. Reconnect the power supply to both CPUA and CPUB.

12. Check that the LEDs on the front of the TCC unit are lit and showing a steady green light. When the RBC is powered down, the ETCS Enable button shall 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

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IG21		
Replace an NCL RBC System – ISDN Board		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	NCL Radio Block Centre (RBC) System ISDN Module, Processing Module, Quad Fast Ethernet Interface, Memory Module Carrier
Excludes:	All other ISDN Board, TCC Power Supply Unit

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.

BEFORE INSTALLATION WORK

1. Inform the Signaller before any work takes place on this equipment.

2. Check the replacement module is not damaged and is correct type.

3. Check that CPUA & CPUB and CPU-RJ48 cables have safe insulation and are correctly labelled.

4. Isolate the module from the supply by operating the rocker switch on the front of CPU A or B to the OFF position.

All work shall be carried out in accordance with general instruction for staff working on S&T Equipment.

AFTER INSTALLATION WORK

5. Check both CPUA & CPUB and CPU-RJ48 cables are connected correctly, and the plugs are securely locked in place.

6. Reconnect the module to the supply by operating the rocker switch on the front of CPU A or B to the ON position.

NOTE: *If the RBC is fully powered down, the ETCS Enable button shall 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*

7. Confirm that the LEDs are lit on the front of the TCC unit and show a steady green indication.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IG22		
Replacement of Printed Circuit Cards (PCCs) – SIOM, LAN and DPM Cards (NCL Only)		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	NCL Radio Block Centre (RBC) System - Printed Circuit Cards (PCCs) - MPM,SIOM,LAN and DPM Cards
Excludes:	All other types of NCL Radio Block Centre (RBC) - PCCs

GENERAL

When removing or handling any boards, the ESD wrist strap shall always be worn and connected to the ESD bonding point.

Where an RBC Processor card has to be extracted from the Processor, the Processor shall be powered down first or otherwise the card will be damaged.

In the event of replacing multiple cards, each card should be replaced one at a time to avoid confusion.

Inform the Signaller before replacing any RBC cards.

BEFORE INSTALLATION WORK

1. Check the Mod State and Firmware version of the replacement printed card, and that it matches the existing.

2. Check the replacement RBC Printed Circuit Card is not damaged and is correct type.

3. Isolate the RBC Processor Unit from the power supply.

AFTER INSTALLATION WORK

4. Check that Printed Circuit card is securely pushed home and locked in place.

5. Reconnect the power supply.

6. Check that the front LEDs of the MPM and SIOM cards are displaying a green or yellow light in the three channels.

NOTE: *It may take several minutes for the LEDs to display yellow or green following reboot of the RBC.*

7. To verify that the RBC processor works correctly, confirm that the LEDs on the rear of the processor unit are lit and displaying a steady green light.

When the RBC is powered down, the ETCS Enable button shall 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.

8. Check the RBC Technician's Facility for any errors or fault codes.

NOTE: *The spare cards will be stored in a secure location.*

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IG23		
Replace an NCL RBC System- 48V DC Power Supply		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Future 2500 RBC 48VDC Power Supply
Excludes:	Any other power supplies

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.

Caution: The PSUs supply both the network switches and the RBC processor.

The PSU Input is 230v AC. If any of the 48 V DC power supplies fail due to physical damage, unsuitable output voltage levels, failure alarms not tripping or other reasons, it shall be replaced by a serviceable one with a pre-wired IEC C14 plug.

BEFORE INSTALLATION WORK

Removal

1. Check the replacement unit is of the correct type and not damaged.
2. Voltage shall be checked on the 48 V DC output of all four PSUs. When the faulty PSU has been identified it shall be disconnected via the associated IEC C14 plug from the PD A or PD B. After the disconnection has been made, check for voltage on all other PSU's.
3. Disconnect the V+ and V- wire connections to the PSU from the DC Output terminals.
4. The unit shall be removed from the mounting rail with the IEC C14 plug disconnected at the PD A or PD B but with wires remaining terminated on the input side of the PSU

Replacement

5. Check that replacement unit is the same type as the one removed.
6. Check that the mains power supply A or B is isolated.
7. Place the PSU on the mounting rail.
8. Connect the V+ and V- wire connections to the DC Output terminals of the replacement PSU.
9. Check input side wires are terminated correctly prior to plugging the IEC C14 plug back into the PD A or PD B as per application design.

Perform the following checks for the proper installation after replacing power supplies:

10. Check that the 'PSU ON' LED is lit on all four power supplies.

11. Check that the Trainguard Futur 2500/Network Switches operates correctly.

12. Check the voltage at the output.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IG24		
Replace an NCL RBC System- 230V AC 2U 10 Way PDU Strip		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Future 2500 RBC 230V AC 2U 10 Way PDU Strip
Excludes:	All Other Power Supplies

GENERAL

Before undertaking any work within an existing/operational RBC cubicle, the Signaller shall be informed before doing so.

Work shall be carried out by competent staff in accordance with NR/L3/SIGELP/ 50002.

Caution: The PSUs supply both the network switches and the RBC processor.

All work shall be carried out in accordance with general instruction for staff work on S&T equipment.

BEFORE INSTALLATION WORK

Removal

1. To isolate the 230V AC equipment, the IEC C14 plugs shall be disconnected from the power distribution units (PDU) as per application design.
2. Isolate the 230V AC supply at the relevant MCB on the distribution Board within the power cubicle and apply a lock off device.
3. Operating the corresponding rotary isolation switches A or B to the OFF position and remove the securing screws and remove front of the rotary switch.
4. Test using digital multi-meter on the incoming / outgoing side from the rotary switch terminal block for 0V AC.
5. Remove the corresponding output wires from the rotary switch terminal block as per Power distribution diagrams.
6. Remove defective PDU strip.

Replacement

7. Check the replacement unit is of the correct type and not damaged.
8. Mount the replacement PDU strip in it’s original position.
9. Reconnect the corresponding IEC C14 plugs to the PDU as per application design.
10. Reconnect the corresponding wires to the rotary switch output side terminal block as per Power distribution diagrams.

11. Replace front cover of rotary switch and secure with screws.

12. Turn rotary switch to ON position.

13. Remove Lock off device from the relevant MCB on the distribution Board within the power cubicle and restore power.

Perform the following checks to ensure the proper installation after replacing power supplies:

14. Check that the 'PSU ON' LED is lit on all four power supplies.

15. Check that the Trainguard Futur 2500/Network Switches operate correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IG25		
Replace an NCL RBC System- Future 2500 Series E Fan Module		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Future 2500 RBC Fan Module
Excludes:	Any Other Fan Module

***** INDEPENDENCE EXEMPT *****

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.

NOTE: *The fan module is designed to be hot swapped - there is no requirement to isolate the power supply.*

BEFORE INSTALLATION WORK

1. Check the replacement unit is of the correct type and not damaged.
2. Unscrew the two thumb screws at the front of the associated fan module that anchor the fan module to the cabinet.
3. Carefully slide the fan module out and away from the cabinet.

AFTER INSTALLATION WORK

4. Check the unit is correctly labelled.
5. Insert the new fan module, check that it is seated correctly in the cubicle.
6. Tighten up the two thumb screws at the front of the fan module.
7. Check the health indicator at the front of the fan module, the green 'on' indicator shall illuminate.

END

Includes:	CPS-3
Excludes:	All other UCI variants

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

CPS-3 modules shall be powered down before replacement.

Equipment Identification

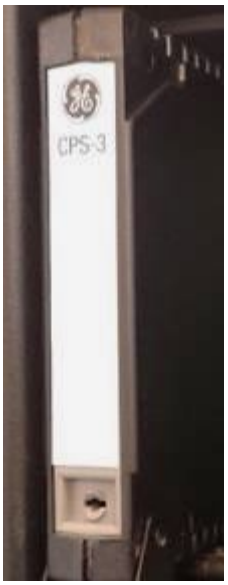


Figure 1 – CPS-3 Module

BEFORE INSTALLATION WORK

1. Check that the CDU-1 unit is fitted.
2. Check the replacement CPS module is the correct type and not damaged.
3. Verify the location of the failed unit.
4. Use the Maintenance Workstation or the ASM Configuration Documentation to verify the replacement module is the correct version (modification level).
5. Place the chassis power switch to the “OFF” position (O).

Location of the Version Information

AFTER INSTALLATION WORK

6. Check that replaced CPS-3 module is correctly installed.

7. Place the chassis power switch to the “ON” position (I).

8. Check that after approximately 4 minutes that the system has restarted without error and that the “5V PWR” and Health LED’s on the CDU-1 are illuminated.

9. Check no alarm messages are displayed on CDU-1. If any alarm is displayed investigate further.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IH02		
Replace an ElectroLogIXS Chassis Information (CI) Module		
Issue No: 02	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	UCI-3
Excludes:	All other UCI variants

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

When installing or removing the UCI-3 module the ElectroLogIXS Chassis power switch shall be switched to the "OFF" position.

Failure to remove power from the ElectroLogIXS can damage the module.

Equipment Identification Image

Figure 1 - UCI 3 Module

BEFORE INSTALLATION WORK

1. Check the CDU is fitted.
2. Check the replacement UCI-3 module is the correct type and version (modification level).
3. Check the replacement is not damaged.
4. Verify the location of the failed unit.
5. Check that UCI-3 module does not have an EPROM fitted, if fitted, this shall be removed.
6. Check that the UCI-3 module does not have DIP switch pack fitted this should be removed.
7. Place the chassis power switch to the "OFF" position (O).
8. Verify the DIP switches on the backplane are set as per ASM Configuration Documentation.

9. Place the faulty module within an anti-static container and label as faulty.

AFTER INSTALLATION

10. Check that the replaced UCI-3 module is correctly installed.

11. Place the Chassis power switch to the ON position (I).

12. Use the Maintenance Workstation or ASM Configuration Documentation to reload the application data.

13. Check that after approximately 4 minutes that the system has restarted without error and that the “5V PWR” and Health LED’s on the CDU are illuminated.

14. Check no alarm messages are displayed on CDU-1. If any alarm is displayed investigate further.

END

Includes:	CIO-PCA
Excludes:	CIO-1A, CIO-CLA, CIO-2A, CIO-MDA variants

Electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

The system shall not be powered down prior to changing CIO-PCA modules. These modules are designed to be “hot swappable”.

Equipment Identification Image

Figure 1 – CIO-PCA

BEFORE INSTALLATION WORK

1. Check that the CDU (Figure 2) is fitted, as this confirms that there are no faults, and the system is operating correctly.

2. Check the replacement CIO-PCA module is the correct type and version (modification level).

The replacement CIO-PCA module needs to be configured using the configuration application.

3. Check the replacement module is not damaged.

4. Do not switch off the power.

5. Check the existing cables for safe insulation.

6. Check existing cabling is correctly labelled.

AFTER INSTALLATION WORK

7. Check that replaced CIO-PCA module is secure and correctly installed.

8. All associated RSTi Modules shall be Power Cycled.

9. Check that after approximately 4 minutes that the system has restarted without error and that the “5V PWR” and Health LEDs on the CDU are illuminated.

Figure 2 - CDU

10. Check no alarm messages are displayed on CDU-1. If any alarm is displayed, then investigate further.

11. Check the final function is working correctly

END

Includes:	VIO24-86S, VIO50-86S, VLD-R8AC
Excludes:	All other VIO or VLD variants

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

The system shall not be powered down prior to changing IO modules. These modules are designed to be "hot swappable".

Equipment Identification Image

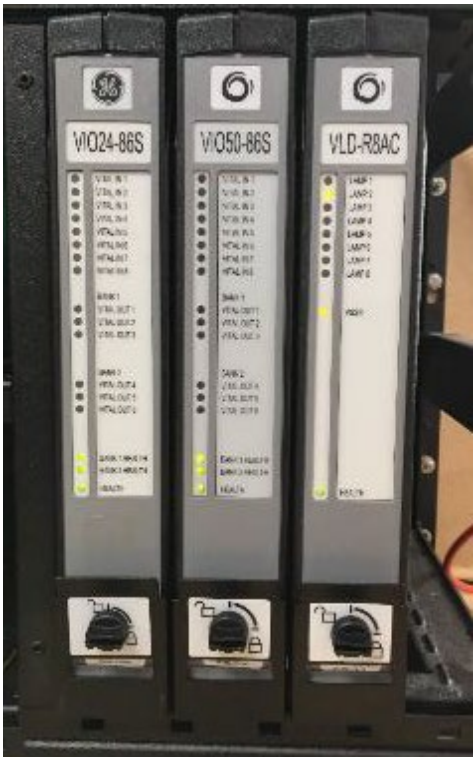


Figure 1 - VIO24-86S, VIO50-86S & VLD-R8AC Modules

BEFORE INSTALLATION WORK

1. Check the CDU is fitted.
2. Check the replacement is the Correct Type and version (modification level) replacement I/O module.
3. Check the replacement I/O module is Not Damaged.
4. Verify the location of the failed module.

AFTER INSTALLATION WORK

5. Check that replaced I/O module is correctly installed.

6. Check that after approximately 4 minutes that the system has restarted without error and that the “5V PWR” and Health LED’s on the CDU are illuminated.

7. Clear SSR count on I/O module. The SSR count shall always be cleared when a new module is installed.

8. Check no alarm messages are displayed on CDU-1. If any alarm is displayed, then investigate further.

9. Check that link comes up correctly on the CDU-1.

10. Check that the VSSR is energised by visually checking the LED on the VLD-R8AC module, The LED can take up to 30s to first illuminate after the module is powered up and then should remain lit continuously.

    If there is a fault the VSSR will pick and drop every 30s until the SSR limit is reached.

11. Check at least one function controlled by the output module operates correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IH05		
Replace an ElectroLogIXS Vital Peripheral Master (VPM) Module		
Issue No: 02	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	VPM-3
Excludes:	All other VPM variants

Appropriate electrostatic precautions shall be taken when equipment. Where provided electrostatic discharge points (ESD) shall be used.

When installing or removing a VPM-3 module verify that the power switch is in the OFF position. Failure to remove power from the ElectroLogIXS can damage the module.

Equipment Identification Image

Figure 1 - VPM-3 Module

BEFORE INSTALLATION WORK

1. Check the CDU is fitted
2. Check the replacement VPM-3 module is the correct type and version (modification level).
3. Check the replacement VPM-3 module is Not Damaged.
4. Verify the location of the failed module.
5. Place the chassis Power Switch to the “OFF” position (O).

6. WIRE COUNT the VPM-3 module.

7. Check existing cabling has safe insulation.

8. Check existing cabling is correctly labelled.

9. Remove the module and place it in an anti-static bag, labelled it as faulty.

AFTER INSTALLATION WORK

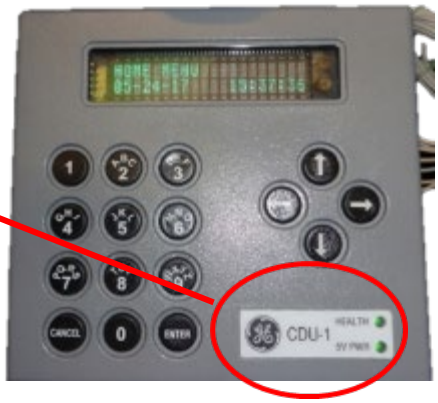
10. Check that replaced VPM-3 module is correctly installed.

11. WIRE COUNT and check cabling is secure.

12. Place the power switch to the ON (I) position.

13. Check the module health on the VPM-3 the CPU Status Indications should be flashing yellow.

14. Check that after approximately 4 minutes that the system has restarted without error and that the “5V PWR” and Health LED’s on the CDU-1 are illuminated.



15. Check no alarm messages are displayed on CDU-1. If any alarm is displayed, then investigate further.

16. If a new VPM-3 module has been installed, verify that the correct version of the Executive (firmware) is loaded by checking the Maintenance Terminal or ASM Configuration Documentation.

17. Clear SSR count on I/O module. The SSR count shall always be cleared when a new module is installed.

18. Verify that the correct LED indications are illuminated on the VPM-3.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IH06		
Replace an ElectroLogIXS Personality Module (VIO24-86S and VIO50-86S)		
Issue No: 02	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	VIO24-86S and VIO50-86S Personality Modules
Excludes:	VLD-R8AC and all other Personality Module variants

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

If more than one Personality Module has to be replaced this shall be carried out one module at a time. This safety measure will remove the possibility that connectors will be accidentally crossed between adjacent modules.

Equipment Identification Image

Figure 1 - VIO24-86S

Figure 2 - VIO50-86S

BEFORE INSTALLATION WORK

1. Check that the CDU is fitted.

2. Check the replacement VIO24-86S or VIO50-86S module is the correct type and not damaged.

3. Check the keying pins are correctly configured on the personality module.

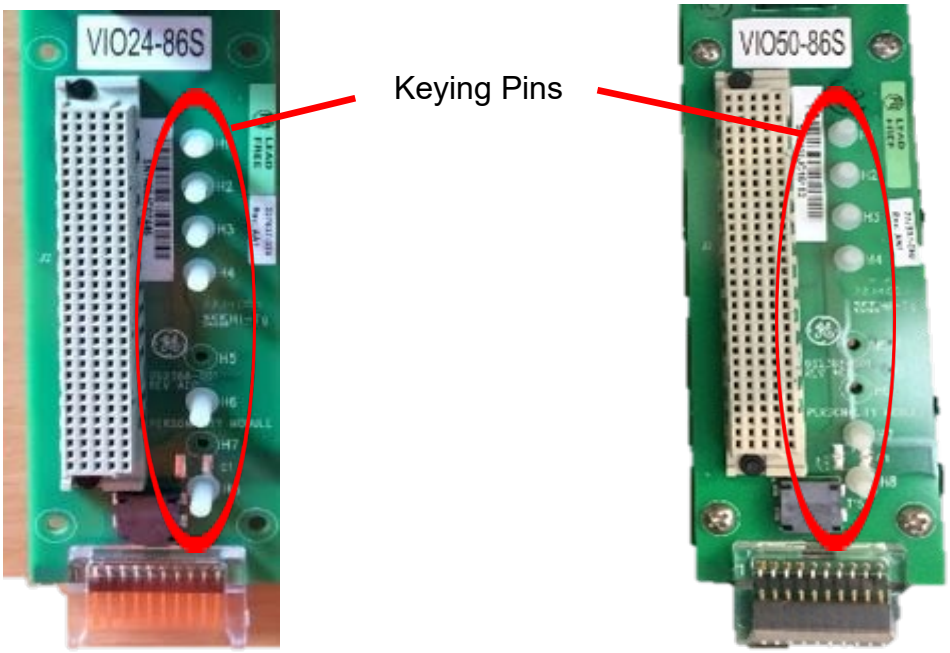
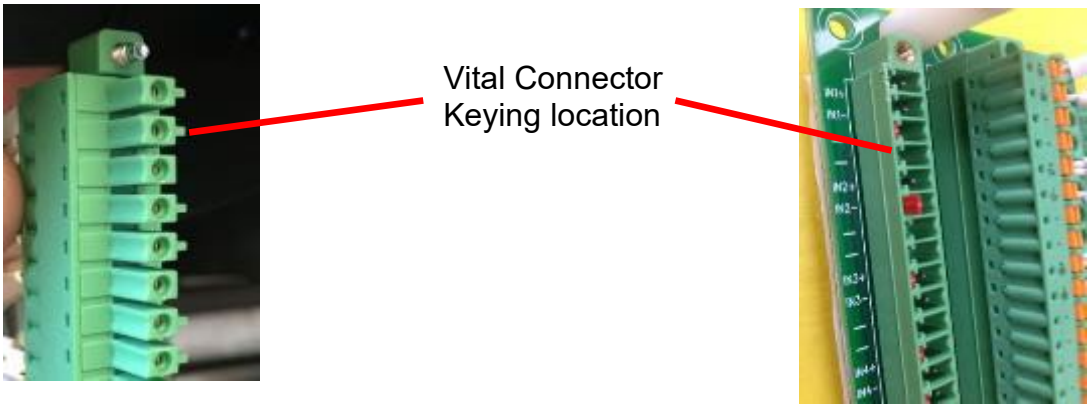


Figure 3 – Keying Pin Locations

4. Check the vital connector keying is correctly configured.



5. Check existing cabling has safe insulation.

6. Check existing cabling is correctly labelled.

AFTER INSTALLATION WORK

7. Check replacement personality module is correctly installed.

8. Verify the module keying pins correctly configured.

9. Verify the vital connector keying is correct before plugging in the terminal block.

10. Check vital connectors are replaced as labelled.

11. Replace the Input / Output Module and check it is secure and has powered up.

12. Check no alarm messages are displayed on CDU-1. If any alarm is displayed, then investigate further.

13. Check at least one function controlled by the Input / Output module seated on the replaced personality module operates correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IH07		
Replace an ElectroLogIXS Personality Module (VLD – R8AC)		
Issue No: 02	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	VLD-R8AC Personality Module
Excludes:	VIO50-86S Personality Module, VIO24-86S Personality Module and all other Personality Module variants

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

If more than one Personality Module has to be replaced this shall be carried out one module at a time. This safety measure will remove the possibility that connectors will be accidentally crossed between adjacent modules.

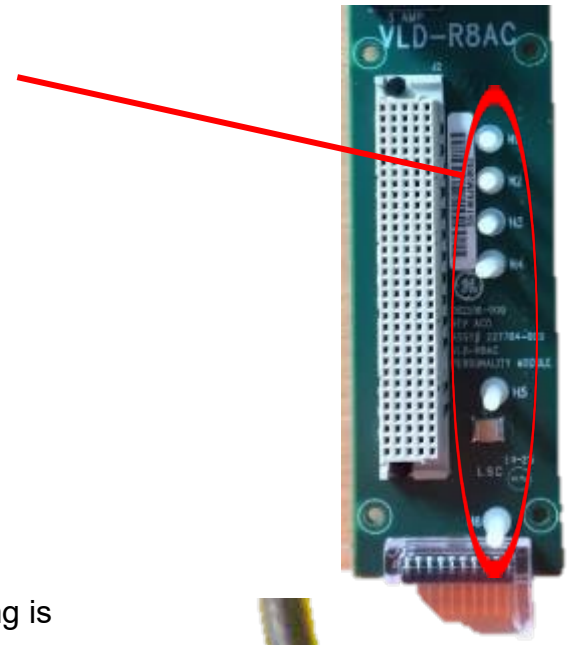
Equipment Identification Image

Figure 1 - VLD-R8AC

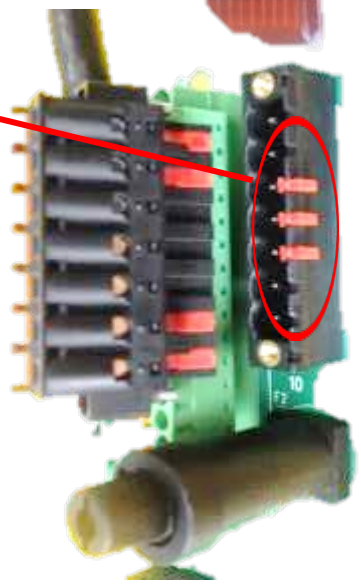
BEFORE INSTALLATION WORK

1. Check that the CDU is fitted.
2. Check the replacement VLD-R8AC module is the correct type and not damaged.
3. Verify the location of the failed module.

4. Check the keying pins are correctly configured on the personality module.



5. Check vital connector keying is correctly configured on the 110vAC connector socket.



6. Check existing cabling has safe insulation.

7. Check existing cabling is correctly labelled.

8. Check existing personality module is Isolated from the 110vAC supply.

AFTER INSTALLATION WORK

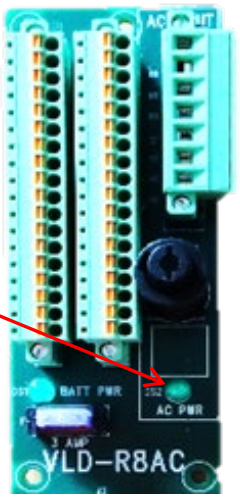
9. Check replacement personality module is correctly installed.

10. Verify the module keying pins correctly configured.

11. Verify the vital connector keying is correct before plugging in the terminal block.

12. Check vital connectors are replaced as labelled.

13. Before replacing module, reconnect the 110V supply and check green AC PWR LED on the Personality Module is illuminated.



14. Replace the Output Module and check it is secure and has powered up.

15. Check no alarm messages are displayed on CDU-1. If any alarm is displayed, then investigate further.

16. Check at least one function controlled by the Output module seated on the replaced personality module operates correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IH08		
Replace an ElectroLogIXS Chassis		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	ElectroLogIXS Chassis
Excludes:	All other types of Chassis

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

An ElectroLogIXS chassis change is straight forward, from a hardware point of view, as the connections to the system are plug coupled.

All system configuration settings shall need to be updated as these are stored on the backplane.

For further information see NR/SMS/Appendix/22 – General Information on the ElectroLogIXS System.

Equipment Identification Images

1 Slot Chassis

4 Slot Chassis

9 Slot Chassis

Figure 1 – Chassis Layouts

BEFORE INSTALLATION WORK

1. Check CDU is fitted.
2. Check that the replacement Chassis unit is of the Correct Type and is Not Damaged.
3. Check the replacement is the correct version (modification level).
4. Verify the location of the faulty Chassis unit.

5. Power down using the chassis switch (O).

6. Isolate the supply to the Chassis Unit and verify this by using a volt meter on the input terminals.

7. WIRE COUNT the Chassis Unit and check all the wires have safe insulation and are correctly labelled.

8. Remove the wires from the Chassis Unit and insulate them.

9. Swap all modules from the old to new chassis including the personality modules. This shall be done one module at a time.

   Installing each module following the individual test plans and reference to the site setup sheet.

10. Set chassis identity DIP switch shunts located under the UCI-3 module as per the location diagrams on the new chassis.

11. Remove and label as faulty the old Chassis Unit.

AFTER INSTALLATION WORK

12. Check that the replaced Chassis Unit is securely mounted.

13. Check modules are secure and correctly installed.

14. Reconnect the power supply.

15. WIRE COUNT the Chassis Unit and check all cables are correctly installed and secure.

16. Switch on using the Chassis switch (I).

17. Configuration as shown in ASM Configuration Documentation.

18. Check the system restarts without error after 4 minutes, that no alarm messages are displayed on CDU-1.

   And the health and power LEDs are illuminated.

   If any alarm is present investigate further.

19. Check one function on each IO module operates correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IK01		
Replace an ARAMIS System - Fan Units		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Client PC and Core Switch Fans
Excludes:	All other types of fan.

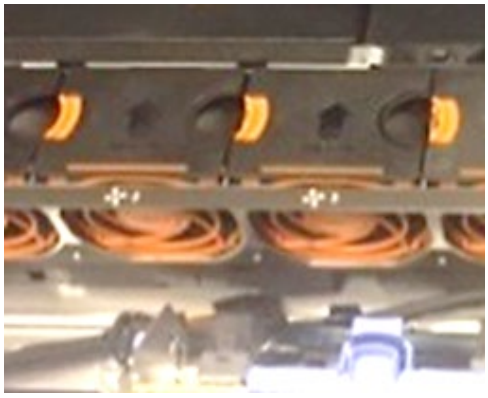
A tested electrostatic wrist strap and cord connected to the cubicle frame should be worn when undertaking these works.

To maintain proper cooling while the system is on, only one fan shall be replaced at a time.

Let the fan blades completely stop before you remove the fan tray.

The cooling fans are hot-swappable.

Equipment Identification Image



Client PC

Core Switch

Figure 1 – Type of Fan

BEFORE INSTALLATION WORK

1. Check replacement Fan is Correct Type and is Not Damaged.
2. Verify the identity of the failed Fan.
3. Remove the Fan.

AFTER INSTALLATION WORK

4. Check the Fan is mounted securely and locked into position.
5. Confirm power status LED for the Fan is now showing steady green LED (if fitted).

   The fans may change speed a few times as they synchronize with each other and adjust to the proper operating speed.

6. Verify that replaced fan and the others in the bank are working.

7. Confirm the Fan is indicating healthy and failure has cleared from the Client PC Workstation.

8. Check that the replacement unit is correctly labelled.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IK02		
Replace an ARAMIS System - Power Supply Units		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Client PC, Firewall, Core Switch, Server, Access Switch, Maintenance Switch. SAN and Maintenance Server Power Supply Units (PSU)
Excludes:	All other ARAMIS PSU's and Equipment

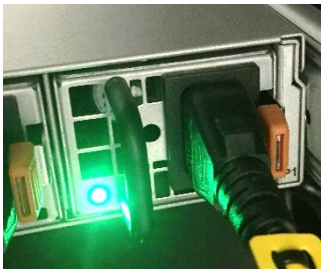
A tested electrostatic wrist strap and cord connected to the cubicle frame should be worn when undertaking these works.

Only one PSU shall be powered down at a time. If you are required to replace both units then before powering down the second unit you will need to verify that the first unit is on line and fully enabled before commencing the replacement of the second PSU.

Equipment Identification Images

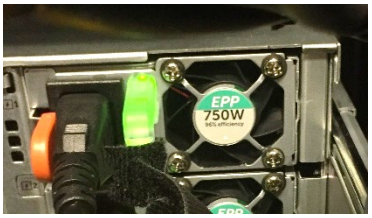
Client PC

Firewall



Core switch

Server



Access Switch

Maintenance Switch

Maintenance Server

SAN

Figure 1 - PSU Types

BEFORE INSTALLATION WORK

1. Check replacement PSU is Correct Type, Rating and is Not Damaged.

2. Verify the identity of the failed PSU.

3. Check the existing wiring has safe insulation.

4. Check the existing wiring is correctly labelled.

5. Disconnect Power supply by removing power lead, if not hot swappable.

6. Remove the PSU and label as faulty.

AFTER INSTALLATION WORK

7. Reconnect the power supply, if not hot swappable.

   After the installation of a new power supply unit, wait for 15 seconds for the system to recognize the power supply unit and determine its status.

8. Check the PSU is mounted securely and locked into position.

9. Confirm Power Status LED’s for both the replaced PSU and its partner are showing steady green indications (where fitted).

10. Using the Client Workstation confirm the replaced PSU is indicating healthy and failure has cleared.

11. Check that the replacement unit is correctly labelled.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/IK03		
Replace a Client PC – Hard Drive		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	ARAMIS Client PC – Hard Drive
Excludes:	All other Hard Drives

A tested electrostatic wrist strap and cord connected to the cubicle frame should be worn when undertaking these works.

To maintain proper system cooling, all empty hard-drive slots should have hard-drive blanks installed. If you are not replacing the hard drive immediately, insert a hard-drive blank in the empty hard-drive slot.

All hard drives are connected to the system board through the hard-drive backplane.

Hard drives are mounted on hard-drive carriers these are not supplied with the replacement hard drive and it is necessary to swap the carrier when a hard drive is replaced.

Use only hard drives that have been tested and approved for use with the hard-drive backplane.

When formatting a hard drive, allow enough time for the formatting to be completed. Be aware that high-capacity hard drives can take a number of hours to format and to up to an hour to re-build.

BEFORE INSTALLATION WORK

1. Check replacement Hard Drive is correct type and is not damaged.
2. Verify the identity of the failed Hard Drive
3. Remove the bezel, press the release button and withdraw the Hard Drive, seated on its carrier, using the carrier handle.

DURING THE INSTALATION

4. Check the replacement Hard Drive is correctly fitted to the carrier before inserting the Hard Drive and carrier into the server.

AFTER INSTALLATION WORK

5. Visually check the Hard Drive is mounted securely and has engaged with the backplane.
6. Verify the carrying handle has locked into place before replacing the bezel.
7. Confirm the failure has cleared from the Client PC Monitor.
8. Check that the replacement unit is correctly labelled

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IK05		
Replace an ARAMIS System – SAN Controller		
Issue No: 01	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	ARAMIS SAN Controller.
Excludes:	All other types of Controller.

A tested electrostatic wrist strap and cord connected to the cubicle frame shall be worn when undertaking these works.

When two controllers are installed in an enclosure, they must be the same model. Mixing controller types in the same enclosure is not supported.

Equipment Identification Image

Figure 1 – SAN Controller

BEFORE INSTALLATION WORK

1. Check replacement controller is correct type and is not damaged.
2. Verify the identity of the failed Controller.
3. Carry out a controlled shut down of the failed Controller using the SMU.
4. WIRE COUNT the Controller and check for safe insulation / correct labelling.
5. Disconnect the cables.
6. Remove the Controller and label as faulty.

AFTER INSTALLATION WORK

7. Check the Controller is mounted securely and locked into position.

8. Reconnect the cables and WIRE COUNT the Controller.

   The new Controller should automatically begin initializing.

   If the firmware versions differ between the twocontrollers, the Partner Firmware Update feature brings the older firmware to the later firmware level.

9. Verify the Controller is displaying a green LED and is on line using the NAGIOS system.

10. Check that the replacement unit is correctly labelled.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IK06		
Replace an ARAMIS System – Amulet		
Issue No: 01	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	ARAMIS Amulet.
Excludes:	All other types of Amulet.

This Test Plan contains a configuration process which can only be carried out by a competent person, if you do not hold Sig.20.30 then you will be unable to complete every step and therefore cannot restore this item to service.

Equipment Identification Image

Figure 1 – Amulet

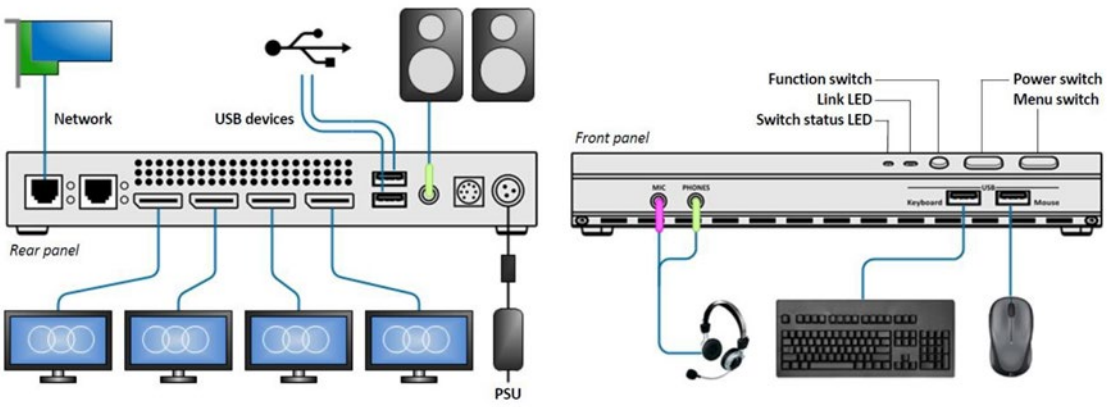


Figure 2 – Amulet Overview

BEFORE INSTALLATION WORK

1. Check replacement Amulet is correct type and is not damaged.
2. Verify the identity of the failed Amulet.

3. Confirm and note the IP address of the PCoIP host.

4. WIRE COUNT the Amulet and check for safe insulation correct labelling.

5. Disconnect the power supply.

6. Disconnect the cables.

   The Network Fibre should have a cable cap fitted to stop contamination of the fibre.

7. Remove the Amulet and label as faulty.

AFTER INSTALLATION WORK

8. Check the is mounted securely.

9. Reconnect the cables and WIRE COUNT the Amulet.

10. Reconnect the power supply.

11. Carry out the Configuration Process shown in NR/SMS/Appendix/19 Section 15 (Configuration of the Amulet).

12. Verify the operator's work station is working correctly.

13. Check that the replacement unit is correctly labelled.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IK07		
Replace an ARAMIS System – Maintenance Terminal		
Issue No: 01	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	ARAMIS Maintenance Terminal.
Excludes:	All other types of Maintenance Terminal.

BEFORE INSTALLATION WORK

1. Check replacement Terminal is correct type and is not damaged.
2. WIRE COUNT the Terminal and check for safe insulation correct labelling.
3. Disconnect the power supply.
4. Disconnect the cables.
5. Remove the Terminal and label as faulty.

AFTER INSTALLATION WORK

6. Check the is mounted securely.
7. Reconnect the cables and WIRE COUNT the Terminal.
8. Reconnect the power supply.
9. Power up the terminal and log in.
10. Launch the Nagios System and confirm the status of the ARAMIS components.
11. Check that the replacement unit is correctly labelled.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IK08		
Replace an ARAMIS System – KVM Rack		
Issue No: 01	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	ARAMIS KVM Rack.
Excludes:	All other types of KVM Rack.

Equipment Identification Image

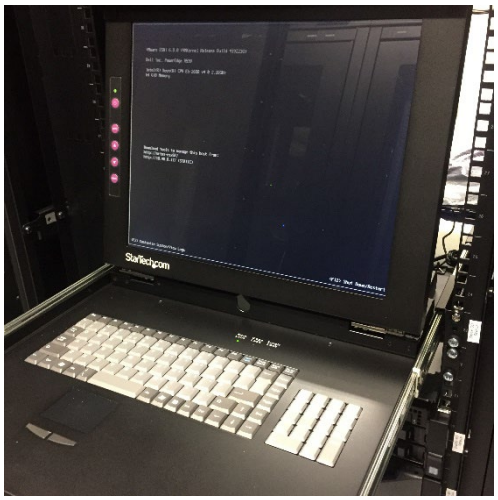


Figure 1 – KVM Rack

BEFORE INSTALLATION WORK

1. Check replacement KVM Rack is correct type and is not damaged.
2. WIRE COUNT the KVM Rack and check for safe insulation correct labelling.
3. Disconnect the power supply.
4. Disconnect the cables.
5. Remove the KVM Rack and label as faulty.

AFTER INSTALLATION WORK

6. Check the KVM Rack is mounted securely.
7. Reconnect the cables and WIRE COUNT the Terminal.
8. Reconnect the power supply.
9. Open the Maintenance Terminal.
10. Launch the Nagios System and confirm the status of the ARAMIS components.
11. Check that the replacement unit is correctly labelled.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IM01		
Replace a Smartlock SmartIO COM module		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

GENERAL

Spare modules shall be stored in ambient conditions no worse than for the operational SmartIO to prevent any adverse effect during storage. Prior to the installation of a spare, it shall be allowed to reach the same temperature as the operating equipment prevent any adverse effect to the performance of the modules, when unpacked and powered-up.

When removing or handling any SmartIO modules, check that an ESD wrist strap is connected to the ESD Bonding Point on the walkway side of the Rack; this wristband shall be worn on the wrist of personnel prior to the removal and handling of any SmartIO modules.

Removal off both SmartIO COM modules, or removal of the second COM module while the other is not in its operational mode, terminates all communications with the CIXL, this causes all outputs on all SmartIO racks to go to their most restrictive state and the Signaller loses all controls and indications for the area controlled by the SmartIO.

BEFORE INSTALLATION WORK

1. Check replacement module is not damaged and is of the correct type.

2. Check the part number and model number of the replacement is the same as the module to be replaced.

3. Check the mechanical coding pins of the replacement module match those shown on the site-specific drawings.

AFTER INSTALLATION WORK

4. Check replacement item is correctly installed.

5. Observe front panel indicators and confirm that after the initialisation phases (Up to 10 minutes); both OK Indicators are blinking, both ERR indicators are off, and that INT and EXT indicators blink on both channels. See Figure 1.

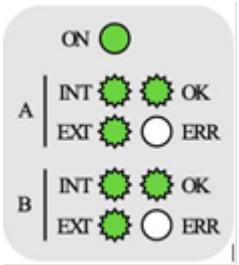


Figure 1 - Front Panel indicators

6. Wait at least 10 minutes after powering up the replacement before performing any maintenance activity on the second COM module.

7. On the Support System (SSys) HMI, check that the previously reported alarms have become inactive (white) and clear them from the display. If the failure is still present or if one of the previous checks failed, refer to 2nd line maintenance.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IM02		
Replace a Smartlock SmartIO Configuration key		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	SmartIO COM configuration key
Excludes:	All other parts and configuration keys

GENERAL

Spare parts and modules shall be stored in ambient conditions no worse than for the operational SmartIO to prevent any adverse effect during storage. Prior to the installation of a spare, it shall be allowed to reach the same temperature as the operating equipment prevent any adverse effect to the performance of the part, when unpacked and powered-up.

Powering off both COM modules, or powering of a COM module while the other is not in its operational mode, terminates all communications with the CIXL, this this causes all outputs on all SmartIO racks to go to their most restrictive state and the signaller loses all controls and indications for the area controlled by the SmartIO.

If the system is operational, but running in degraded mode, it is recommended that failure reports regarding the state of front panel indicators are completed before attempting repairs to aid the correct recording of observations.

BEFORE INSTALLATION WORK

1. Check replacement item is not damaged and is of the correct type.

2. Check that the replacement configuration key is labelled with the same identification information as the key being replaced.

AFTER INSTALLATION WORK

3. Check replacement item is Correctly Installed.

4. Observe front panel indicators and confirm that after the initialisation phases (Up to 10 minutes); both OK Indicators are blinking, both ERR indicators are off, and that INT and EXT indicators blink on both channels. See Figure 1.

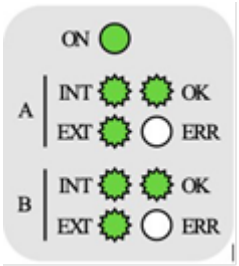


Figure 1 - Front Panel indicators

5. Wait at least 10 minutes after powering up the COM module before performing any maintenance activity on the second COM module.

6. On the SSys HMI, check that the previously reported alarms have become inactive (white) and clear them from the alarm display. If the failure is still present or if one of the previous checks failed, refer to 2nd line maintenance.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IM03		
Replace a Smartlock SmartIO PS Module		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	SmartIO PS module
Excludes:	All other types of Module

GENERAL

Spare parts and modules shall be stored in ambient conditions no worse than for the operational SmartIO to prevent any adverse effect during storage. Prior to the installation of a spare, it shall be allowed to reach the same temperature as the operating equipment to prevent any adverse effect to the performance of the part, when unpacked and powered-up.

When removing or handling any SmartIO modules, check that an ESD wrist strap is connected to the ESD Bonding Point on the walkway side of the Rack; this wristband SHALL be worn on the wrist of personnel prior to the removal and handling of any SmartIO modules.

Removal of both SmartIO PS modules, or removal of the second PS module, while the other is not in its operational mode, shuts down the SmartIO. This causes all outputs to be switched off (as opposed to going to their most restrictive states) and the Signaller loses all controls and indications for that area.

If the system is operational, but running in degraded mode, it is recommended that failure reports regarding the state of front panel indicators are completed before attempting repairs.

BEFORE INSTALLATION WORK

1. Check replacement module is not damaged and is of the correct type.

2. Check the part number and model number of the replacement is the same as the module to be replaced.

3. Check the mechanical coding pins of the replacement module match those shown on the site-specific drawings.

AFTER INSTALLATION WORK

4. Check replacement item is correctly installed.

5. Observe front panel indicators and confirm that both Power In and Power Out indications are lit green as shown in Figure 1.

Figure 1 - PS module operational mode indications

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IM04		
Replace a Smartlock SmartIO Generic Module		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	SmartIO IM, PM2DC, SM2, SM7 modules
Excludes:	SmartIO PS and COM and all other modules

GENERAL

Spare parts and modules shall be stored in ambient conditions no worse than for the operational SmartIO to prevent any adverse effect during storage. Prior to the installation of a spare, it shall be allowed to reach the same temperature as the operating equipment, this prevents any adverse effect to the performance of the part, when unpacked and powered-up.

When removing or handling any SmartIO modules, check that an ESD wrist strap is connected to the ESD Bonding Point on the walkway side of the Rack; this wristband SHALL be worn on the wrist of personnel prior to the removal and handling of any SmartIO modules.

Removal off both SmartIO PSU modules, or removal of the second PSU module, while the other is not in its operational mode, shuts down the SmartIO. This causes all outputs to be switched off (as opposed to going to their most restrictive states) and the Signaller loses all controls and indications for that area.

If the system is operational, but running in degraded mode, it is recommended that failure reports regarding the state of front panel indicators are completed before attempting repairs.

BEFORE INSTALLATION WORK

1. Check replacement module is not damaged and is of the correct type.

2. Check the part number and model number of the replacement is the same as the module to be replaced.

3. Check the mechanical coding pins of the replacement module match those shown on the site-specific drawings.

AFTER INSTALLATION WORK

4. Check replacement item is correctly installed.

5. Observe front panel indicators and confirm that after the initialisation phases (Up to 3 minutes) all indicators are correct for the operational mode of the module type as shown in Table 1.

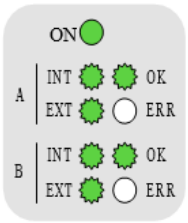
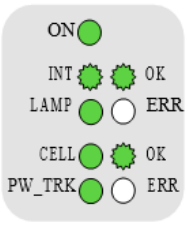
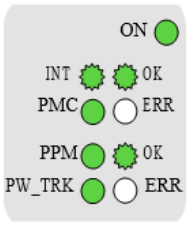
MODULE	COM IM	SM2 SM7	PM2DCv2
LED STATE			

Table 1 - Generic SmartIO modules operational mode, front panel LED state

6. On the SSys HMI, check that the previously reported alarms have become inactive (white) and clear them from the display. If the failure is still present or if one of the previous checks failed, refer to 2nd line maintenance.

7. Check replacement module operates correctly.

"Operates correctly means", observing the correct indications on the module itself and confirming the correct operation of one function operated by the TFM.

For example, a signal's aspect can be changed, points operated normal and reverse, etc.

For Signal modules check correct operation of the signal function.

"Operates correctly means", confirming the signal aspect can be changed

For Points Modules check correct operation of the points.

"Operates correctly means", confirming the correct operation of the point ends both normal and reverse.

For Input modules check, by changing the status of an input, that the module responds correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IM05		
Replace a Smartlock Point Drive Isolation Module (PDIM)		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	SmartIO Point Drive Isolation Module
Excludes:	All other SmartIO modules

GENERAL

Spare parts and modules shall be stored in ambient conditions no worse than for the operational SmartIO to prevent any adverse effect during storage. Prior to the installation of a spare, it shall be allowed to reach the same temperature as the operating equipment, this prevents any adverse effect to the performance of the part, when unpacked and powered-up.

Removal of a Point Drive Isolation Module (PDIM) causes the Signaller to not be able to move the affected point ends. However, the detection state of the point end continues to be reported.

If the system is operational, but running in degraded mode, it is recommended that failure reports regarding the state of front panel indicators are completed before attempting repairs to aid the correct recording of observations.

BEFORE INSTALLATION WORK

1. Check replacement module is not damaged and is of the correct type.

2. Check the part number and model number of the replacement is the same as the module to be replaced.

AFTER INSTALLATION WORK

3. Check replacement item is correctly installed.

4. On the SSys HMI, check that the previously reported alarms have become inactive (white) and clear them from the display. If the failure is still present or if one of the previous checks failed, refer to 2nd line maintenance.

5. Check replacement PDIM operates correctly.

“Operates correctly means”, confirming the correct operation of the point end both normal and reverse.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IM06		
Replace a SmartIO Supply monitoring devices		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Surge Arrestors, 110V AC Supply and 120V DC supply detection relays, Earth leakage detectors
Excludes:	All other SmartIO modules and parts

GENERAL

Spare parts and modules shall be stored in ambient conditions no worse than for the operational SmartIO to prevent any adverse effect during storage. Prior to the installation of a spare, it shall be allowed to reach the same temperature as the operating equipment, this prevents any adverse effect to the performance of the part, when unpacked and powered-up.

If the system is operational, but running in degraded mode, it is recommended that failure reports regarding the state of front panel indicators are completed before attempting repairs to aid the correct recording of observations.

BEFORE INSTALLATION WORK

1. Check replacement unit is not damaged and is of the correct type.
2. Carry out a WIRE COUNT of the existing unit to the wiring diagrams.
3. Isolate the supply feed by opening the MCB to the device.

AFTER INSTALLATION WORK

4. Check replacement item is correctly installed.
5. Carry out a WIRE COUNT of the new unit to the wiring diagrams.
6. Close the MCB to the device.
7. Check the visual indication of correct operation on the replaced part.
8. On the SSys HMI, check that the previously reported alarms have become inactive (white) and clear them from the display. If the failure is still present or if one of the previous checks failed, refer to 2nd line maintenance.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IM07		
Replace a SmartIO Redundant or non-service critical device		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Voltage converters, UPS
Excludes:	Service affecting device replacement

GENERAL

Spare parts and modules shall be stored in ambient conditions no worse than for the operational SmartIO to prevent any adverse effect during storage. Prior to the installation of a spare, it shall be allowed to reach the same temperature as the operating equipment, to prevent any adverse effect on the performance of the part, when unpacked and powered-up.

When removing or handling any SmartIO device, check that an ESD wrist strap is connected to the ESD Bonding Point on the walkway side of the rack; this wristband shall be worn on the wrist of personnel prior to the removal and handling of any SmartIO component device.

Removal off some units whilst others are already in a failed state shuts down the SmartIO. This causes all outputs to be switched off (as opposed to going to their most restrictive states) and the signaller loses all controls and indications for that area.

If the system is operational, but running in degraded mode, it is recommended that failure reports regarding the state of front panel indicators are completed before attempting repairs to aid the correct recording of observations.

BEFORE INSTALLATION WORK

1. Check replacement item is not damaged and is of the correct type

2. Check the part number and model number of the replacement is the same as the device to be replaced.

3. Isolate the supply feed to the device by opening the MCB.

AFTER INSTALLATION WORK

4. Check replacement item is correctly installed.

5. Close the MCB to the device.

6. Check the visual indication of correct operation on the replaced device (where applicable).

7. On the SSys HMI, check that the previously reported alarms have become inactive (white) and clear them from the display. If the failure is still present or if one of the previous checks failed, refer to 2nd line maintenance.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IM08		
Replace a SmartIO service critical device or cable		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	MCBs, Isolation switches, Y-Diodes, Inter Rack Cables, Busbar fuse holders
Excludes:	Resilient or monitoring devices

GENERAL

Spare parts and modules shall be stored in ambient conditions no worse than for the operational SmartIO to prevent any adverse effect during storage. Prior to the installation of a spare, it shall be allowed to reach the same temperature as the operating equipment, this prevents any adverse effect to the performance of the part, when unpacked and powered-up.

When removing or handling any SmartIO device, check that an ESD wrist strap is connected to the ESD Bonding Point on the walkway side of the rack; this wristband shall be worn on the wrist of personnel prior to the removal and handling of any SmartIO component device.

Removal of the above units for repair will shut down some or all SmartIO signalling and control functions. This will cause outputs to be switched off (as opposed to going to their most restrictive states) and the signaller will lose all controls and indications for the affected assets.

If the system is operational, but running in degraded mode, it is recommended that failure reports regarding the state of front panel indicators are completed before attempting repairs to aid the correct recording of observations.

BEFORE INSTALLATION WORK

1. Check replacement item is not damaged and is of the correct type.

2. Check the part number and model number of the replacement is the same as the device to be replaced.

AFTER INSTALLATION WORK

1. Check replacement item is correctly Installed.

2. Check the visual indication of correct operation on the replaced device (where applicable)

3. Observe front panel indicators on all affected SmartIO modules, confirm that after the initialisation phases (Up to 3 minutes) all indicators are correct for the operational mode of the module type as shown in Table 1.

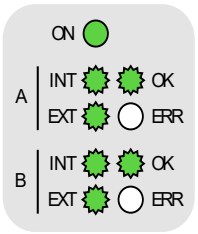
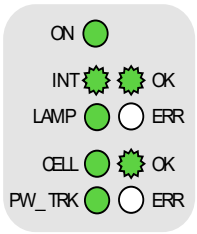
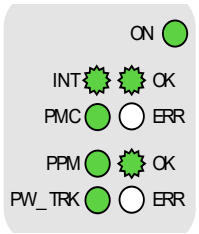
MODULE	COM IM OM	SM2 SM7	PM2DCv2
LED STATE			

Table 1 - Generic SmartIO modules operational mode, front panel LED state

4. On the SSys HMI, check that the previously reported alarms have become inactive (white) and clear them from the display. If the failure is still present or if one of the checks failed, refer to 2nd line maintenance.

5. Perform a check of the affected assets.

Maintenance affecting Signalling PW_TRK supplies to SM modules:

Confirm that the PW_TRK LED is lit Green on all SM module front panels.

Maintenance affecting Point PPM supplies to PM modules.

Confirm that the PW_TRK, PPM and PMC LEDs are lit Green on al PM module front panels.

Maintenance affecting Point PW_TRK, or PMC supplies to PM modules.

Check correct operation of the points.

"Operates correctly means", confirming the correct operation of the point ends both normal and reverse.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/IS01		
Replace a WESTeX Level Crossing Predictor Card		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	80012 Transceiver, 80013 Relay Drive, 80016 DAX, 80020 Control Interface, 80115 Data Recorder, 80211 Intelligent Processor Island, 80214 Processor, 80265 SEAR Interface, 80255 Data Recorder Interface, 80019 Keyboard/Display, 80020 Keyboard/Display Interface
Excludes:	Surface Protection Panel, Front Termination Panel, Rear Termination Panel, Mother Board

*****independence Exempt*****

Possession of the level crossing and level crossing predictor (LCP) shall be taken before any work can start.

Allow adequate time to complete all the testing.
Some setups require no trains within the strike in areas of the level crossing.

The LCP shall not be reconnected until all work is complete and system setup up in conjunction with the Manufactures Handbook.

Appropriate electrostatic precautions shall be taken when handling boards.

Electrostatic discharge points (ESD) are provided in the LCP cabinet.

BEFORE RE-INSTALLATION WORK

1 Check that Possession of the Level Crossing has been taken from the Signaller**.**

2 Check Level Crossing is placed on Local Control.

3 Check Replacement Card is correct type.

4 Refer to the replacement table for Programming and Recalibration requirements.

5 Shut down the LCP at the power switch located on the left of the Front Termination panel.

AFTER RE-INSTALLATION WORK

6 Check Software version (Processor Card only) and prepare to apply correct actions from the replacement, See Table 1.

7 Check Replacement card is correctly installed and aligned.

8 Plug in the Data Recorder Interface Cable (80214 to 80255 only).

9 Check that Jumpers have been applied correctly (80211 Intelligent Processor Island Card only).

10 Power up the LCP at the power switch located on the left of the Front Termination panel.

11 Allow the system to self test.

12 Apply appropriate actions from Table 1, referring to the manufacturers handbook.

13 *Test LCP Test* NR/SMS/Test/155.

14 Once completed enter details on the Site Record Card.

15 Place Level crossing back onto Auto and hand back to Signaller.

16 Observe trains on all affected Strike Ins and Island cards and review readings.

Card Replacement	Calibration Setup Required	Approach Length and Linearisation Setup Required	Island Adjustment Required	Default Setting and Reprogramming Required
80211 Intelligent Processor Island	No	No	Yes (for track associated with 80211 only)	No
80012 Transceiver	Yes (for track associated with 80012 only)	No	No	No
80013 Relay Drive	No	No	No	No
80214 Processor	No	No	No	No
80214 Processor (New Software Update Level) #1	Yes (Both Tracks)	Yes #2	No	Yes (Both Tracks)
80115 Data Recorder	No	No	No	No
80016 DAX Card	No	No	No	No
80255 Data Recorder Interface Module	No	No	No	No
80019 Keyboard/Display	No	No	No	No
80020 Keyboard/Display Interface Module #1	Yes (Both Tracks)	Yes #2 (Both Tracks)	No	Yes (Both Tracks)

Table 1 – Card replacement set-up

#1 Where later versions of software level have been applied to the PROM or if the control interface Module is replaced, first set the system to default parameters and then perform complete reprogramming and recalibration referring to the manufacturers manual.

#2 Can be accomplished by re-entering the EZ and Linerisation data from the history record card.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IS10		
Replace a Module in HXP-3 Level Crossing Processor		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	RMM, SIM, TLM, TRM, RSI, RYD and CPU modules, present on the HXP-3R and HXP-3R2 systems and the AXD modules, present only on the HXP-3R2 systems.
Excludes:	All other Level Crossing Processor's Modules

Electrostatic protections (ESP) measures, as detailed within this procedure shall always followed.

BEFORE INSTALLATION WORK

NOTE: *If the RMM Module is to be replace in the, check that the local parameters are the same as those stated in the site diagrams. If they do not match, record the values and contact your SM(S) for guidance.*

1. Turn the system power off by placing the master ON/OFF switch in the OFF position.

2. Remove the front panel of the HXP-3.

3. Check that the replacement module is not damaged and is the correct type of Module.

4. Where applicable, compare the jumper settings on the replacement module to those on the site diagrams. If they do not match, record the settings and contact your supervisor for guidance.

Removal Procedure For Sim And RMM Modules

5. Remove the IDK

6. Using the ESD strap, remove the required module by placing a finger in the hole provided and pull gently to disengage the module for the DIN connectors.

Removal Procedure For All Other Modules

7. Using the ESD strap, remove the module by using a finger to gently pull out and up on the PC card ejector until the module disengages from the DIN connectors.

8. Pull the module straight out until clear of the top and bottom Module slots.

Installation Procedure For All Modules

9. Locate correct module slot and slide module into position until the DIN connectors are engaged.

10. Check the module is completely seated in the DIN connections.

11. Install the IDK where necessary.

NOTE: *Check that the same operating program software version is uploaded to both CPU modules before returning the unit to service by checking the information on the EPROMs.*

AFTER INSTALLATION WORK

NOTE: *If the RMM module is replaced in the HXP-3R, check that all local parameters are set correctly before returning the unit to service.*

12. Check that replacement module is correctly installed.

13. Restore the systems power by placing the master on/off switch in the on position.

14. Check that the power LED on the TLM and each module belonging to the Normal System is on.

15. Place the Standby/Auto/Normal switch on the TLM in the standby position and check that the power LED on the TLM and each module belonging to the standby system is on.

NOTE: *Any checks on the power LED on the SIM module must be carried out before the installation of the IDK, as the IDK will hide the display.*

16. Install the IDK and verify the operation of the system as stated in the HXP-3 field reference manual.

17. Check that all diagnostic codes are deleted from memory by pressing the Monitor SEL key on the IDK until the SD mode is selected, then press shift and clear to delete.

18. Momentarily move the Standby/Auto/Normal switch on the TLM to the normal position to reset the system before placing it in the auto position.

19. Check the front panel is properly installed to the front of the HXP-3.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IS15		
Replace a Module in VHLC (Vital Harmon Logic Controller)		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	VLP, ACP, SSM, VGPIO, VGPI, NVIO, PSM, SIM and VSDAC Modules
Excludes:	All other VHLC Modules

General

Electrostatic Protection (ESP) measures shall be followed at all times.

NOTE: *Before powering down the system, a list of all controls should be obtained as a reference.*

BEFORE INSTALLATION WORK

1. Check replacement module is not damaged and is correct type.

   NOTE: *Before installing VLP, ACP and SIM modules, check that the correct memory chips are present on the replacement module.*

2. Place the power switch on the PSM in the OFF position.

3. When replacing the PSM it is also necessary to isolate the supply to the module before removing it Remove the front panel.

4. When replacing the VLP module disconnect the cable for the Logger PC.

5. Check that the replacement Module is not damaged and is the correct type of Module.

   NOTE: *There might still be power at the I/O Modules even when the power is off.*

6. Using the ESD strap, remove the Module by pulling gently to disengage the Module from its keyed connector on the front of the backboard.

   NOTE: *Each Module is connected using a cable with a keyed connector, thus preventing other Modules being installed in a slot wired for a different type of Module.*

7. Mark the removed module as faulty.

AFTER INSTALLATION WORK

8. Check that replacement Module is seated and connected correctly.

9. When installing the PSM reconnect the supply to the module before removing it.

10. When installing the VLP module it is necessary to confirm that the cable for the Logger PC is re-inserted into the port on the front of the module.

11. Place the power switch on the PSM in the ON position.

12. During a normal set-up sequence check the following on the VLP Module:

    a) The first pair of yellow LEDs light and stays lit.

    b) The second, third, fourth and sixth LED pairs light in sequence.

    c) The sixth LED lights, there is a pause, then the seventh LED lights.

    d) The remaining LEDs light, one pair at a time until all are lit.

    e) The LEDs turn on and off randomly for 2 seconds.

    f) When the VLP start-up is complete, each LED turns on and off from bottom to top in a continually repeating sequential pattern.

13. Check that the message on the ACP CDU reads ‘Harmon ATCS VHLC’.

14. When replacing an ACP, it is also be necessary to transfer the defined scheme data to the new module by using a laptop and you should contact your supervisor for guidance in this matter.

15. When replacing the VLP it is also be necessary to check the output of the Logger PC to confirm that data is being logged correctly.

    A list of new controls shall be obtained as a check.

16. Check replacement module is correctly labelled.

END

GENERAL

Before handling any electronic equipment observe electrostatic discharge precautions.

Protection / Possession arrangements shall be made before commencing work on a HIMatrix Level Crossing System.

Before powering down a HIMatrix unit inform the Signaller as to the effect on the operational railway.

Protect against rain or inclement weather if working in an open location case or equipment housing.

EQUIPMENT IDENTIFICATION

Figure 1 – F30 Unit

Figure 2 – F3 Unit

BEFORE INSTALLATION WORK

If a local control facility is provided, this might need to be operated. Refer to the relevant application Faulting Guide. E.g, for an MCB level crossing, open the LCU door and turn the LCU switch from the Normal / Stop position to the Lower / Hand position.

Downloading data to a HIMatrix unit can take place prior to or post installation. If downloaded prior to installation, either an “F30 Download Record” or an “F3 Download Record” sticky label will be affixed to the HIMatrix unit. Refer to NR/SMTH/Part04/IS17 (Download Data to a HIMatrix Programmable Logic Controller (PLC) F30 and F3).

1. Check the replacement HIMatrix unit is not damaged and is the correct type.

2. Isolate the power supply to the HIMatrix unit to be replaced using the corresponding fuse/MCB.

3. Check the plugs and connectors and Ethernet cable(s) are correctly labelled.

4. Detach the wiring plugs and connectors and Ethernet cables and remove the RJ45 blanking plugs attached to the HIMatrix unit to be replaced.

5. Check the condition of the plugs and the associated wiring for safe insulation.

6. Remove the HIMatrix unit and label it as faulty.

AFTER INSTALLATION WORK

7. Check the replacement HIMatrix unit is correctly installed.

8. Reconnect all plugs and connectors and reinsert the RJ45 blanking plugs to the correct corresponding sockets in the HIMatrix unit. **DO NOT RECONNECT ANY ETHERNET CABLE(S).**

9. Check all plugs and connectors and RJ45 blanking plugs are correctly installed and secure.

10. Restore the power supply to the HIMatrix unit.

11. If the HIMatrix unit is an F3, check that the RUN LED is blinking (Figure 3).

    If the F3 RUN LED is illuminated and not blinking, check there are no Ethernet cables connected and then power the unit off and on using the corresponding fuse/MCB.

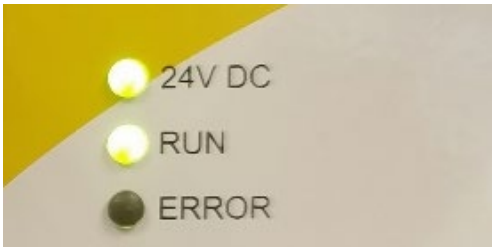


Figure 3 – HIMatrix unit RUN LED

12. If the HIMatrix unit is an F30, check that the RUN LED is illuminated and either steady or blinking.

13. If the HIMatrix unit has not had data downloaded prior to installation or the downloaded data is incorrect, use the SILworX laptop to download the correct User Programme (F30) or Rack ID and IP Address (F3).

    Refer to NR/SMTH/Part04/IS17 (Download Data to a HIMatrix Programmable Logic Controller (PLC) F30 and F3).

14. After downloading the correct User Programme or Rack ID and IP Address, reconnect the Ethernet cable(s) to the correct corresponding sockets in the HIMatrix unit.

15. Check the Ethernet cable(s) are correctly installed and secure.

16. Check the HIMatrix unit Ethernet port LEDs (Figure 4) are either steady or blinking green.

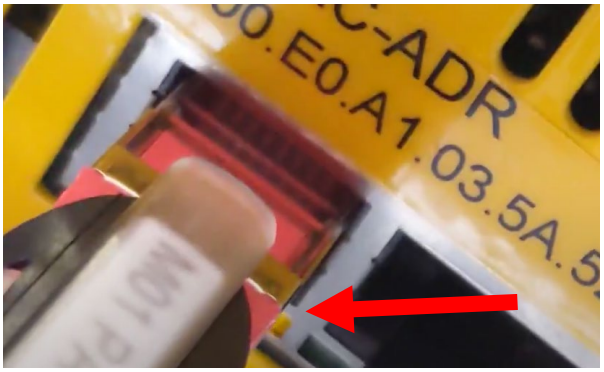


Figure 4 – HIMatrix unit Ethernet port LEDs

17. Check equipment connected to the HIMatrix unit operates correctly.

NOTE: *"Operates correctly" means observing the correct LED indications and confirming the correct operation of at least one function operated by the HIMatrix unit. For example, a level crossing raising and lowering cycle, points operated normal and reverse, signal aspect changed.*

If a Technician Reset button or similar is provided, it may need pressing after replacement of a HIMatrix unit. Refer to the relevant application Faulting Guide. E.g., for an MCB level crossing, replacement of the F30 or any F3 controlling red RTLs requires the Technician Reset button pressing.

18. Check the data logger to confirm the HIMatrix unit fault(s) has been cleared. If any alarm is present investigate further.

NOTE: *Guidance on fault finding can be found in:*

- *NR/SMTH/Part10/FF28 (Faulting Guide: HIMatrix Programmable Logic Controller (PLC) F30 & F3).*
- *NR/SMTH/Part10/FF29 (Faulting Guide: HIMatrix Manually Controlled Barrier Level Crossing).*

END

EQUIPMENT IDENTIFICATION

Figure 1 – F30 Unit

Figure 2 – F3 Unit

BEFORE DOWNLOADING

- Downloading data to a HIMatrix unit can take place prior to or post installation.
- If downloading after installation, confirm all the pre-download installation steps of NR/SMTH/Part04/IS16 (Replace a HIMatrix Programmable Logic Controller (PLC) F30 and F3) have been completed.
- If downloaded prior to installation, either an “F30 Download Record” sticky label (Figure 3) or an “F3 Download Record” sticky label (Figure 4) will be affixed to the HIMatrix unit.
- The acronym MAC, used throughout this document, refers to Media Access Control.

HIMatrix F30 Download Record			
Hardware MAC Address:			
User Programme Filename:			
Technician Initials:		Date:	

Figure 3 - HIMatrix F30 Download Record Label

HIMatrix F3 Download Record			
Hardware MAC Address:			
IP Address:			
Rack Number:			
Technician Initials:		Date:	

Figure 4 - HIMatrix F3 Download Record Label

1. Check any affixed label User Programme filename (for F30s) or Rack ID and IP Address (for F3s) against the location case diagrams. If the details match, new data does not need to be downloaded.

2. If downloading data prior to installation, obtain either an “F30 Download Record” or an “F3 Download Record” label and write on the label the following:

    a) F30 – the MAC Address printed on the unit and the User Programme filename stated in the location case diagrams.

    b) F3 – the MAC Address printed on the unit and the Rack ID and IP Address stated in the location case diagrams.

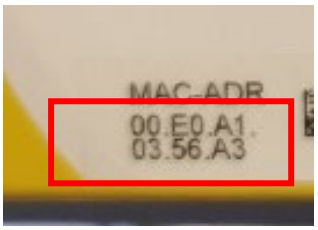


Figure 5 – MAC Address

3. Follow the procedures described in Appendix A to open SILworX and then follow:

    a) Appendix B to download a User Programme to an F30; or

    b) Appendix C to download a Rack ID and IP address to an F3.

AFTER DOWNLOADING

4. Remove the SILworX laptop Ethernet connection.

APPENDIX A - Open SILworX

1. Start the laptop.

2. Log in to the laptop:

   - Username = maintainer
   - Password = maintainer

3. Check a SILworX licence dongle is inserted into a USB port on the laptop.

4. Insert into the laptop CD drive the maintenance copy CD containing the User Programme for the installation's F30.

   NOTE: *The CD will be labelled with the installation name and a User Programme filename matching the location case diagrams.*

5. Start SILworX on the laptop – double click on the desktop icon or select the application from the Windows Start menu.

   NOTE: *If a dongle with a SILworX licence is not inserted, SILworX will report a licence error.*

6. On the SILworX menu bar, select Project > Restore (Figure 6).

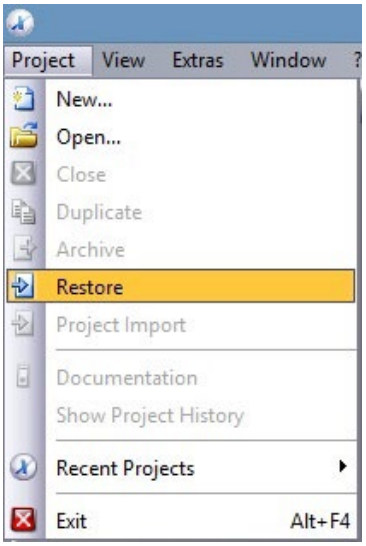


Figure 6 – Restore Option

7. At the Restore window, click the button (Figure 7) with three dots to begin browsing for the User Programme.

Figure 7 – Button

8. Using Windows explorer (Figure 8), navigate to the CD drive, click on the filename matching that shown on the location case diagrams for the F30.

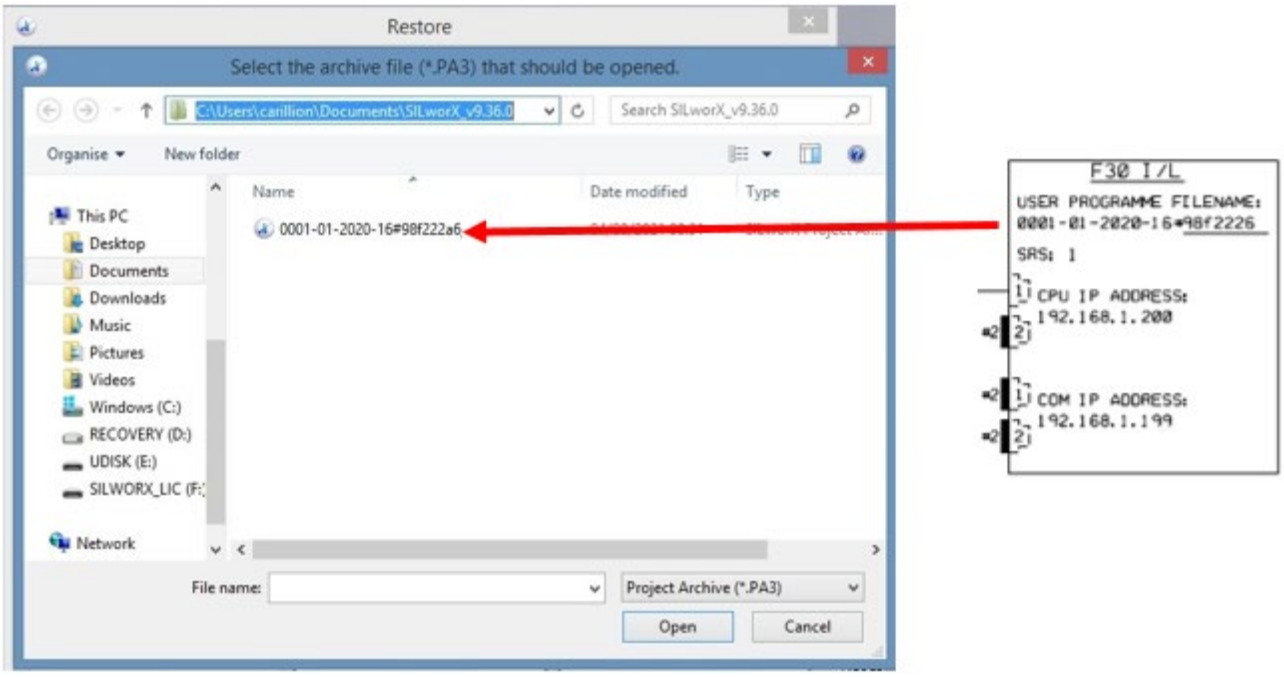


Figure 8 – Windows Explorer

9. Click the Open button.

10. At the Restore window (Figure 9), click the OK button.

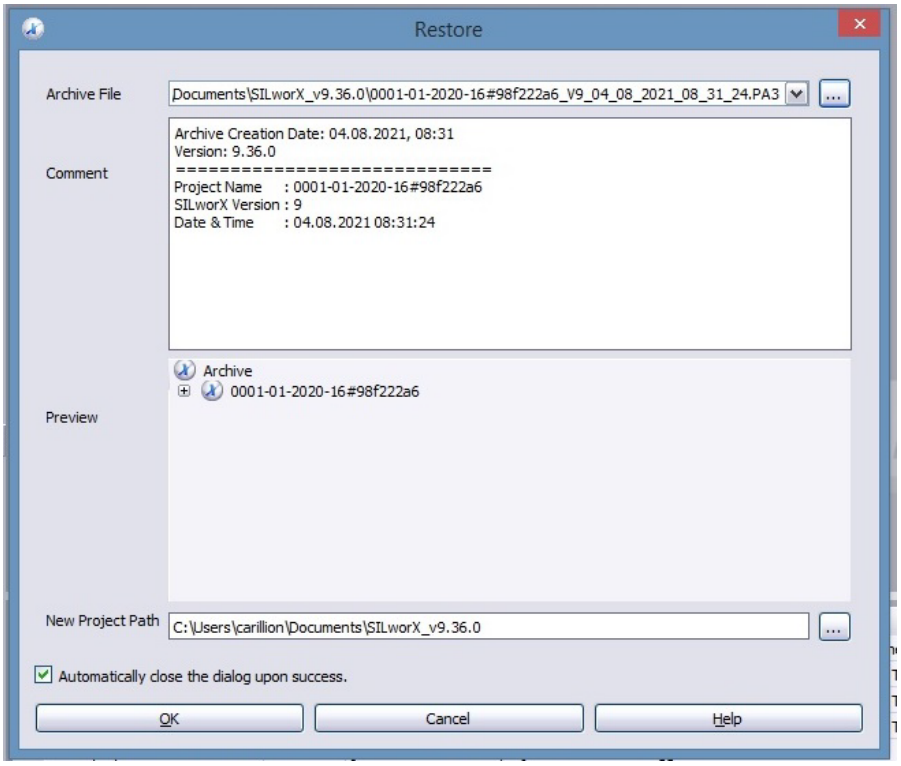


Figure 9 – Restore Window

11. If you are then prompted to Overwrite, click the Yes button.

12. At the User Log-in window (Figure 10), type in the following credentials:

    - User Group = Administrator
    - Password = (Leave blank – see Figure 10)

Figure 10 – User Log-in Screen

13. Click the Log-in button. The User Programme is now open in SILworX.

14. Click on the + symbol adjacent to “Configuration” to expand the User Programme details beneath the “Configuration” entry.

15. Check the SRS number in square brackets (next to name of the installation) matches the location case diagrams for the F30 being downloaded. See Figure 11.

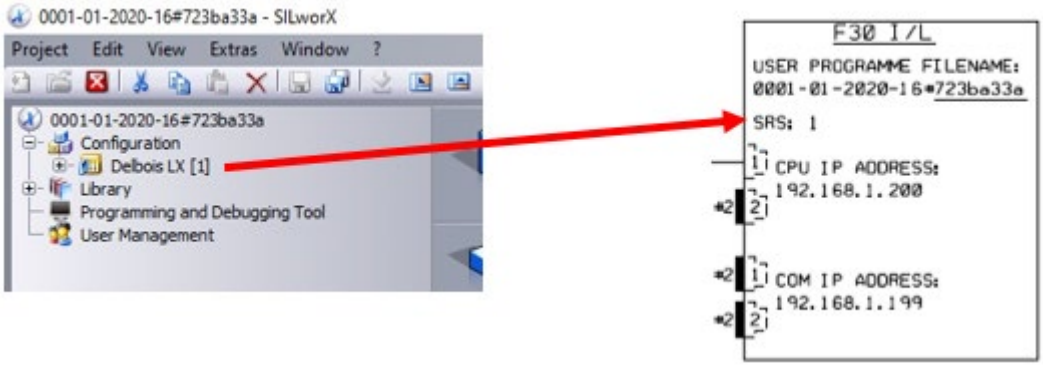


Figure 11 – SRS Number Comparison

16. Click on the installation name / SRS number to highlight it (Figure 12).

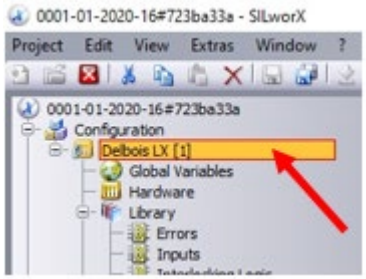


Figure 12 – Installation Name / SRS Number

17. You are now ready to connect to the installation's F30 or F3s. Go to:

    a) Appendix B to download a User Programme to an F30; or

    b) Appendix C to download a Rack ID and IP address to an F3.

APPENDIX B - Download a User Programme to an F30

1. Connect an Ethernet cable between the laptop and the F30.

2. Click the Online button (Figure 13)

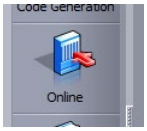


Figure 13 – Online Button

3. You are now connected to the F30.

4. At the System Login window (Figure 14), click the Search button.

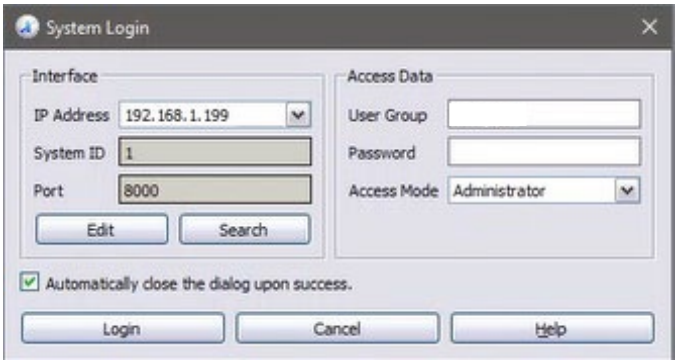


Figure 14 – System Login Window

5. At the Search via MAC Window (Figure 15), enter the MAC address printed on the F30 module.

Figure 15 – Search via MAC Window and MAC Address

6. Click Search. The SRS etc. fields will self-populate.

7. Click the Apply button.

8. At the System Login window (Figure 16), enter one of the following Access Data credentials:

   - User Group = Administrator
   - Password = (Leave blank)
   - Access Mode = Administrator

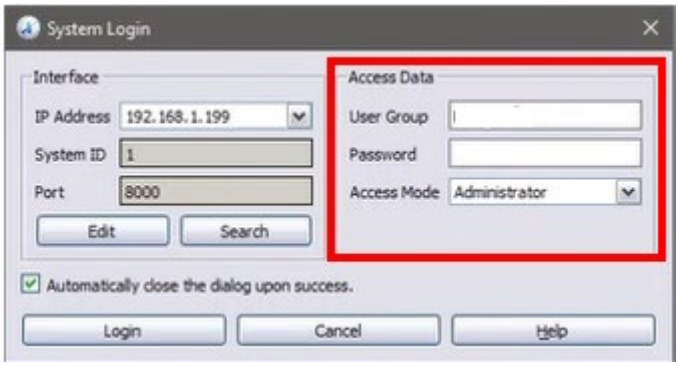


Figure 16 – System Login Window

9. Click the Login button. You are now logged into the F30.

10. Check the F30 System State is not RUN in one of two ways:

    a) Check the RUN LED on the front of the F30 is blinking; or

    b) Using SILworX, check the System State value is STOP (Figure 17).

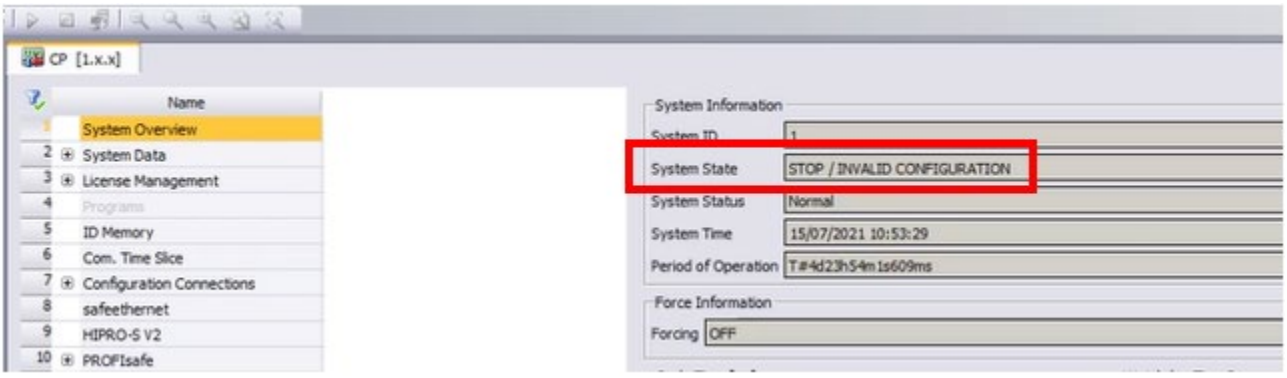


Figure 17 – System State Value

11. If the F30 System State is RUN, click on the square Stop button at the top of the screen (Figure 18).

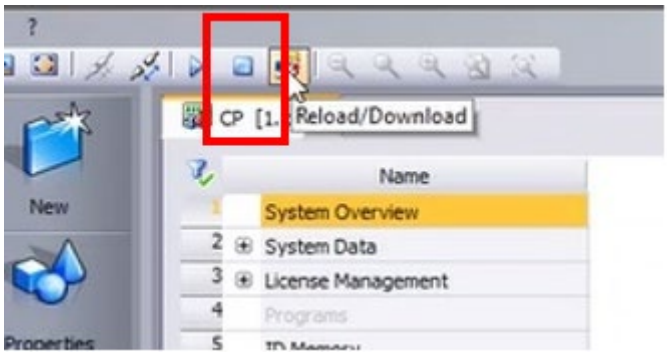


Figure 18 – Stop Button

12. At the Resource Stop window (Figure 19) click the OK button.

Figure 19 – Resource Stop Window

13. Download the new User Programme by clicking on the Reload/Download button (Figure 20).

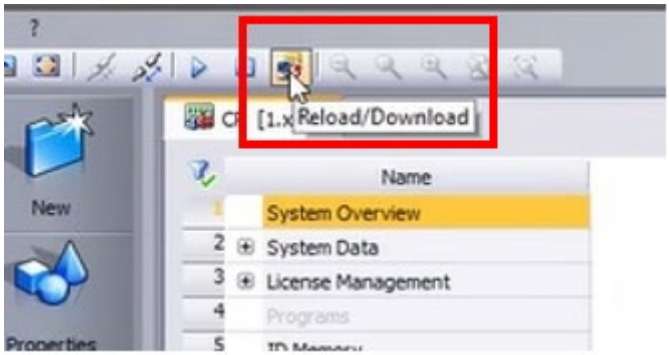


Figure 20 – Reload/Download Button

14. At the Reload/Download window, untick the “Create Project Archive after Loading” checkbox.

15. In the reload/download window, check the CRC matches the location case diagrams for the F30 being downloaded (Figure 21).

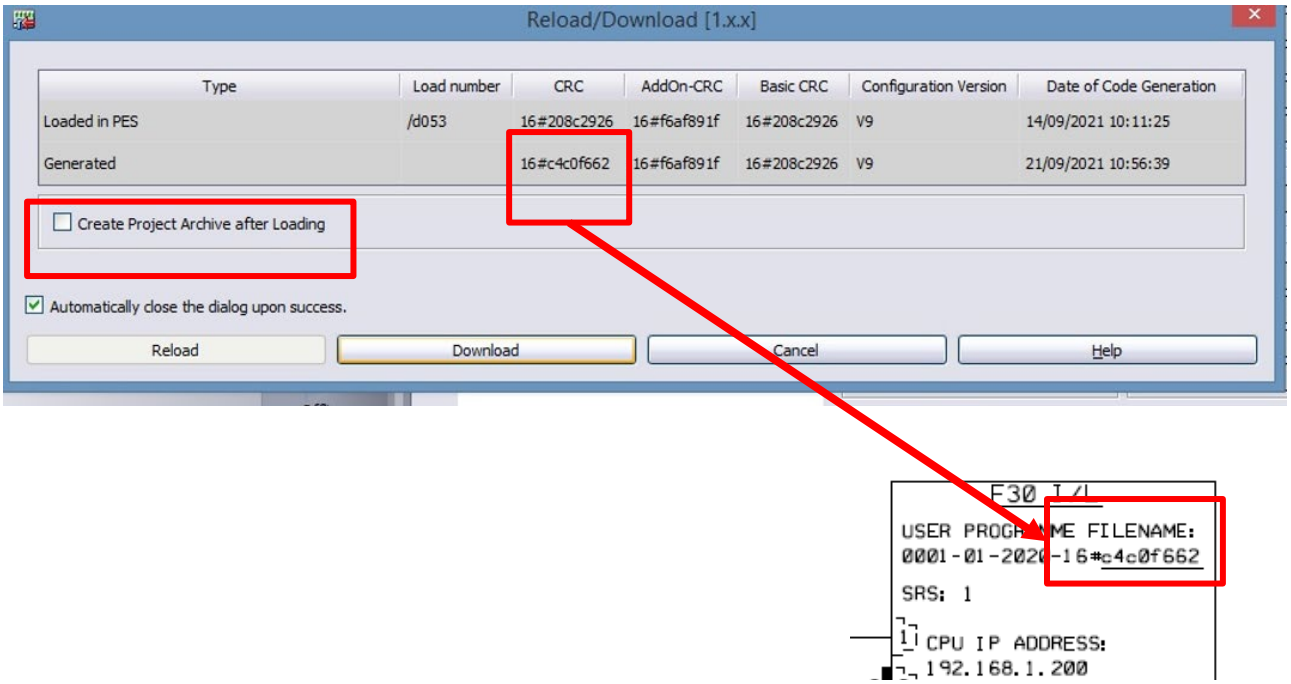


Figure 21 – Reload/Download Window

NOTE: *"Loaded in the PES" refers to what is already downloaded to the F30. "Generated" is the new user programme to be downloaded. In some instances, only one CRC will be shown.*

16. Click the Download button.

17. If the triangular Play button is greyed out (Figure 22), go to Step 19.

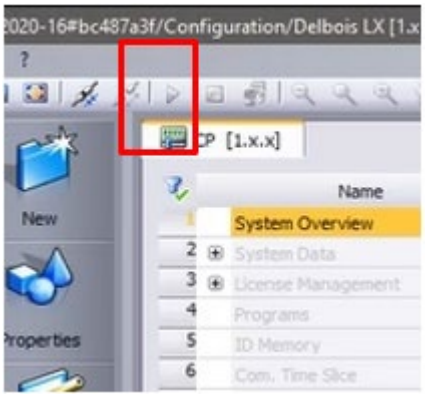


Figure 22 – Play Button Greyed out

18. If the triangular Play button is not greyed out (Figure 23), click it to set the F30 System State to RUN. Then go to Step 20.

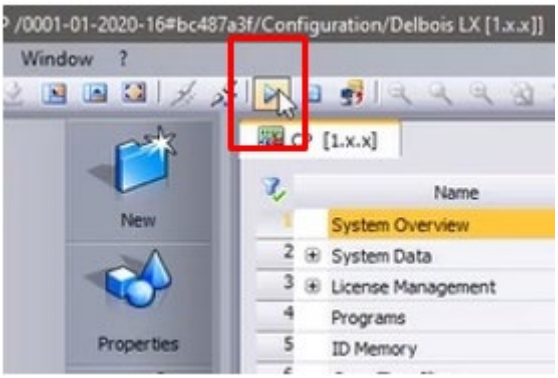


Figure 23 – Play Button NOT Grayed out

19. If the triangular Play button is greyed out, log-in to the F30 again following steps 1 to 9, then click the triangular Play button to set the F30 System State to RUN.

20. At the Resource Cold Start window (Figure 24) click the OK button. This completes the F30 download

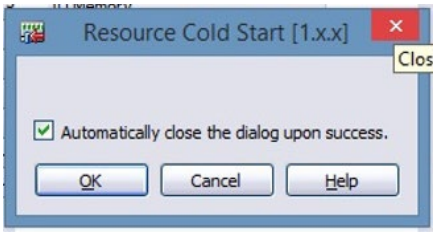


Figure 24 – Resource Cold Start Window

21. Close the Search via MAC and System Login windows (if open) and then close SILworX.

22. Disconnect the laptop Ethernet cable from the F30.

If downloading as part of the installation of a new HIMatrix unit, continue to complete the remaining installation steps of NR/SMTH/Part04/IS16 (Replace a HIMatrix Programmable Logic Controller (PLC) F30 and F3).

APPENDIX C - Download a Rack ID and IP Address to an F3

If the F3 RUN LED is illuminated and steady (not blinking), check there are no Ethernet cables connected and power the unit off and on using the corresponding fuse/MCB.

1. Connect an Ethernet cable between the laptop and the F3.

2. Click the Online button (Figure 25).

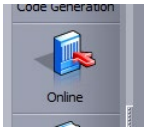


Figure 25 – Online Button

3. You are now connected to the F3.

4. At the System Login window (Figure 26), click the Search button.

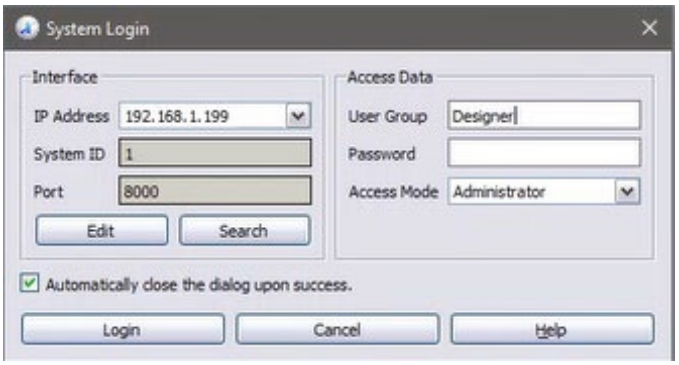


Figure 26 – System Login Window

5. At the Search via MAC Window (Figure 27), enter the MAC address printed on the F3 module.

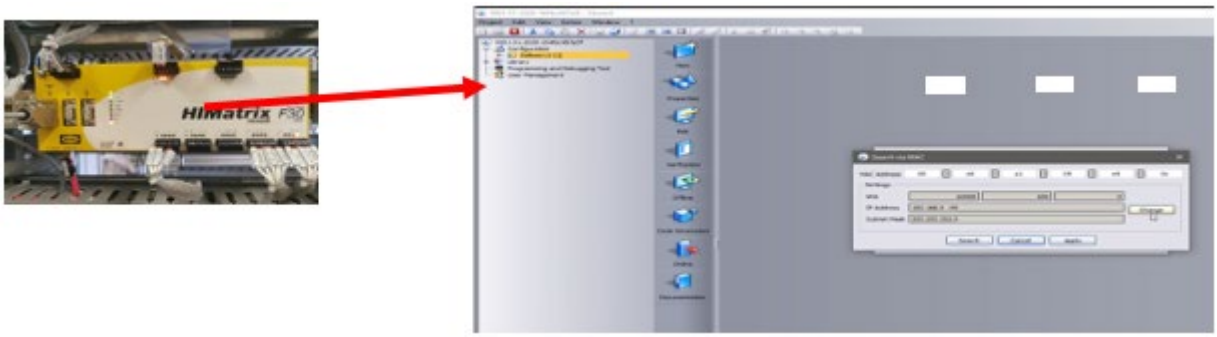


Figure 27 – Search via MAC Window

6. Click Search. The SRS etc. Fields will self-populate.

7. Click the Change button.

8. At the Write via MAC window (Figure 28), enter the F30 Interlocking SRS number and F3 Rack ID, exactly as per the location case diagrams for the F3 being downloaded.

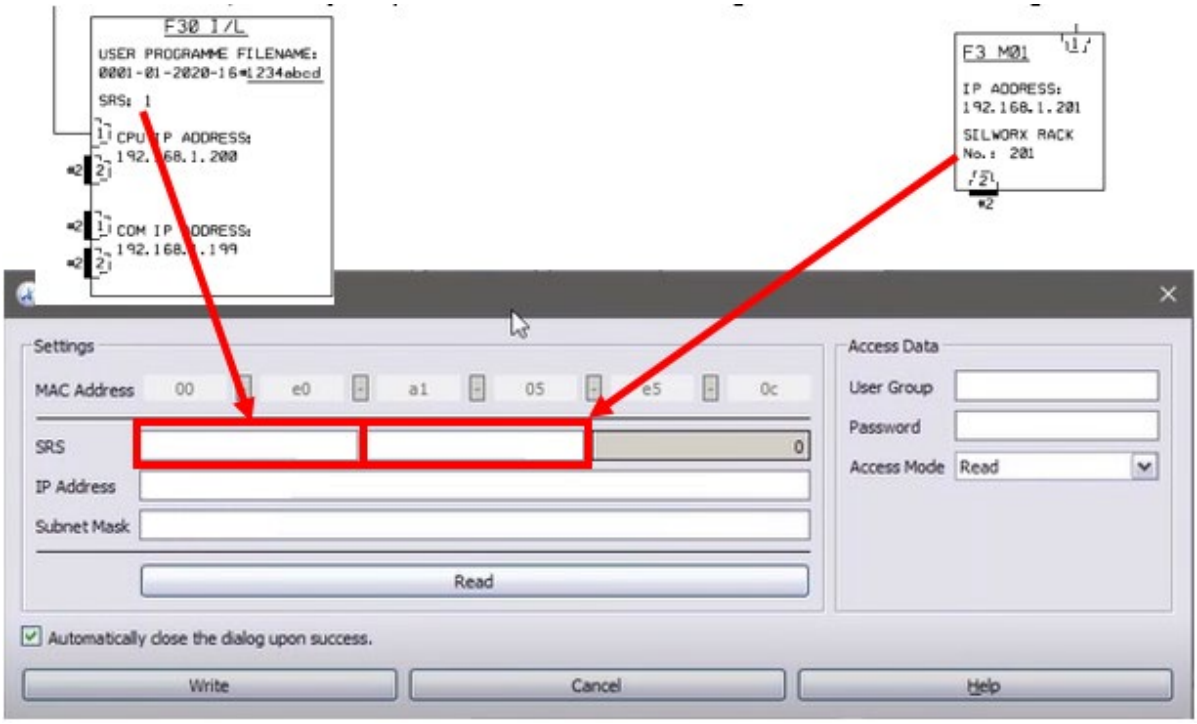


Figure 28 – Write via MAC Window

9. Enter the F3 IP Address and Subnet Mask values (Figure 29) exactly as per the location case diagrams for the F3 being downloaded.

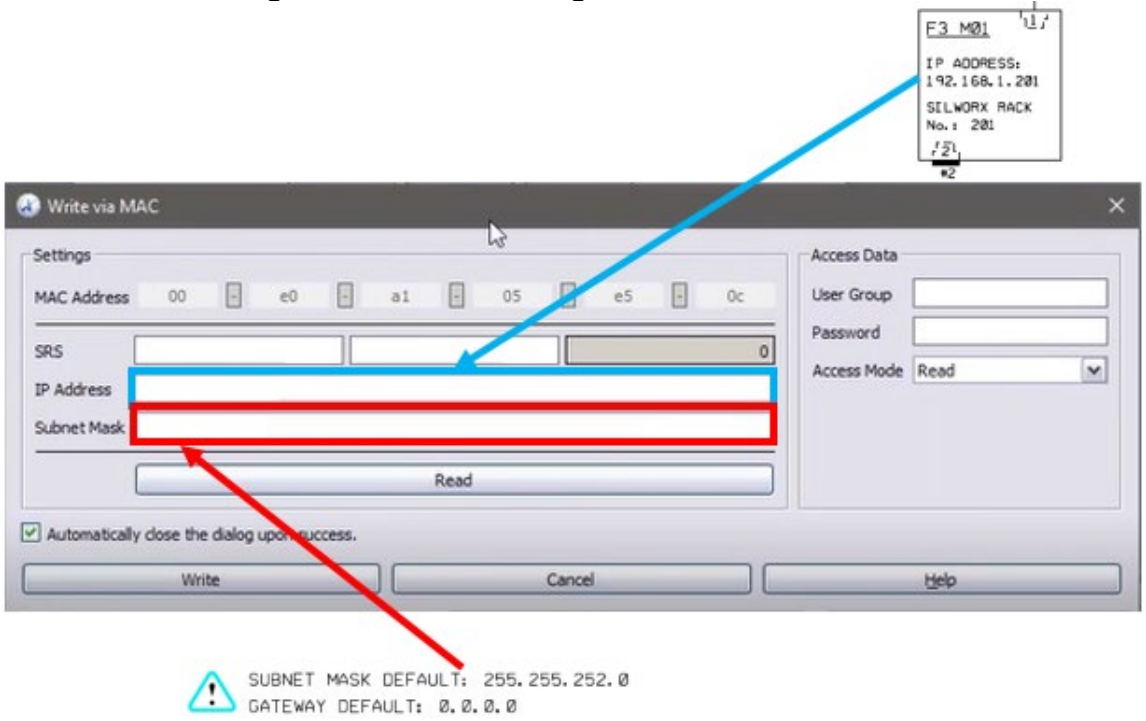


Figure 29 – IP Address and Subnet Mask values

10. Enter the following Access Data credentials (Figure 30):

    - User Group = Administrator
    - Password = (Leave blank)
    - Access Mode = Administrator

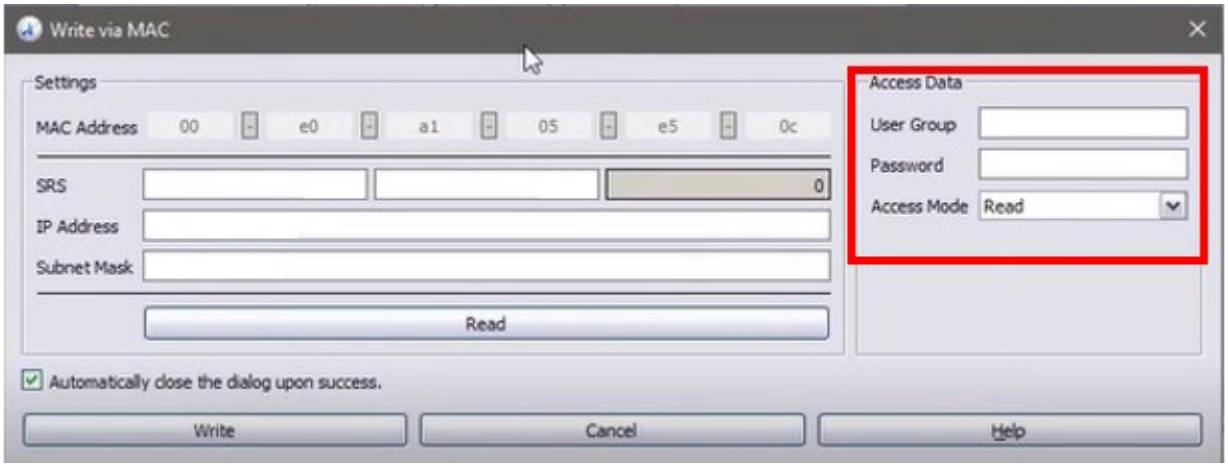


Figure 30 – Access Data Credentials

11. Click the Write button. This completes the F3 download.

12. Close the Search via MAC and System Login windows (if open) and then close SILworX.

13. Disconnect the laptop Ethernet cable from the F3.

    If downloading as part of the installation of a new HIMatrix unit, continue to complete the remaining installation steps of NR/SMTH/Part04/IS16 (Replace a HIMatrix Programmable Logic Controller (PLC) F30 and F3).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IS20		
Replace a SIMIS-W ACC EOM Card		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

***** INDEPENDENCE EXEMPT *****

Includes:	SOM, SOMS, POM, IMON, UNOM
Excludes:	ECC-CU, ECC BUREP and all other types SIMIS Card

Before powering down an ACC obtain the Signaller's permission.

BEFORE INSTALLATION WORK

1. Check the replacement card is the correct type and not damaged.

2. Check the replacement card version and the mod. state is correct.

3. Power down the ACC by switching off the power supply boards of all three-computer channels.

4. Remove and label the failed card as defective.

AFTER INSTALATION WORK

5. Check the card is correctly installed and secure.

6. Power up the ACC by switching on the power supply boards of all three-computer channels.

7. Check the correct operation of replacement card.

NOTE: *"Check the correct operation" means observing the correct indications on the EOM and confirming the correct operation of one function operated by the EOM, for example a signal aspect can be changed, or points operated normal & reverse.*

8. Check, or arrange for the correct labelling of the new card.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IS21		
Replace a SIMIS-W ECC BUREP Card		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

***** INDEPENDENCE EXEMPT *****

Includes:	ECC BUREP Card
Excludes:	SOM, POM, IMON, UNOM, ECC-CU, and all other types SIMIS Card

Before powering down an ACC obtain the Signaller's permission.

Note: Consult Equipment List for modification state.

Observe any local restrictions that apply.

BEFORE INSTALLATION WORK

1. Check the replacement card is the correct type and not damaged.
2. Check the replacement card version and the mod. state is correct.
3. Power down the ACC by switching off the power supply boards of all three-computer channels.
4. Remove and label the failed card as defective.

AFTER INSTALATION WORK

5. Check the card is correctly installed and secure.
6. Power up the ACC by switching on the power supply boards of all three-computer channels.
7. Check the correct operation of replacement card.

NOTE: *"Check the correct operation" means observing the correct indications on the ECC-BUREP card (See ACC section in the S&D manual).*

8. Check, or arrange for the correct labelling of the new card.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IS22		
Replace a SIMIS-W ECC-CU Card		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	ECC-CU Card
Excludes:	SOM, POM, IMON, UNOM, ECC BUREP and all other types SIMIS Card

Before powering down an ACC obtain the Signaller's permission.

Note: Consult Equipment List for modification state.

Observe any local restrictions that apply.

BEFORE INSTALLATION WORK

1. Check the replacement card is the correct type and not damaged.
2. Check the replacement card version and the mod. state is correct.
3. Check that the replace card has the correct software version installed.
4. Power down the ACC by switching off the power supply boards of all three-computer channels.
5. Remove and label the failed card as defective.

AFTER INSTALATION WORK

6. Check the card is correctly installed and secure.
7. Power up the ACC by switching on the power supply boards of all three-computer channels.
8. Check the correct operation of replacement card.

NOTE: *"Check the correct operation" means observing the correct indications on the ECC-CU card (See ACC section in the S&D manual).*

9. Check, or arrange for the correct labelling of the new card.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IS23		
Replace a SIMIS-W IIC/OMC Non-CPU Card		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

***** INDEPENDENCE EXEMPT *****

Includes:	VESUV3, VESIN, KOMDA2, BUREP16 and BUMA Cards
Excludes:	SOM, POM, IMON, UNOM, ECC BUREP, ECC-CU, VENUS3, Axle Counter Evaluators and all other types SIMIS Card.

Before powering down an ACC obtain the Signaller's permission.

Note: Consult Equipment List for modification state.

Observe any local restrictions that apply.

BEFORE INSTALLATION WORK

1. Check the replacement card is the correct type and not damaged.
2. Check the replacement card version and the mod. state is correct.
3. Power down affected computer channel by setting the reset switch to "OFF" ("AUS") on the relevant VENUS3 card and switching off the relevant power supply board for the affected computer channel.
4. Remove and label the failed card as defective.

AFTER INSTALATION WORK

5. Check the card is correctly installed and secure.
6. Power up the affected computer channels.
7. Perform the “update computer channel" procedure (See S&D Manual).
8. Check that the affected IIC/OMC channel has updated and that the card operates correctly by observing the correct Indications on the IIC/OMC (see the IIC/OMC section of the S&D manual).
9. Check, or arrange for the correct labelling of the new card.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/IS24		
Replace a SIMIS-W IIC/OMC VENUS3 CPU Card		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	VENUS3 CPU Card
Excludes:	VESUV3, VESIN, KOMDA2, BUREP16 and BUMA Cards

Before powering down an ACC obtain the Signaller's permission.

Note: Consult Equipment List for modification state.

Observe any local restrictions that apply.

BEFORE INSTALLATION WORK

1. Check the replacement card is the correct type and not damaged.
2. Check the replacement card version and the mod. state is correct.
3. Check the replacement card has the correct software version installed.
4. Power down affected computer channel by setting the reset switch to "OFF" ("AUS") on the relevant VENUS3 card and switching off the relevant power supply board for the affected computer channel.
5. Remove and label the failed card as defective.

AFTER INSTALATION WORK

6. Check the card is correctly installed and secure.
7. Power up the affected computer channels.
8. Perform the "update computer channel" procedure (See S&D Manual).
9. Check that the affected IIC/OMC channel has updated and that the card operates correctly by observing the correct Indications on the IIC/OMC (see the IIC/OMC section of the S&D manual).
10. Check, or arrange for the correct labelling of the new card.

END

Before powering down an ACC inform the Signaller as to the effect to the operational railway.

Note: Consult Equipment List for modification state.

Observe any local restrictions that apply.

BEFORE INSTALLATION WORK

1. Check the replacement connector is the correct type and not damaged.

   NOTE: *This should include pin alignment, internal contamination (Inc. metallic flakes), code comb alignment.*

2. Check the connector version and the mod. state is correct.

3. Check that the replacement card has the correct software version installed.

   NOTE: *There are 4 types of connector, depending on the type of lamps connected to the SOM6. Installation of the wrong type will cause incorrect operation of the SOM6.*

4. Power down ACC by switching off the power supply boards for all three computer channels.

5. Remove and label the failed connector as defective.

AFTER INSTALATION WORK

6. Check the connector is correctly installed and secure.

7. Check that the red retain jumper is set in the correct position (see wiring diagrams).

8. Power up ACC by switching on the power supply boards for all three computer channels.

9. Check replacement SOM 6 card and connector operate correctly. By observing the correct indications on the SOM 6 and confirming correct operation all aspects controlled by the SOM 6.

10. Test for correct operating current for all aspects controlled by the SOM 6.

11. Check that the red retain function of the SOM 6 operates correctly by setting a proceed aspect (or the least restrictive aspect) for one or both the signals.

    Then disconnect the feed to a lit aspect at the CDC and check that the SOM 6 correctly illuminates the most restrictive aspects.

12. Re-start the ACC, power down the ACC by switching off the power supply boards of all three computer channels After 10 seconds, power up the ACC by switching on the power supply boards of all three computer channels.

13. Check that the ACC card operates correctly by observing the correct indications on the ACC and VICOS. (See ACC section in the S&D manual).

14. Check, or arrange for the correct labelling of the new card.

END

Includes:	PAM Point Detection Module
Excludes:	PSU Module, Transformer, Phase Detect Modules, ELDs and Motor Power Module.

Observe any local restrictions that apply.

BEFORE INSTALLATION WORK

1. Check that the replacement module is not damaged and is of the correct type.
2. Check that the plug connectors are not damage.
3. Check existing wiring has safe insulation.
4. Check the existing wiring is correctly labelled.
5. Isolate PAM at the incoming links. (PAM O&M Manual).

AFTER INSTALATION WORK

6. Check that the replacement module is correctly installed.
7. Check that the plug connections are replaced as labelled.
8. Check that the plug connections are secure.
9. Reconnect the PAM.
10. Carry out NR/SMS/PartB/Test/202 (Siemens Point Detection Module Test).
11. Carry out NR/SMS/PartB/Test/201 (Siemens Point Module Correspondence Test).
12. Check, or arrange for the correct labelling of the module, including normal & reverse labels.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/KL01		
Replace a Keylock within an Electric Release Instrument or Mechanical Lever		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Keylock's mounted within an Electric Release Instrument or Mechanical Lever
Excludes:	All other keylocks

This work does not require any electrical disconnections

BEFORE INSTALLATION WORK

1. Check replacement keylock is not damaged and is correct type.

AFTER INSTALLATION WORK

2. Check replacement keylock is correctly installed, and that the solenoid assembly and terminal block are correctly fitted to the rear of the keylock **(ELECTRICAL RELEASE ONLY).**

3. Check that keys can only be withdrawn when the release is given.

4. Check that the release can only be given back when both keys are operated to the locked position.

5. Check that the key which operates the slide has to be removed first after the release is given, and that the key which releases the slide has to be operated first to return the release.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD01		
Replace a Barrier Boom		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Level Crossing Barrier Booms, Skirt, Pivot, AHBC shell bearings, ram pins, post, brackets, pogo stick and gear train
Excludes:	All other Barrier or Boom

BEFORE INSTALLATION WORK

1. For Missing Equipment Only: Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check replacement item is not damaged and is correct type (length, cross-section, boom light position, reflecting strip, fracture segment, skirt, strainer wire).

3. Check any existing wiring has safe insulation.

4. Check any existing wiring is correctly labelled.

5. Check existing barrier is isolated from the supply.

During installation work check that the boom is supported and/or weights removed and check top ram pin moves freely in ram.

AFTER INSTALLATION WORK

6. Check replacement item is correctly installed.

7. Check barrier ram pins move freely in the ram **(BR-WR TYPE BARRIERS ONLY).**

8. Check top ram pin is prevented from turning in its frame **(AHB Mk.1 (PENGUIN) BARRIERS ONLY).**

9. Check wiring is replaced as labelled.

10. WIRE COUNT replacement boom to the wiring diagram.

11. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.

12. Check new split pins, fracture bolts, and/or lock tabs are correctly installed.

13. Check all wires and cables are secure and clear of moving parts.

14. Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests - Level crossing barriers). On the barrier supply throughout operation cycle.

15. Check barrier and any skirt moves freely.

16. Check any boom lights for correct alignment and operation.

17. Check any strainer wire is correctly adjusted.

18. Check the tip force and damping are correct according to the type of barrier (see the barrier equipment standard).

19. Check the boom adapter locating pins retaining nuts are tightened to the correct torque (16 Nm) **(BR843 BARRIERS ONLY).**

20. Check barriers operate correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/LD02		
Replace a Barrier Power Pack		
Issue No. 06	Issue Date: 04/03/17	Compliance Date: 31/05/17

Includes:	Hydraulic and electro-mechanical power pack
Excludes:	Hydraulic actuator, hose, electric motor.

BEFORE INSTALLATION WORK

1. Check replacement power pack is Not Damaged and is Correct Type.
2. Check the auto/manual valve is switched to correct position [Hydraulic Power Unit (NR/SMS/LC21)]. (BR SPEC 843 HYDRAULIC PACKS ONLY)
3. WIRE COUNT existing power pack to the wiring diagram.
4. Note the position of the top trunnion bracket in relation to the holes on the operating arm (long or short setting).
5. Check existing wiring has Safe Insulation.
6. INSULATION TEST replacement power pack (minimum 2M ohms terminals to case).
7. Check existing wiring is Correctly Labelled.
8. Check existing power pack is Isolated from the supply.

AFTER INSTALLATION WORK

9. Check any air has been excluded from the hydraulic system before continuing [General Information on Level Crossing Equipment [NR/SMS/Appendix/03)]. (RURAL BARRIER HYDRAULIC PACKS ONLY)
10. Check the replacement pack has been Correctly Installed using new M12 X 50mm Grade 10.9 bolts torqued to 70Nm to secure the top trunnion and new M12 X 35mm Grade 8.8 bolts torqued to 70Nm to secure the bottom trunnion.
11. Check new spirol pins and tab washers have been fitted and are Correctly Installed.
12. Check in both the lowered and raised position, that the top trunnion pivot pin on the barrier pack is centralised and both circlips are Correctly Installed and undamaged.
13. Check that a bolt secured with a nut has been fitted to the unused holes within the operating arm and that both the nut and bolt head are coloured RED.
14. Check wiring is replaced as labelled.
15. WIRE COUNT replacement power pack to the wiring diagram.
16. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
17. Check barrier and any skirt moves freely.
18. Dynamic Earth Test [Level crossing barriers (NR/SMS/Test/052)] barrier supply throughout operation cycle.
19. Check the tip force and damping are correct according to the type of barrier (see NR/SMS/Part/Z04 and the appropriate the barrier equipment standard).
20. Check barriers operate correctly.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD03		
Replace a Level Crossing Gate		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Gates, Gate post or boom gates with S&T equipment fitted
Excludes:	Gate stops

BEFORE INSTALLATION WORK

1. Check replacement item is not damaged and is correct type (length).
2. Check drive mechanism is disconnected.
3. Check any existing wiring has safe insulation **(ELECTRIC ITEMS ONLY).**
4. Check any existing wiring is correctly labelled **(ELECTRIC ITEMS ONLY).**
5. Check existing equipment is isolated from the supply **(ELECTRIC ITEMS ONLY).**

AFTER INSTALLATION WORK

6. Check replacement item is correctly installed.
7. Check gate moves freely with correct alignment of gate stop, gate post rollers, ramps and gate locks.
8. Check any gate lamps are illuminated and are in correct alignment with road traffic.
9. Carry out an EARTH TEST (DC) or EARTH TEST (AC) on all gate lamps.
10. Check any red target is correctly fitted.
11. Check gate cannot be opened when locked **(LOCKABLE WICKET GATES ONLY).**
12. Check signals cannot be cleared until gates are fully open to railway and locked.
13. Check no gates can be unlocked with signals clear.
14. Check all gates lock into any gate stops.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD04		
Replace a Level Crossing Local Control Unit (LCU)		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	LCU Door Keylocks
Excludes:	All other door keylocks

BEFORE INSTALLATION WORK

1. Check replacement LCU is not damaged and is correct type.
2. WIRE COUNT existing LCU to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring is correctly labelled.
5. Check existing LCU is Isolated from the supply.

AFTER INSTALLATION WORK

6. Check replacement LCU is correctly installed.
7. Check wiring is replaced as labelled.
8. WIRE COUNT LCU to the wiring diagram.
9. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
10. Check terminations are secure and suitably protected.
11. Check wires and cables are secured and are clear of moving parts.
12. EARTH TEST (DC) or EARTH TEST (AC) the supply where designed to be earth free.
13. Check that with the LCU door open, the key cannot be removed from the keylock.
14. Check correct operation of barriers from LCU.
15. Check that LCU door cannot be closed until Auto/Normal button/switch has been operated to the Auto/Normal position**. (ABCL, AFBCL, AHBC, AOCL, AOCR, & MCB-CCTV ONLY).**
16. Check that with the LCU door closed and the key removed, the LCU door is locked.
17. Check that the crossing sequence does not re-set until the LCU door is closed and locked.

18. Carry out a NR/SMS/PartB/Test/070 - 084,159 and 160 (Level crossing sequence test). Record the test measurements on the record card together with the reason for the test.

19. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD05		
Replace a Level Crossing Flasher Unit		
Issue No: 08	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Road light flasher units, bell pulse units
Excludes:	All other flasher units

BEFORE INSTALLATION WORK

1. Check replacement flasher unit is not damaged and is correct type.
2. WIRE COUNT existing flasher unit to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring is correctly labelled.
5. Check existing flasher unit is isolated from the supply.

AFTER INSTALLATION WORK

6. Check replacement flasher unit is correctly installed.
7. Check wiring is replaced as labelled.
8. WIRE COUNT flasher unit to the wiring diagram.
9. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
10. Check flashing rate of red road lights, see NR/SMS/PartZ/Z04 (Level Crossing – Reference Values).
11. Check Flasher Unit Road Traffic Light delay setting. If required, adjust to check that barriers start to rise before the Road Traffic Lights turn off **(AOCL+B Crossing Flasher Units only).**
12. Check bells operate correctly **(BELL PULSE UNITS ONLY).**
13. EARTH TEST (DC) or EARTH TEST (AC) supply throughout operation cycle.
14. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD06		
Replace a Level Crossing Gate Post Mechanical Equipment Lock		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Gate post mechanical equipment, Blacks Lock, Level crossing keylock
Excludes:	LCU Door lock keylock, and Gate drive equipment

BEFORE INSTALLATION WORK

1. Check replacement lock is not damaged and is correct type.

   During installation work check springs are not damaged and are correctly seated

AFTER INSTALLATION WORK

2. Check replacement lock is correctly installed.
3. Check that replacement lock can only be released by correct key/keys, including the emergency key.
4. Check plunger, when withdrawn is clear of lock face **(BLACKS LOCK ONLY).**
5. Check plunger travel does not damage casting.
6. Check new split pins and studs are correctly installed.
7. Check correct alignment of gate post rollers and ramps.
8. Check that the lever is locked until all gates are closed and bolted.
9. Check that all gates are locked by the lever/switch.
10. Check that the key cannot be removed from the keylock with the gate open.
11. Check that the gate is closed and locked with the key removed.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/LD07		
Replace an S60 Machine (Down Position) Damper Spring		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	S60 Barrier Machine
Excludes:	All other barrier machines

BEFORE INSTALLATION WORK

1. Check replacement dampening spring is Not Damaged and is of Correct Type.
2. With signallers permission take the crossing on local control and maintain the barrier boom in the raised position for the duration of the replacement

AFTER INSTALLATION WORK

3. Check replacement dampening spring is correctly installed.
4. Check the lock nut function is effective.
5. Check that no components within the barrier are susceptible to mechanical damage following the replacement.
6. Check that the when the boom is lowered the dampening is effective and the boom comes to rest in the horizontal position.
7. Check the weather seal is intact and correctly seated before reinstalling the outer casing.
8. If possible, observe the operation of the barrier through a complete lower and raise cycle.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD08		
Replace a Level Crossing Light Unit		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Road signal light unit, Miniature Stop Light (MSL) unit, Miniature Warning Light (MWL) unit
Excludes:	All other miniature stop lights

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Check replacement unit is not damaged and is correct type.
3. WIRE COUNT existing unit to the wiring diagram.
4. Check existing wiring has safe insulation.
5. Check existing wiring is correctly labelled.
6. Check existing unit is isolated from the supply.

AFTER INSTALLATION WORK

7. Check replacement unit is correctly installed.
8. Check wiring is replaced as labelled.
9. WIRE COUNT replacement unit to the wiring diagrams.
10. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
11. Check lenses are of correct type (colour) and are correctly installed in the replacement unit. (Any rubber seals are seated correctly).
12. Check that the hoods are correctly fitted and are secure in the replacement unit.
13. Check that the correctly rated lamps are installed.
14. Check that all the lamps (main and any auxiliary) illuminate correctly and test for correct voltages NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests). Record the test measurements on the record card, together with the reason for the test.
15. Check the alignment and height of replacement unit for public use, see NR/SMS/PartC/LC11 (Road Lights and Audible Warnings). (Check that the coloured lights cannot be misread as signal aspects by train drivers).
16. Check flashing rate of lights (70 - 90 flashes per minute) (RED ROAD LIGHTS ONLY).

17. Carry out EARTH TEST (DC) or EARTH TEST (AC) supply throughout operation cycle.

18. Test that the red road lamps are proved (NR/SMS/PartD) (RED ROAD LIGHTS ONLY).

19. If proved, check all indications back to the relevant signal box.

20. Check, or arrange for, correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD09		
Replace a barrier boom light		
Issue No: 02	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Boom Light Unit (for Level Crossing Barrier Boom)
Excludes:	All other types of Light Unit

BEFORE INSTALLATION WORK

1. Check replacement unit is not damaged and is correct type (LED boom light unit has a white housing which differs to the filament type which is black).

2. WIRE COUNT existing unit to the wiring diagram.

3. Check existing wiring has safe insulation.

4. Check existing wiring is correctly labelled.

5. Check existing unit is isolated from the supply.

AFTER INSTALLATION WORK

6. Check replacement unit is correctly installed.

7. Check wiring is replaced as labelled (LED boom lights are polarity sensitive - note wiring colour).

8. WIRE COUNT replacement unit to the wiring diagram.

9. Check boom lights for correct alignment (considering the angle of the road to that of the rail).

10. EARTH TEST (DC) or EARTH TEST (AC) supplies where designed to be earth free.

11. Check the boom lights for correct operation (i.e. illuminates and extinguishes at the correct boom angle).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD10		
Replace a Level Crossing Audible Warning Control Unit (AWCU)		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Mechanical Sangamo/Schlumberger Audible Warning Control Unit. Electronic Audible Warning Control Unit
Excludes:	Audible warning device (bell or yodel)

BEFORE INSTALLATION WORK

1. Check replacement AWCU is not damaged and is correct type.
2. WIRE COUNT existing AWCU to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring is correctly labelled.
5. Check existing audible warning unit is Isolated from supply.

AFTER INSTALLATION WORK

6. Check replacement AWCU is correctly installed.
7. Check wiring is replaced as labelled.
8. WIRE COUNT replacement AWCU to the wiring diagram.
9. Check terminations are secure and suitably protected.
10. Check (as provided) that the ‘on time’, ‘off time’ are correctly set.
11. Check that the time is correctly set (mechanical devices) or displayed correctly (electronic devices).
12. Check (as provided) by using override switch that audible warnings operate correctly for day and night settings.
13. Check override switch is left in correct position (mechanical devices).
14. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD11		
Replace a Level Crossing Gate Machine		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Wheel, gears, racks and gate drive levers within signal box
Excludes:	Gate equipment outside signal box

When replacement of gate machine requires the disarrangement of interlocking, a combination of this test plan and NR/SMTH/Part04/LV05 (Replace a Mechanical Interlocking Component) shall be used.

BEFORE INSTALLATION WORK

1. Check replacement item is not damaged and is correct type.

AFTER INSTALLATION WORK

2. Check replacement item is correctly installed.

3. Check lock nuts, wedge keys, pins and/or new split pins are correctly installed.

4. Check that the apparatus operated by the replacement items functions correctly in the correct direction with enough stroke and without undue strain on fittings, cranks, and stools.

5. Check all gates lock into any gate stop.

6. Check that gates cannot be operated from either fully across railway, or fully across road positions while they are locked by the correct locking levers.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD12		
Replace a PCB Board in an Invensys S60 Barrier Machine		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	S60 Barrier Machine PCB Board
Excludes:	Any other PCB Board

BEFORE INSTALLATION WORK

1. Check replacement unit is of correct type and is not damaged.
2. Check that any links or switches are correctly configured.
3. Isolate power by the S60 Barrier Machine.
4. Apply the Lock Bar with the tethered 'R' Clip in place within the affected barrier machine with the correct designation towards the motor (either keep down or keep up). Failure to do so can result in unintended movement. (Appendix B).

AFTER INSTALLATION WORK

5. Check replacement S60 PCB Board is correctly installed, labelled and check the board retaining screws for security.
6. Check wiring plugs and cables are correctly retained in their respected housings.
7. WIRE COUNT affected wires to the site diagrams.
8. Check wiring and cables are not susceptible to mechanical damage.
9. Arrange to restore the power supply to the S60 Barrier Machine.
10. Check that the snubbing settings match the component being removed.
11. Check correct status LED's are illuminated (Appendix A).
12. Check operation of the affected S60 Barrier Machine for correct operation.
13. Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test) - Level Crossing Barriers.

APPENDIX A - PCB LED Indications

i) The PCB has a series of LED indications that monitor key Barrier Machine functions. This minimizes the need for a multi-meter when troubleshooting the status of the mechanism. The LED indications are listed below (in left to right order on the PCB);

ii) Power ON (Green) - Indicates Battery Power is present on terminals 4 & 5 and the PCB is receiving power. If the power level is outside the normal limits, the Health LED flashes at a rate of 4 Hz.

iii) Gate Request (Red) - Also known as Gate Control (GC). Indicates Gate control input is present. The barrier should raise or be raised when LED is lit.

iv) Brake On (Red) - Indicates power is being sent from the PCB to energize the electric brake. LED should be lit when the barrier is fully raised.

v) Breaker Tripped (Red) - Indicates that the Electronic Auto Restore Overload is activated.

vi) Motor Up (Red) - Indicates power is being sent from the PCB to energize the motor to raise the boom.

vii) Motor Down (Green) - Indicates power is being sent from the PCB to energize the motor to lower the boom.

viii) Health (Yellow) - Indicates that the microprocessor is operating properly. The LED flashes at a one (1) cycle per second rate (1/2 second on, 1/2 second off) when board is healthy. If the CPU detects a failed condition, the LED flashes at a rate of 4 Hz. Any mode other than 1 Hz indicates a failed condition. Refer to the Troubleshooting Section for further information.

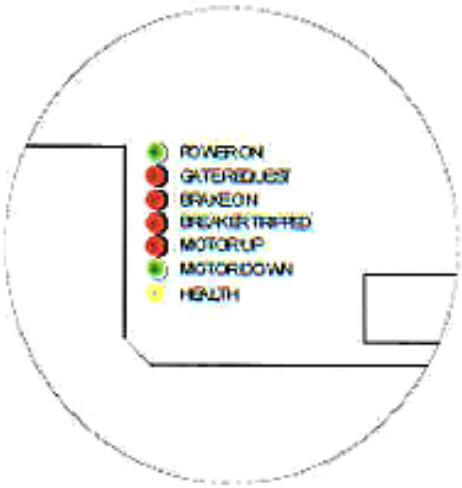


Figure 1 - LED DETAIL

APPENDIX B - Lock Bar Operation

1. Apply Lock Bar to prevent Movement. Always check that tethered R clip is used to secure the lock bar in place.

Figure 2 – Lock Bar

2. It is essential to apply the lock bar with the correct designation towards the motor (either keep down or keep up) failure to do so can result in unintended movement.

3. When the lock bar is applied to keep the barrier down, the barrier if raised falls down.

4. When the lock bar is applied to keep the barrier up, it is possible to move the barrier to the raised position.

5. When required to remove the lock bar, the following procedure shall be used:

    a) Read and comply with any safety precautions.

    b) Turn the Isolation switch to position '0'.

    c) Check fingers and loose clothing are clear of the mechanism, remove the R-Clip and slide the look bar off. As this might be under a small amount load, it can require gently twisting to reduce the friction.

6. When the lock bar is removed, if the barriers is raised, it can fall under gravity.

7. Failure to remove the lock bar before powered movement of the S60 Barrier Machine can result in operation of external over-current protection or cause damage to the machine.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD14		
Replace EBI Gate 630 Barrier Crank Handle Gear Mechanism		
Issue No: 02	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	630 Barrier Crank Handle Gear Mechanism
Excludes:	All other types of Crank Handle Mechanism

GENERAL

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.

This task shall be completed with the boom in the lowered position, this is to prevent the boom from moving during the process.

BEFORE INSTALLATION WORK

1. Check replacement hand crank gear mechanism is not damaged and is the correct type.
2. Isolate the barrier machine from the supply.
3. Unscrew and remove hand crank gear mechanism, noting its position and orientation.

AFTER INSTALLATION WORK

4. Check the installed replacement hand crank gear mechanism is in the correct position and orientation.
5. Check cap head screws are tight with the correct size Allen key.
6. Check the operation of the crank handle, by operating the barrier machine, raising and lowering boom without excess force, with the gear teeth fully engaging.
7. Reconnect the main power supply.
8. Check the correct operation of the barrier machine under power.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/LD15		
Replace an EBI Gate 630 Barrier Machine		
Issue No. 02	Issue Date: 01/09/18	Compliance Date: 01/12/18

Includes:	EBI Gate 630 Barrier Machine, Skirt, pogo stick, support arms, strainer wire, counter-weights, boom lights.
Excludes:	All other Barrier Machines and components

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.

Care shall be taken when manually operating the barrier machine if the counter-weights have been removed or the boom has been damaged, the unbalanced boom may cause the crank handle to turn.

BEFORE INSTALLATION WORK

1. Check the existing concrete pedestal is undamaged.
2. Check the existing earth connections are in place and there is continuity to an effective earth and are free from any earth faults.
3. Check existing barrier machine is in the fully horizontal (lowered) position.
4. Check the crank handle is inserted correctly into the crank hole.
5. Check the crank handle is secured in place with the locking pin and that it is locked in place with a padlock.
6. Check existing barrier machine is Isolated from the supply.
7. Check all fixing bolts are secure, free from corrosion and capable of sustaining the load.
8. Check any existing wiring for damage and that it has safe insulation.
9. Remove any existing boom assembly, support arms, counter-weights (noting there position).

AFTER INSTALLATION

These steps should be carried our prior to the installation of the boom

10. Check the pedestal is sitting squarely and level on the base foundation.
11. Check the mounting bolts do not protrude into the pedestal by more than 108mm.
12. Check the pedestal mounting bolts are securely fastened.
13. Check the earth connections are in place and there is continuity to an effective earth and they are free from any earth faults.
14. Check the cable glands are securely sealed.
15. Check the cables are secured to the barrier machine cable tray.
16. Check any plug couplers are not damaged and are securely connected.
17. Check the wiring terminations correspond to the diagrams and the cores are correctly labelled.
18. Check the tension of the motor cog belt is between 5 - 10mm.
19. Unlock and remove the locking pin from the crank handle.
20. Manually operate the barrier machine to the fully vertical (raised) position. Check that the movement is smooth and unobstructed.
21. Manually operate the barrier machine to the fully horizontal (lowered) position. Check that the movement is smooth and unobstructed.
22. Close and lock the crank hole flap.
23. Reconnect the power supply to the barrier machine.
24. Check the voltage on the power supply terminals is between21 to 28V DC

    Terminal X14 is the positive and X7 the negative.
25. Carry out a DYNAMIC EARTH TEST (052)
26. Re-fit and secure the barrier machine front cover.
27. Check the correct electrical operation of the barrier machine. Raise the barrier machine and check that the movement is smooth and unobstructed.
28. Check the correct electrical operation of the barrier machine. Lower the barrier machine and check that the movement is smooth and unobstructed.

29. Replace the crank handle and locking pin and padlock the cover.

30. Re-fit and lock the barrier machine external cover.

BOOM INSTALLATION / REFIT

31. Re isolate the barrier machine before proceeding.

32. Check the boom and fittings are Correctly Installed.

33. Check the barrier machine boom flange connections (Six M16 flange screws) are torqued to 140Nm.

34. Check the boom support arm to boom connections are secure, (Four M6 screws) torqued to 7Nm.

35. Check the number of counter weights for type of boom fitted is correct.

36. Check the weights are installed and distributed correctly to counter weight arm/s.

37. Check the correct installation of any boom extensions tubes.

38. Check the correct installation of any support arms.

39. Check the correct installation of any skirt.

40. Check any strainer wire is correctly installed and adjusted.

41. Check the safety ‘break away’ device surfaces are greased and free from dirt, and corrosion.

42. Check the safety ‘break away’ device is installed correctly and torque the M16 nut to 140Nm.

43. Check the pogo stick touches the ground when the boom is in the horizontal (lowered) position, it should not cause an upward pressure on the boom.

44. Check the pogo stick adjustment leg does not exceed 242mm in length.

45. Check the pogo stick adjustment counter-nut is torqued to 55Nm.

46. Check the boom light wiring is replaced as labelled.

47. Check the boom integrity wiring is replaced as labelled.

48. Check the wiring access plate water seal is intact.

49. Check the wiring access plate is secured in place.

CHECK THE OPERATION OF THE BARRIER MACHINE

50. Unlock and remove the locking pin from the crank handle.

51. Manually operate the barrier machine to the fully vertical (raised) position and check the following:

    a) The movement is smooth and unobstructed

    b) The skirt moves freely

    c) The Pogo stick moves freely

    d) The gravitational pawl engages

    e) Counter weights are free from obstruction

52. Remove the crank handle and allow the barrier to 'self-fall' to the horizontal (lowered) position and check the following:

    a) The movement is smooth and unobstructed

    b) The skirt moves freely

    c) The Pogo stick moves freely

    d) The Pogo stick makes contact with the ground without it applying an upward pressure on the boom

    e) The boom is horizontal to the road surface

    f) The gravitational pawl dis-engages

53. Reconnect the Power to the barrier machine

54. Check the barrier operates correctly using the Local Control Unit.

55. Check the boom lights are securely fitted to the boom and operate correctly.

56. Check the boom reflective strips are visible and clean.

57. If possible observe the passage of a train.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/LD16		
Replace an EBI Gate 630 Barrier Boom		
Issue No. 02	Issue Date: 01/09/18	Compliance Date: 01/12/18

Includes:	EBI Gate 630 Barrier Boom, Skirt, pogo stick, support arms, strainer wire, counter-weights, boom lights.
Excludes:	All other Barrier Booms and components

Appropriate Protection / Possession arrangement shall be taken before commencing work on the Level Crossing System.

Manual Handling of components may be heavy and unevenly balanced.

Care shall be taken when carrying out any work inside the Barrier Machine there are movable parts.

Opening the Crank Hole Flap will release the electromagnetic brake which will cause the barrier boom to fall.

When operating the barrier, take care not to trap limbs between the boom assembly / fencing / guards.

It is essential that the barrier boom is in the horizontal position (lowered) before any work activity is carried out.

Care shall be taken when manually operating the barrier machine if the counter-weights have been removed of the boom has been damaged, the unbalanced boom may cause the crank handle to turn.

BEFORE INSTALLATION WORK

1. Check replacement item is Not Damaged and is Correct Type.
2. Check any existing wiring for damage and that it has safe insulation.
3. Check any existing wiring is Correctly Labelled.
4. Check barrier machine is in the horizontal (lowered) position.
5. Check the crank handle is inserted correctly into the crank hole.
6. Check the crank handle is secured in place with the locking pin and that it is locked in place with a padlock.

AFTER INSTALLATION WORK

7. Check replacement items are Correctly Installed.
8. Check the barrier machine boom flange connections (Six M16 flange screws) are torqued to 140Nm.
9. Check the boom support arm to boom connections (Four M6 screws) are torqued to 7Nm.

10. Check the number of counter weights for type of boom fitted is correct.

11. Check the weights are installed and distributed correctly to counter weight arm/s (Two M24 screws) torqued to 200Nm.

12. Check the correct installation of any boom extensions tubes.

13. Check the correct installation of any support arms.

14. Check the correct installation of any skirt.

15. Check any strainer wire is correctly installed and adjusted.

16. Check the safety 'break away' device surfaces are greased and free from dirt, and corrosion.

17. Check the safety 'break away' device is installed correctly:

    - M16 nut torque = 140Nm.

18. Check the pogo stick touches the ground when the boom is in the horizontal (lowered) position, it should not cause an upward pressure on the boom.

19. Check the pogo stick adjustment leg does not exceed 242mm in length.

20. Check the pogo stick adjustment counter-nut torqued to 55Nm:

21. Check the boom light wiring is replaced as labelled.

22. Check the boom integrity wiring is replaced as labelled.

23. Check the wiring access plate water seal is intact.

24. Check the wiring access plate is secured in place.

CHECK THE OPERATION OF THE BARRIER MACHINE

25. Check the barrier machine is installed as described in NR/SMTH/Part 04/LD15

26. Unlock and remove the locking pin from the crank handle.

27. Manually operate the barrier machine to the fully vertical (raised) position and check the following:

    - The movement is smooth and unobstructed
    - The skirt moves freely
    - The Pogo stick moves freely
    - The gravitational pawl engages
    - Counter weights are free from obstruction

28. Remove the crank handle and allow the barrier to 'self-fall' to the horizontal (lowered) position and check the following:

    - The movement is smooth and unobstructed
    - The skirt moves freely
    - The Pogo stick moves freely
    - The Pogo stick makes contact with the ground without it applying an upward pressure on the boom
    - The boom is horizontal to the road surface
    - The gravitational pawl dis-engages

29. Close and lock the crank hole flap.

30. Replace the crank handle and locking pin and padlock the cover.

31. Check the barrier operates correctly using the Local Control Unit.

32. Check the boom lights for correct operation and alignment.

33. Check the boom reflective strips are visible and clean.

34. If possible observe the passage of a train.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD17		
Replace an EBI Gate 630 Motor		
Issue No. 02	Issue Date: 01/09/18	Compliance Date: 01/12/18

Includes:	EBI Gate 630 Barrier Machine Motor
Excludes:	All other Level Crossing Systems

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.

This task shall be completed with the boom in the lowered position, this is to prevent the boom from moving during the process

BEFORE INSTALLATION WORK

1. Check the replacement motor is Not Damaged and is the Correct Type.
2. Isolate the barrier machine from the supply.
3. WIRE COUNT the motor.
4. Disconnect and label the connections to the motor as required.
5. Check the condition of the connector/plugs and the associated wiring.
6. Release and remove the motor and cog belt, noting its positon and orientation.

AFTER INSTALLATION WORK

7. Check the installed replacement motor and cog belt are in the correct positon and orientation.
8. Check the tension of the motor cog belt is between 5 – 10mm.
9. Check the motor mounting bolts are torqued to 30Nm.
10. WIRE COUNT the motor.
11. Check all connections, plugs and sockets are securely fitted.
12. Close and lock the crank hole flap.
13. Reconnect the main power supply.
14. Carry out a DYNAMIC EARTH TEST (052)
15. Check the correct operation and functionality of the barrier by raising and lowering the booms a number of times under power.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD18		
Replace EBI Gate 630 Cog Belt		
Issue No. 02	Issue Date: 01/09/18	Compliance Date: 01/12/18

Includes:	EBI Gate 630 Barrier Cog Belt
Excludes:	All other Level Crossing Cog Belts or Drive Belts

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.

This task shall be completed with the boom in the lowered position, this is to prevent the boom from moving during the process

BEFORE INSTALLATION WORK

1. Check the replacement cog belt is Not Damaged and is the Correct Type.
2. Isolate the barrier machine from the supply.
3. Release and remove the cog belt, noting its positon and orientation.

AFTER INSTALLATION WORK

4. Check the installed replacement cog belt is in the correct positon and orientation.
5. Check the motor mounting bolts are torqued to 30Nm.
6. Check the cog belt tension is correct, between 5-10mm.
7. Reconnect the main power supply.
8. Check the correct operation and functionality of the barrier by raising and lowering the booms a number of times under power.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD19		
Replace EBI Gate 2000 - Modular Components		
Issue No. 1	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	EBI Gate 2000 Control Hut (ERR-8) Power Supply Module EMF-8: Sound Generator EDG-5, Earth leakage detection modules (Bender Units), Current measurement modules (of barrier machines circuits), Compact Flash cards for PLC A and B, Computer (KMP) for DNC.
Excludes:	All other Level Crossing Systems

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.

The following modules require configuration and/or programming before installing them in the system:

a) Power Supply Module EMF-8,

b) Sound Generator EDG-5,

c) Earth leakage detection modules (Bender Units),

d) Current measurement modules (of barrier machines circuits),

e) Compact Flash cards for PLC A and B,

f) Computer (KMP) for DNC.

Typically these parts are delivered by the manufacturer as already prepared for installation in strictly defined LX system and module position – identified by serial number on the device.

PRE INSTALLATION WORK

1. Check unit/ module has been configured / programmed correctly before installation commences, if you are unsure or unable to vivify this do not install the item.

BEFORE INSTALLATION WORK

2. Check the replacement unit/module is Not Damaged and is the Correct Type/version.
3. Isolate the module by removing the corresponding fuse.
4. Detach all plugs or connectors attached to the module to be replaced.
5. Check the condition of the connector/plugs and the associated wiring.
6. Remove the module, noting its positon and orientation.

AFTER INSTALLATION WORK

7. Check the installed replacement module in the correct positon and orientation.

8. Re-connect all plugs or connectors to the correct corresponding sockets in the module.

9. Check all connections, plugs and sockets are securely fitted.

10. Reinstall the fuse previously removed.

11. Check the correct operation and functionality of the replaced module by observing system status on local diagnostic panel or ERP-9.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/LD20		
Replace a EBI Gate 200 Level Crossing System Sub-Component		
Issue No: 02	Issue Date: 04/03/17	Compliance Date: 31/05/17

Includes:	Sub -Component parts associated with the EBI Gate 200 Level Crossing system.
Excludes:	All other Types of Level Crossing and type or make of parts.

Before any work is undertaken possession of the EBI Gate 200 Level Crossing system should be taken. The signaller should be informed that the level crossing system will be non-operational.

The system should be powered down for this task by disconnection of the power supply at the unit fuse links. The unit shall not be powered up with any sub-component missing

BEFORE INSTALLATION WORK

1. Check the EBI Gate 200 unit has been isolated from the power supply and UPS isolation fuse
2. Check the replacement sub-component is of the Correct Type and is not damaged

INSTALLATION WORK

Red/Green LED Unit

3. Check existing wiring is correctly labelled.
4. Disconnect the aspect cable from the plug coupler.
5. Unbolt the aspect unit from the mounting frame.
6. Remove the aspect unit and store safely for return.
7. Fit the new aspect unit and fasten all fixing bolts.
8. Reconnect the aspect cable to the plug coupler.
9. Check the LED unit lights when required
10. If this is the only replacement being made move to the “AFTER INSTALLATION WORK” section.

Speaker

11. Check existing wiring is correctly labelled.
12. Disconnect the speaker cable from the speaker.
13. Unbolt the speaker from the unit.
14. Remove the speaker and dispose as directed.

15. Fit new the new speaker and fasten all fixing bolts.

16. Reconnect the speaker cable to the speaker.

17. Check speaker is operating correctly (Note each post has a speaker both front and back).

18. If this is the only replacement being made move to the “AFTER INSTALLATION WORK” section.

Speaker Cable

19. Check existing wiring is correctly labelled.

20. Disconnect the speaker cable from the speaker and audio module.

21. Cut cable ties that secure the cable to the unit.

22. Remove the speaker cable.

23. Fit new the new speaker cable.

24. Secure the cable to the unit with new cable ties.

25. Reconnect the speaker cable to the speaker and audio module.

26. Check speaker connected to the cable is operating correctly (Note each post has a speaker both front and back).

27. If this is the only replacement being made move to the “AFTER INSTALLATION WORK” section.

Microphone Assembly

28. Check existing wiring is correctly labelled.

29. Disconnect the microphone cable from the audio module.

30. Cut cable ties that secure the cable to the unit.

31. Unbolt the microphone assembly from the unit.

32. Remove the microphone assembly.

33. Fit new the new microphone assembly and fasten all fixing bolts.

34. Secure the cable to the unit with new cable ties.

35. Reconnect the microphone cable to the audio module.

36. If this is the only replacement being made move to the “AFTER INSTALLATION WORK” section.

Audio Module Unit

37. Check existing wiring is correctly labelled.

38. Disconnect all cables from the audio module unit.

39. Note the position of the adjuster on the audio module.

40. Remove the audio module unit.

41. Fit the new audio module unit, fasten all fixing bolts.

42. Reconnect the cables to the audio module unit.

43. Set the audio adjustment position the same position as the faulty unit.

44. Test the audio output levels and adjust as required.

45. If this is the only replacement being made move to the “AFTER INSTALLATION WORK” section.

Audio Module Power Cable

46. Check existing wiring is correctly labelled.

47. Disconnect the cable from the audio module and the backplane.

48. Remove the audio module power cable.

49. Fit the new audio power cable.

50. Reconnect the cable to the audio module and the backplane

51. Check the audio module works when required

52. If this is the only replacement being made move to the “AFTER INSTALLATION WORK” section.

Push Button Assembly

53. Check existing wiring is correctly labelled.

54. Disconnect the push button assembly cable from the backplane.

55. Remove the outer blue bezel using the special button extractor tool and unscrew the push button from the front.

56. Fit the new switch to the unit then fit the push button blue bezel.

57. Reconnect the push button assembly cable to the backplane.

58. Operate the push button to check it operates.

59. If this is the only replacement being made move to the “AFTER INSTALLATION WORK” section.

Power Supply Unit

60. Check existing wiring is correctly labelled.

61. Disconnect the wires from the Power Supply Unit.

62. Remove the Power Supply Unit from the backplane.

63. Fit the new Power Supply Unit to the backplane.

64. Reconnect the wires to the Power Supply Unit.

65. Check the equipment fed from the PSU operates correctly

66. If this is the only replacement being made move to the “AFTER INSTALLATION WORK” section.

UPS Controller

67. Check existing wiring is correctly labelled.

68. Disconnect the wires from the UPS Controller.

69. Remove the UPS Controller from the backplane.

70. Fit the new UPS Controller to the backplane.

71. Reconnect the wires to the UPS Controller.

72. Check the UPS is working by pulling the main fuse and leaving it on test for 15 minutes before reinstating the fuse.

73. If this is the only replacement being made move to the “AFTER INSTALLATION WORK” section.

UPS Battery

74. Check existing wiring is correctly labelled.

75. Disconnect the wires from the UPS Battery.

76. Remove the UPS Battery from the mounting plate.

77. Fit the new UPS Battery to the mounting plate.

78. Reconnect the wires to the UPS Battery.

79. Allow the UPS battery to charge for 30 mins before testing it is working by pulling the main fuse and checking the system holds up before reinstating the fuse.

    Full charging can take up to 24hrs, if the battery is discharged.

80. If this is the only replacement being made move to the “AFTER INSTALLATION WORK” section.

AutoDial Unit

81. Check existing wiring is correctly labelled

82. Disconnect the antennae GSM cable from the AutoDial unit

83. Remove SIM Card

84. Remove DIN rail end stop fitted on the left hand side

85. Slide AutoDial unit to the left to unplug

86. Remove AutoDial unit from DIN Rail

87. Fit new AutoDial unit on DIN rail

88. Slide against Siemens CPU to ensure connection

89. Refit Din rail end stop

90. Reconnect antennae wires to AutoDial unit

91. Reinsert SIM card

92. Check “Error Messages” are being received from the affected unit

93. If this is the only replacement being made move to the “AFTER INSTALLATION WORK” section.

Antennae

94. Check existing wiring is correctly labelled

95. Disconnect the antennae GSM cable from the AutoDial unit

96. Remove fixing bolt of antennae to post to remove antennae

97. Remove antennae gasket

98. Fit new antennae and gasket

99. Check “Error Messages” are being received from the affected unit

100. Connect GSM antennae cable to AutoDial unit

AFTER INSTALLATION WORK

101. Check the replacement item is Correctly Installed and secure.

102. Restore power to the EBI Gate 200 unit and reset the axle counter sections to zero NR/SMS/TEST/082 Section 2 and then reset the Axle Counter Board (ACB) displays by turning the selector switch to the Reset position.

103. Inform the signaller when the level crossing system is successfully restored to normal operation. If possible, observe a train through the section(s).

End

Includes:	All sub-component parts associated with the GateCare - NR2 - Power Operated Gate Opener (POGO)
Excludes:	All other Types of Enhanced User Worked Crossing

GENERAL

Before any work is undertaken possession of the NR2 Power Operated Gate Opener (POGO) shall be taken. Inform the Signaller that the level crossing system is non-operational.

Gate Replacement

BEFORE INSTALLATION WORK

1. Check the replacement gate is of the correct type and is not damaged

DURING WORK

2. Check the length of the gate.

3. Check all gates, posts and attachments, particularly for signs of damage or defects.

4. Check post cannot be rotated and that the hinge mountings are undamaged.

5. Check actuator mounting bracket and actuator for damage.

6. Locate and remove the green twelve-way terminal plug from the NR2 Control Board (Figure 1). The removal of this plug disables the red/green buttons, solenoids and N/C contact from a green aspect.

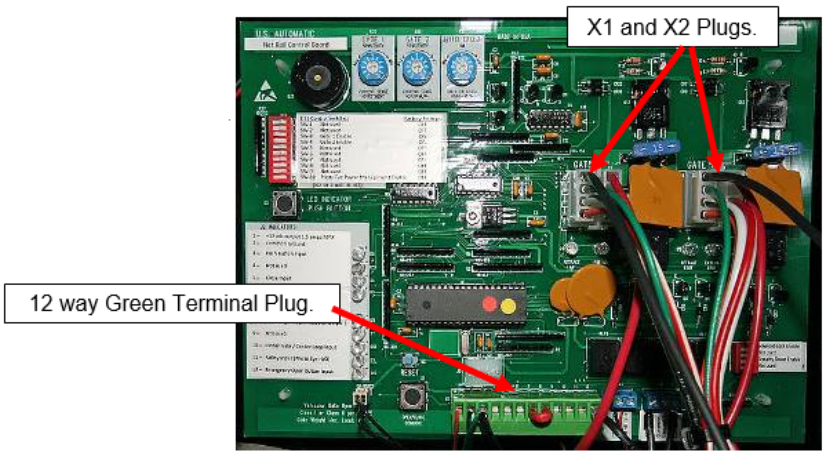


Figure 1 – NR2 Control Board

7. Unplug and move clear the X1 and X2 plugs (Figure 1). This disables the actuators.

8. Unpin the actuator and swing it fully open, securing it so that it does not interfere with the gate replacement.

9. Remove all signage from the damage gate.

10. Disconnect the solenoid. Access is gained by removing two small hex type grub screws and pulling off the end cap (Figure 2).

11. Remove the solenoid and its mounting bracket.

12. Pull solenoid cable back through the gate.

13. Remove and replace the gate.

14. Check the gates are horizontal using a spirit level and adjust as required.

15. Check that the rod eye hinge retaining pin and adjustment/securing nuts are in place and that the lock nuts are tight (Figure 3).

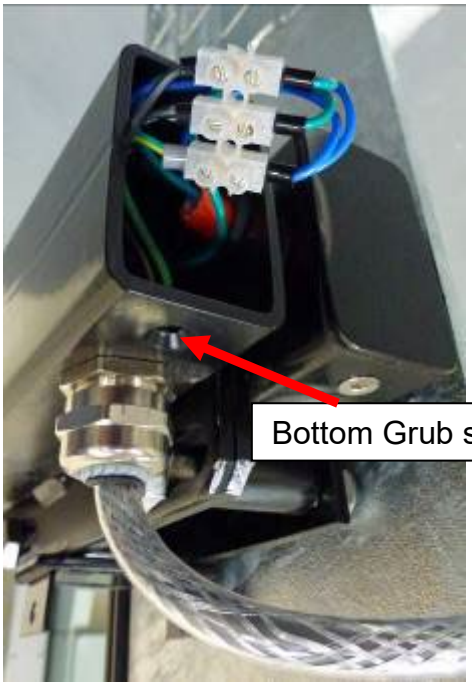


Figure 2 - Solenoid

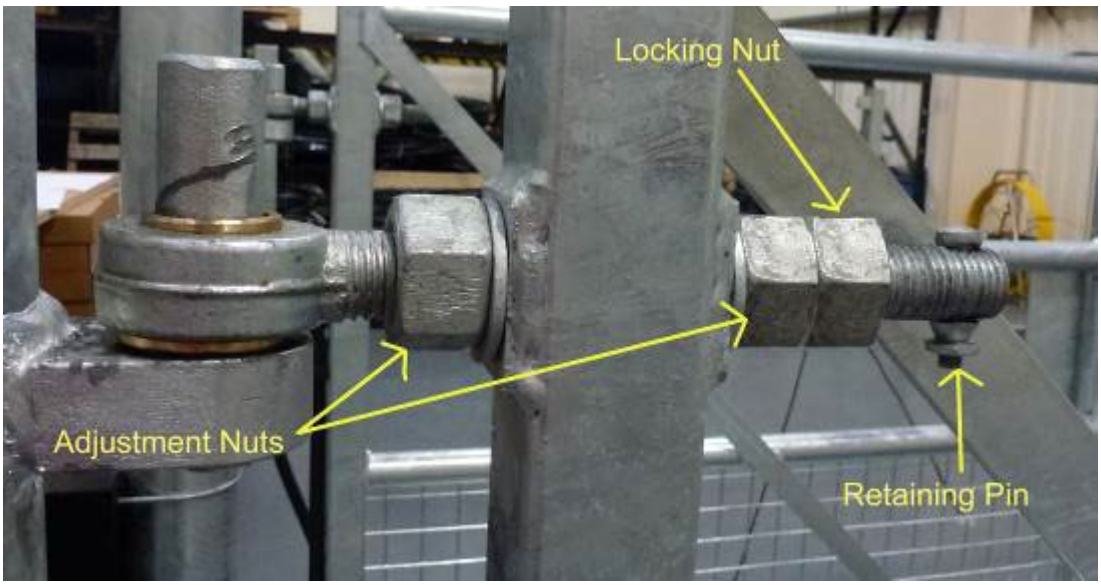


Figure 3 – Hinge Fittings

16. Clean and examine hinges and pivots, then lightly lubricate.

17. Re-thread cable and refit solenoid.

18. Reconnect the actuator.

19. Refit all signage to the new gate.

AFTER INSTALLATION WORK

20. Reconnect the X1, X2 and green 12-way termination plug.

21. Press the reset button.

22. Operate the gates on power in both directions to check correct operation.

23. Check that both the retract and extend limit switches are operating correctly by observing the LED indications as explained in NR/SMS/PartB/Test/084 (Power Operated Gate Opener Adjustment/Test).

Solenoid Replacement

BEFORE INSTALLATION WORK

24. Check the replacement Solenoid is of the correct type and is not damaged.

DURING WORK

25. Locate and remove the green twelve-way terminal plug from the NR2 Control Board (Figure 1). The removal of this plug disables the red/green buttons, solenoids and N/C contact from a green aspect.

26. Disconnect the solenoid; access is gained by removing two small hex type grub screws and pulling off the end cap (Figure 2).

27. Remove the solenoid from its mounting bracket.

28. Refit and reconnect the new solenoid.

AFTER INSTALLATION WORK

29. Reconnect the green 12-way termination plug.

30. Press the reset button.

31. Operate the gates on power in both directions to check correct operation.

32. Check the Solenoid is aligned correctly and that it does not bind with the latch pins and sits centrally between the latch pin jaws in both open and closed positions.

Actuator Replacement

DURING WORK

33. Locate and remove the green twelve-way terminal plug from the NR2 Control Board (Figure 1). The removal of this plug disables the red/green buttons, solenoids and N/C contact from a green aspect.

34. Unplug and move clear the X1 and X2 plugs (Figure 1). This disables the actuators.

35. Disconnect the actuator at the disconnection box.

36. If the actuator that is to be replaced is in the fully extended or fully retracted position disengage the latch pin at the gate end first. This allows you to measure the distance from the actuator shoulder to the end of the ram (Figure 4). This measurement allows the replacement actuator to be coarsely adjusted, to length, saving time during the adjustment phase.

Figure 4 – Actuator Measurement

37. If you have a measurement taken in Step 36 you can now turn the ram section of the new actuator until the desired length is achieved.

38. Remove, replace and reconnect the actuator.

AFTER INSTALLATION WORK

39. Reconnect the X1, X2 and green 12-way termination plug.

40. Press the reset button.

41. Operate the gates on power in both directions to check correct operation.

42. Carry out a full adjustment and test as described in NR/SMS/PartB/Test/084 (Power Operated Gate Opener Adjustment/Test).

NR2 Control Board Replacement

BEFORE INSTALLATION WORK

43. Check the replacement Control Board is of the correct type and is not damaged.

DURING WORK

44. Disconnect and mark all plugs and wires connected to the Control Board.

45. Note the settings on the three potentiometers at the top of the old Control Board and transfer these positions to the new Control Board.

46. Remove and replace the Control Board reconnecting all of the plugs and wires.

AFTER INSTALLATION WORK

47. Press the reset button.

48. Operate the gates on power in both directions to check correct operation.

49. Carry out a full adjustment and test as described in NR/SMS/PartB/Test/084 (Power Operated Gate Opener Adjustment/Test).

Solar Panel Replacement

BEFORE INSTALLATION WORK

50. Check the replacement Solar Panel is of the correct type and is not damaged.

DURING WORK

51. Slip the Solar Panel cable links in the Control Box disconnection box.

52. Disconnect the Solar Panel cable one core at a time and insulation the exposed conductor.

53. Before installing the new Solar Panel check that the two core conductors are insulated.

54. Collapse the Solar Panel post in the approved manner

55. Remove and replace the Solar Panel.

AFTER INSTALLATION WORK

56. Reconnect the Solar panel at the disconnection box but do not replace the links.

57. Using a DC voltmeter, measure the DC voltage and confirm that it is between 17 and 22vDC volts on a sunny day (See Figure 5 and Table 1).

Figure 5 – Solar Panel Voltage Measurement

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

Table 1 – Solar Panel Voltage Measurements

58. Replace the links.

59. Press the reset button.

60. Operate the gates on power in both directions to check correct operation.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD23		
Replace A Shunt (HXP-3)		
Issue No. 1	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Replace a Shunt in the approach section of Level crossing using HXP-3 Predictor.
Excludes:	Replacement of components in the Island of the level crossing

Replacement of a single rail, removal of bonded out joints or minor sleeper replacement can be made without a track setup being undertaken provided the track voltage setup parameters as displayed on the level crossing predictor are unchanged from those on the record card.

If the values are not the same carry out the LIA adjustments NR/SMS/Test/151

To accurately predict a trains arrival time at the crossing, the HXP requires a linear change in the RX.

When connecting the hardwire shunt on an approach terminated with a NBS (Narrow Band Shunt) the RX will normally decrease to a value between “85" and “100", depending on the frequency and length of the approach.

When connecting the hardwire shunt on an approach terminated with a Wideband or Hardwire shunt, the RX should not change.

If a change is noted, check all connections and if the connections are good, replace the component.

BEFORE INSTALLATION WORK

1. Check that the replacement unit is of the Correct Type and is Not Damaged.
2. Wire Count existing unit to the wiring diagram.
3. Check existing wiring is Correctly Labelled.
4. Check and note Value of Loop Impedance (RX).
5. Check and note Value of Ballast Condition. (Phase Angle)
6. Check diagram to confirm replacement of Shunt is in the approach to the level crossing.
7. If rail is to be renewed mark positions of shunts to diagram.

AFTER INSTALLATION WORK

8. If rails have been renewed check length of approach and position of replaced shunts to diagram.

9. Check wiring is replaced as labelled.

10. Check terminations are secure and suitably protected.

11. Place the STANDBY/AUTO/NORMAL switch on the Transfer Logic Module (TLM) in the NORMAL position.

12. Place the CW/MD switch on the Relay Driver Module (RYD) in the MD position.

13. Check RX is 100 or are within the tolerance values specified in the NR/SMS/PART C.

14. Place a hard wire shunt 10% in from the termination shunt (10% of the approach length inside the termination shunt i.e. at the marker positioned at 90% of the approach from the crossing).

    A signal change (RX) of approximately 10% should be seen. If not, check all couplers and track connections.

15. Observe that a full crossing sequence occurs. (check the control tables for Stopping and non- stopping).

16. Remove the hard wire shunt.

17. Place the hardwire test shunt in the approach at the measured 50 percent point (measured from the nearest track wire connections).

    The RX value at the 50 percent point should be half the value at step 4.

18. Remove the hard wire shunt.

19. Place the STANDBY/AUTO/NORMAL switch on the Transfer Logic Module (TLM) to the AUTO position.

20. Note the values of Loop Impedance, Phase Angle and Ballast Condition check to see that these are comparable to the values noted on mtce card, giving due consideration to any environmental changes which have occurred since the reading was first taken.

21. Test all affected track circuits [Voltage, current, drop shunt, pick-up shunt (**NR/SMS/Test/250 to 261**)] and Record the test measurements on the appropriate NR/SMS record card, together with the reason for the test.

22. Verify system operation by observing a minimum of one train normal move on the affected approach.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD30		
Replace a Coe 300 CCTV Module		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Any Coe module or 12V power supply feeding a Coe module. Also any repair to the fibre cable in the system.

BEFORE INSTALLATION WORK

1. Check replacement module is not damaged and is correct type.

AFTER INSTALLATION WORK

2. Check replacement item is correctly installed.

3. Carry out the tasks in NR/SMS/TEST 047 following an alteration to the system.

4. Where there are two or more level crossings supervised by CCTV: Check that the picture of the correct level crossing appears on the correct monitor in the Signal box.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD32		
Replace a Newgate Barrier - Transformer		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	NGR18000 Newgate Barrier Machine 110vac / 240vac Transformer
Excludes:	All other types of transformer

Before any work is undertaken possession of the Level Crossing shall be taken.

This equipment is rate at above 175 volts and reference shall be made to NR SIGELP 50002 – Safe Working Practises when Working on or near Signalling Power Distribution Equipment above 175 Volts

The unit shall not be powered up with any sub-component missing

Equipment Identification Image

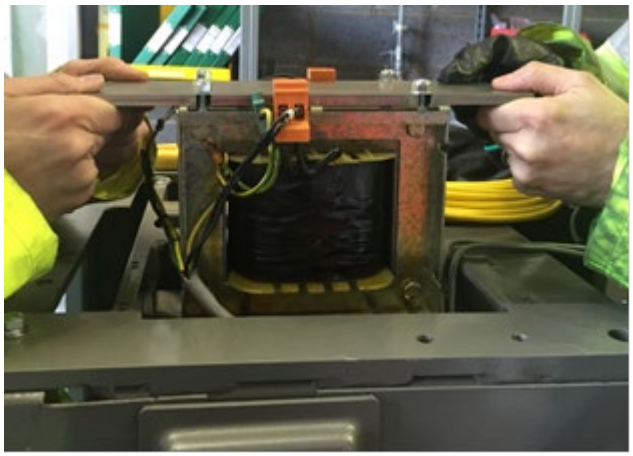


Figure 1 - 110vac / 240vac Transformer

BEFORE INSTALLATION WORK

1. Check replacement 110vac / 240vac Transformer is not damaged and is the correct Type.

2. Verify the barrier is in raised position and locked off using barrier machine locking pin.

3. Isolate the barrier machine at the LXP fuse links, verify this by using a meter on the input terminals.

4. WIRE COUNT the Transformer and check the wires have safe insulation and are correctly labelled.

5. Remove the Transformer and label it as faulty.

AFTER INSTALLATION WORK

6. Check the Transformer is securely mounted.

7. WIRE COUNT the Transformer.

8. Remove barrier machine locking pin.

9. Reconnect the power supply to the machine.

10. Check barriers operate correctly by lowering and raising them.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD33		
Replace a Newgate Barrier - Door Access Safety Switch		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	NGR18000 Newgate Barrier Machine, Operators and Technicians doors
Excludes:	All other types of Door Safety Switch

Before any work is undertaken possession of the Level Crossing shall be taken.

The unit shall not be powered up with any sub-component missing

Equipment Identification Image

Table 1 - Door Safety Switch

BEFORE INSTALLATION WORK

1. Check replacement Safety Switch is not Damaged and is the Correct Type.
2. Verify the Barrier is in raised position and locked off using barrier machine locking pin.
3. Isolate the barrier machine at the LXP fuse links, verify this by using a meter on the input terminals.
4. Isolate the Safety Switch by disconnecting the 24V Supply.
5. WIRE COUNT the Safety Switch and check the wires have safe insulation and are correctly labelled.
6. Remove the Safety Switch and label it as faulty.

AFTER INSTALLATION WORK

7. Check the Safety Switch is securely mounted.
8. WIRE COUNT the Safety Switch.
9. Verify door(s) closes and locks correctly.
10. Reconnect the Safety Switch Supply

11. Reconnect the power supply to the barrier machine.

12. Remove barrier machine locking pin.

13. Observe the lower & raise sequence.

14. Open the door and verify the barrier fails not operate.

15. Recheck the lower & raise sequence.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD34		
Replace a Newgate Barrier - BLSS Limit Switch		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	NGR18000 Newgate Barrier Machine BLSS Limit Switches
Excludes:	All other types of Limit Switch

Before any work is undertaken possession of the Level Crossing shall be taken.

The unit shall not be powered up with any sub-component missing

Equipment Identification Image

Figure 1 - BLSS Limit Switches

BEFORE INSTALLATION WORK

1. Check replacement Limit Switch is not damaged and is the correct Type.
2. Verify the barrier is in raised position and locked off using barrier machine locking pin.
3. Isolate the barrier machine at the LXP fuse links, verify this by using a meter on the input terminals.
4. Isolate the Limit Switch by disconnecting the 24V supply.
5. WIRE COUNT the Limit Switch and check the wires have safe insulation and are correctly labelled.
6. Remove the Limit Switch and label it as faulty.

DURING THE WORK

7. Unlock and lower the barrier by hand to allow the Limit Switch mounting plate to be correctly positioned.

AFTER INSTALLATION WORK

8. Check the Limit Switches is securely mounted to the mounting plate.
    - Fixings shall be torqued to 6.8 Nm.
9. WIRE COUNT the Limit Switch.
10. Check the clearance between the limit switch and its cam by inserting a 1.5mm detection gauge, as shown in Figure 2.
11. Reconnect the Limit Switch supply.
12. 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 3.

Figure 2 - 1.5 mm gauge (Inserted)

Figure 3 - 2 mm gauge (Unable to insert)

13. Release the Barrier locking pin and hand pump the barrier to the up position.
14. Reconnect the power supply to the barrier machine.
15. Observe the lower & raise sequence.
16. Check barrier down input is received by VIO module.
17. If possible, observe the passage of a train in both directions.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD35		
Replace a Newgate Barrier - Control Module		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	NGR18000 Newgate Barrier Machine Control Module
Excludes:	All other types of Barrier Machine Control Module

Before any work is undertaken possession of the Level Crossing shall be taken.

The unit shall not be powered up with any sub-component missing

Equipment Identification Image

Figure 1 - Control Module

BEFORE INSTALLATION WORK

1. Check replacement control Module is not damaged and the software version, is the same or later, IP address as recorded on Label.

2. Verify the barrier is in raised position and locked off using barrier machine locking pin.

3. Isolate the barrier machine at the LXP fuse links, verify this by using a meter on the input terminals.

4. WIRE COUNT the Control Module and check the wires have safe insulation and are correctly labelled.

5. Remove the Control Module and label it as faulty.

AFTER INSTALLATION WORK

6. Check the Control Module is securely mounted.

7. WIRE COUNT the Control Module and confirm all the plugs are pushed home.

8. Reconnect the power supply to the barrier machine

9. Remove barrier machine locking pin.

10. Observe the lower & raise sequence.

11. Verify Operation of the barrier machine by lowering and raising the barriers.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD36		
Replace a Newgate Barrier - Proximity Switch Assembly		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	NGR18000 Newgate Barrier Proximity Switch Assemble
Excludes:	Newgate Individual Proximity Switches and All other types of Proximity Switches

Before any work is undertaken possession of the Level Crossing shall be taken.

The unit shall not be powered up with any sub-component missing.

Individual Proximity Switches shall not be changed

Equipment Identification Image

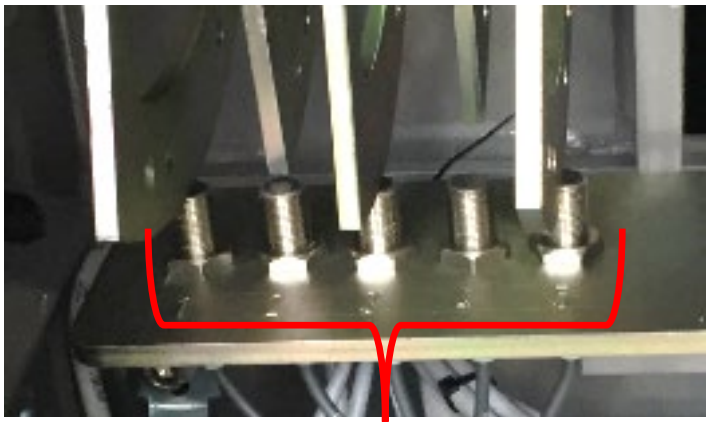


Figure 1 - Proximity Switches

BEFORE INSTALLATION WORK

1. Check replacement Proximity Switch Assembly is not damaged.
2. Isolate the barrier machine at the LXP fuse links, verify this by using a meter on the input terminals.
3. Verify the barrier is in a locked position using barrier machine locking pin.
4. WIRE COUNT the Proximity Switch Assembly and check the wires have safe insulation and are correctly labelled.
5. Remove the Proximity Switch Assembly, mark the failed switch and label the whole assembly as faulty.

AFTER INSTALLATION WORK

6. Check the Proximity Switch is secure.

7. WIRE COUNT the Proximity Switch and check the wires have safe insulation and are correctly labelled.

8. Remove barrier machine locking pin and position the barrier as required for testing.

9. With the barrier in both the raised and lowered positions, check the clearance between each of the proximity switches and its cam by inserting a 1.5mm detection gauge. Remove the 1.5mm gauge and offer up a 2mm detection gauge and check that this gauge cannot not be inserted.

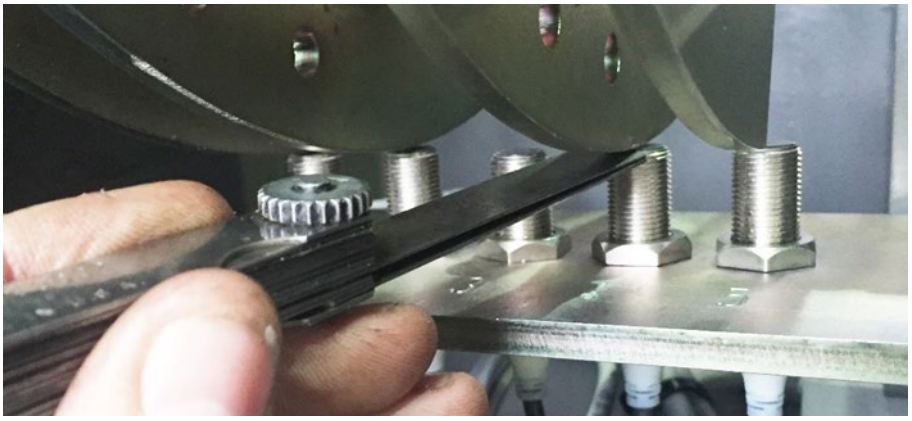


Figure 2 - Position of gauges with the 1.5 mm gauge (Inserted)

10. Hand pump the barrier to the raised position.

11. Check thread lock has been applied.

12. Reconnect machine to power supply

13. Check barriers operate correctly.

14. Apply anti-tamper paint.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD37		
Replace a Newgate Barrier - Hand Pump		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	NGR18000 Newgate Barrier Machine Hand Pump Assembly
Excludes:	All other types of Hand Pump Assembly

Before any work is undertaken possession of the Level Crossing shall be taken.

The unit shall not be powered up with any sub-component missing.

Equipment Identification Image

Figure 1 - Hand Pump

BEFORE INSTALLATION WORK

1. Check replacement Hand Pump Assembly is not damaged.
2. Check an environmental spillage kit and waste oil container are both available.
3. Verify the barrier is in raised position and locked off using barrier machine locking pin.
4. Isolate the barrier machine at the LXP fuse links.
5. Remove the Hand Pump Assembly and label as faulty.

AFTER INSTALLATION WORK

6. Visually check for signs of oil seepage.

7. Remove barrier machine locking pin.

8. Release plunger on manual hand pump.

9. Release motor brake leaver and secure in manual position.

10. Toggle pump direction leaver to the right to lower the boom.

11. Manually pump to lower barrier. (During pumping observe oil level does not drop below minimum level, top up to minimum as required).

12. Check hand pump for ease of operation.

13. Toggle pump direction leaver to the left to raise the boom.

14. Manually pump to raise barrier.

15. Manually raise and lower the barrier a minimum of three times. Leaving the barrier in the raised position.

16. Recheck oil level again.

17. Recheck for leaks from cylinder pipes and couplings.

18. Reconnect machine to power supply.

19. Raise and lower the barrier a minimum of three times on power. Leaving the barrier in the raised position.

20. Check for leaks from cylinder pipes and couplings.

21. Check oil level is correct.

22. If possible, observe a train over the crossing both directions.

23. Dispose of any contaminated items as per NR Environmental Policy

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD38		
Replace a Newgate Barrier - Hydraulic Hose or Damper Cylinder		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	NGR18000 Newgate Barrier Hydraulic Hoses and Damper Cylinders
Excludes:	All other types of Hydraulic Hoses and Damper Cylinders

Before any work is undertaken possession of the Level Crossing shall be taken.

The unit shall not be powered up with any sub-component missing.

For details of the removal process see NRSMS Appendix 24 section 7.

Equipment Identification Image

Figure 1 - Hydraulic Hose

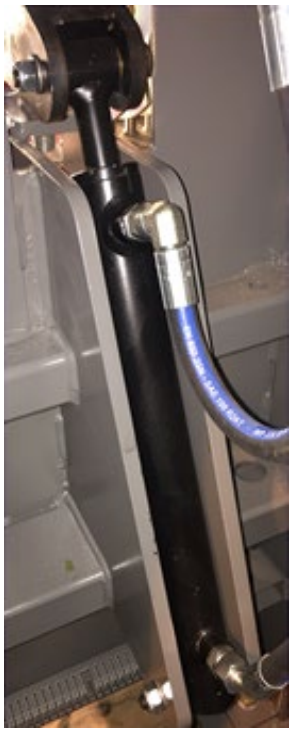


Figure 2 - Damper Cylinder

BEFORE INSTALLATION WORK

1. Check replacement Hydraulic Hose or Damper Cylinder is not damaged.
2. Check an environmental spillage kit and waste oil container are both available.
3. Verify the barrier is in raised position and locked off using barrier machine locking pin.
4. Isolate the barrier machine at the LXP fuse links.

5. Remove the Hydraulic Hose or Damper Cylinder and label as faulty.

AFTER INSTALLATION WORK

6. Visually check for signs of oil seepage.

7. Manually pump to raise barrier.

8. Manually raise and lower the barrier a minimum of three times. Leaving the barrier in the raised position.

9. Recheck oil level again.

10. Check for leaks from cylinder pipes and couplings.

11. Reconnect machine to power supply.

12. Raise and lower the barrier a minimum of three times on power. Leaving the barrier in the raised position.

13. Check for leaks from cylinder pipes and couplings.

14. Check oil level is correct.

15. If possible, observe a train over the crossing both directions.

16. Dispose of any contaminated items as per NR Environmental policy.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD39		
Replace a Newgate Barrier – Brake Release Safety Switch		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	NGR18000 Newgate Barrier - Interlocking Brake Release Safety switch
Excludes:	All other types of Brake Release

Before any work is undertaken possession of the Level Crossing shall be taken.

The unit shall not be powered up with any sub-component missing.

Equipment Identification Image

Figure 1 - Interlocking Safety Switch Brake Release

BEFORE INSTALLATION WORK

1. Check replacement Safety Switch is not damaged and is the correct Type.
2. Release the manual brake.
3. Verify the barrier is in the raised position and locked off using the barrier machine locking pin.
4. Isolate the barrier machine at the LXP fuse links, verify this by using a meter on the input terminals.
5. WIRE COUNT the Safety Switch and check the wires have safe insulation and are correctly labelled.
6. Remove the Safety Switch and label it as faulty.

AFTER INSTALLATION WORK

7. Check the Safety Switch is securely mounted.

- Fixings shall be torqued to 1.5 Nm.

8. WIRE COUNT the Safety Switch.

9. Reconnected the Barrier Machine supply

10. Remove the Barrier Locking Pin.

11. Check barriers don't operate with motor brake lever disengaged.

12. Engage motor brake lever.

13. Check barriers operate correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD40		
Replace a Newgate Barrier – Locking Pin Safety Switch		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	NGR18000 Newgate Barrier Machine – Locking Pin Safety Switch
Excludes:	All other types of Safety Switch

Before any work is undertaken possession of the Level Crossing shall be taken.

The unit shall not be powered up with any sub-component missing

Equipment Identification Image

Figure 1 - Locking Pin Safety Switch

BEFORE INSTALLATION WORK

1. Check replacement Safety Switch is not damaged and is the correct Type.
2. Remove the Safety Switch.
3. Isolate the barrier machine at the LXP fuse links, verify this by using a volt meter on the input terminals.
4. Remove the Safety Switch and label it as faulty.

AFTER INSTALLATION WORK

5. Check the Safety Switch is securely mounted.
6. Check barriers don't operate with Safety Switch disengaged.
7. Engage the Safety Switch.
8. Check barriers operate correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD41		
Replace a Newgate Barrier – Barrier Cage		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	NGR18001 Newgate Barrier Cage
Excludes:	All other types of barrier machine cage

Before any work is undertaken possession of the Level Crossing shall be taken.

For information relation to the removal and refitting of both the front and side cages refer to NR/SMS/Appendix/24 - General Information for the Newgate Barrier System

BEFORE INSTALLATION WORK

1. Check replacement Cage is complete, not Damaged and is the Correct Type.
2. Verify the barrier is in raised position and locked off using barrier machine locking pin.
3. Isolate the barrier machine at the LXP fuse links.
4. Check Guard Assembly has not damaged barrier machine.

AFTER INSTALLATION WORK

5. Check all fixings are secure.
6. Check guard position and clearances.

   For detail of the clearances refer to NR/SMS/PartC/LC32 - Barrier Machine: Newgate, section 4.2

7. Reconnect machine to power supply.
8. Remove barrier machine locking pin.
9. Check barriers operate correctly.
10. If possible, observe a train over the crossing both directions.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD42		
Replace a Newgate Barrier Machine - Heater and Thermostat		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	NGR18000 Newgate Barrier Machine, Heater and Thermostat units.
Excludes:	All other types of Heater and Thermostat

Before any work is undertaken possession of the Level Crossing shall be taken.

The barrier machine shall not be powered up with any sub-component missing.

If either a Heater or Thermostat unit fail, then both units shall be replaced at the same time.

Equipment Identification Image

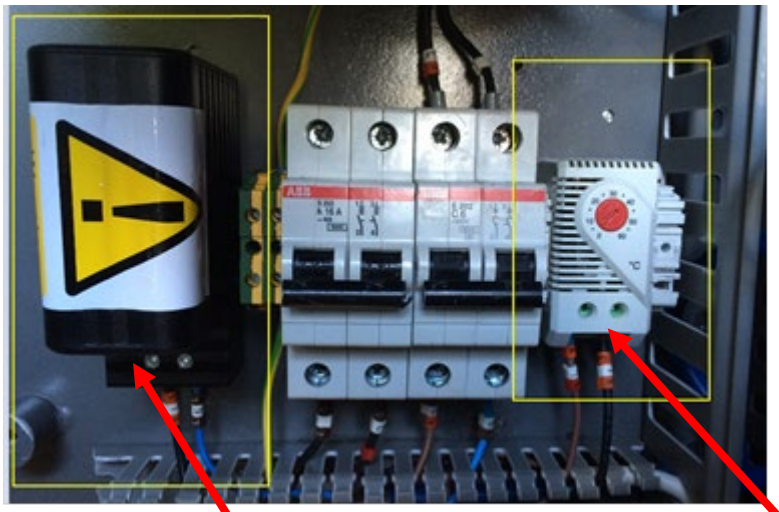


Figure 1 - Heater

Figure 2 - Thermostat unit

BEFORE INSTALLATION WORK

1. Check replacement Heater and Thermostat units are not damaged and are the correct type.

2. Verify the barrier is in raised position and locked off using barrier machine locking pin.

3. Isolate the barrier machine at the LXP fuse links, verify this by using a meter on the input terminals of both the Heater and Thermostat unit.

4. Allow time for the Heater to cool before handling.

5. WIRE COUNT the Heater and Thermostat units and check the wires have safe insulation and are correctly labelled.

6. Remove the Heater and Thermostat units and label both as faulty.

AFTER RE-INSTALLATION WORK

7. Check the Heater and Thermostat units are securely mounted.

8. WIRE COUNT the Heater and Thermostat units.

9. Reconnect the power supply to the barrier machine.

10. Remove barrier machine locking pin.

11. Adjust the Thermostat unit to zero and verify the heater unit starts to warm.

12. Re-adjust the Thermostat unit to its working temperature of 25 degrees.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD50		
Replace a Digital Barriers X-Net Unit		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Digital Barriers X-Net Encoder & Decoder Switch
Excludes:	All other types of Encoder - Decoder Switch / Unit

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Images

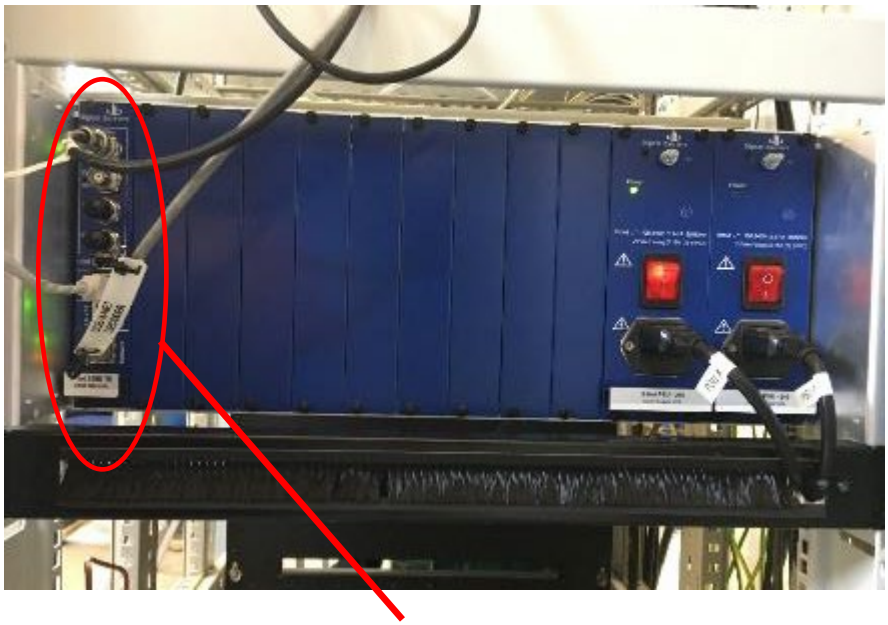


Figure 1 - X-Net Decoder Switch in situ

Figure 2 - X-Net Encoder Switch

BEFORE INSTALLATION WORK

1. Check that the replacement Unit is of the Correct Type and is Not Damaged.
2. Check the replacement is the correct version (modification level).
3. Verify the location of the faulty Unit.
4. WIRE COUNT the Unit and check all the wires have safe insulation and are correctly labelled.
5. Remove the wires from the Unit and insulate them.
6. Remove the unit and label it as faulty.

AFTER INSTALLATION WORK

7. Check that the replaced Unit is securely mounted.

8. WIRE COUNT the Unit and check all cables are correctly installed and secure.

9. For Decoder and Encoder, carry out configuration as shown in ASM Configuration Documentation.

10. Observe or ask the Signaller to observe the CCTV Monitor is displaying the correct picture.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD51		
Replace an X-Net PSU 240V Power Supply Unit		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	Digital Barriers X-Net PSU 240V Power Supply Unit
Excludes:	All other types of Power Supply Unit

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 - X-Net PSU 240V

BEFORE INSTALLATION WORK

1. Check that the replacement PSU is of the Correct Type and Version (modification level).
2. Check the replacement is Not Damaged.
3. Verify the location of the faulty PSU.
4. Place the power switch to the OFF position.
5. Check all cables are correctly labelled.
6. Remove the input 240V cable.
7. Remove PSU and label as faulty.

AFTER INSTALLATION WORK

8. Check the replaced PSU is securely mounted.

9. Reconnect the input 240V cable.

10. Place the power switch to the ON position.

11. Verify the Power LED is illuminated Green.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD52		
Replace an X-Net Encoder PSU		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	X-Net Encoder PSU 110-240Vac/12Vdc 1.25A
Excludes:	All other types of PSU

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

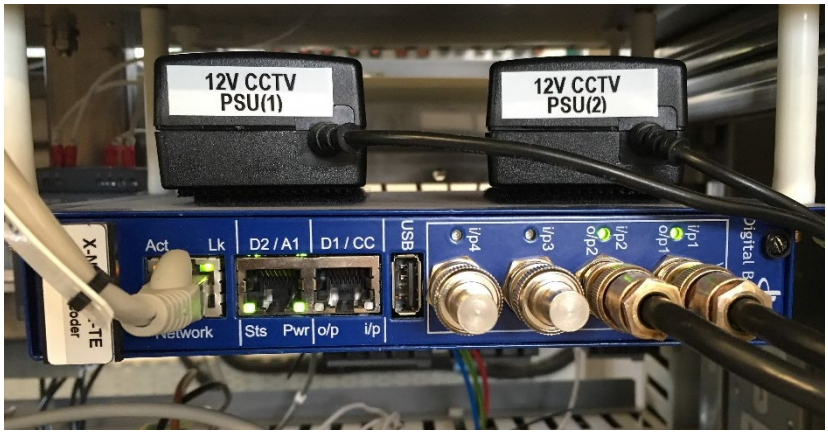


Figure 1 - X-Net Encoder PSU

BEFORE INSTALLATION WORK

1. Check that the replacement PSU is of the Correct Type and version (modification level).
2. Check the replacement is not damaged.
3. Verify the location of the faulty PSU.
4. Disconnect the PSU from the power source.
5. WIRE COUNT the unit and check for safe insulation.
6. Remove the PSU wires from the interface terminals (See Figure 2).
7. Remove the PSU and label it as faulty.

AFTER INSTALLATION WORK

8. Check that the replaced PSU is securely mounted.
9. Connect PSU wires from the interface terminals.

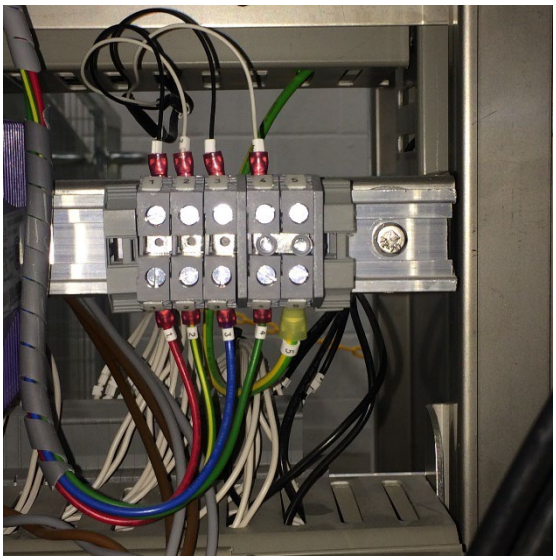


Figure 2 - X-Net Encoder PSU Interface

10. WIRE COUNT the PSU interface and check all cables are correctly installed and secure.

11. Re connect power supply and check the PSU output is within Nominally 12vdc and the correct polarity (refer to maintenance drawings).

12. Check the PSU unit is working using X-Net web interface to confirm power from the replaced unit operating.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD58		
Replace a Level Crossing Filament Light Unit		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Road signal filament light unit, Miniature Stop Light (MSL) unit
Excludes:	LCU Door lock keylock, and Gate drive equipment Road signal LED SLM light unit, Miniature Stop Light (MSL) unit

GENERAL

BEFORE INSTALLATION WORK

1. Check replacement unit is not damaged and is correct type.

2. WIRE COUNT existing unit to the wiring diagram.

3. Check existing wiring has safe insulation.

4. Check existing wiring is correctly labelled.

5. Check existing unit is isolated from the supply.

AFTER INSTALLATION WORK

6. Check replacement unit is correctly installed.

7. Check wiring is replaced as labelled.

8. WIRE COUNT replacement unit to the wiring diagrams.

9. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.

10. Check lenses are of correct type (colour) and are correctly installed in the replacement unit (any rubber seals are seated correctly).

11. Check that the hoods are correctly fitted and are secure in the replacement unit.

12. Check that the correctly rated lamps are installed.

13. Check that all the lamps (main and any auxiliary) illuminate correctly and test for correct voltages NR/SMS/PartZ/Z01 (Signal – Reference Values) - Lamp voltage.

    Record the test measurements on the NR/SMS record card, together with the reason for the test.

14. Check the alignment and height of replacement unit for public use (see HMRI guidance and crossing section order). Check that the coloured lights cannot be misread as signal aspects by train drivers.

15. Check flashing rate of lights NR/SMS/PartZ/Z04 (Level Crossing – Reference Values), (RED ROAD LIGHTS ONLY).

16. EARTH TEST supply throughout operation cycle.

17. Test that the red road lamps are proved as shown in the (NR/SMS/LX series), (RED ROAD LIGHTS ONLY).

18. If proved, check all indications back to the relevant signal box.

19. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD60		
Replace a BR843 Level Crossing Barrier Pedestal		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	BR843 Level Crossing Barrier Pedestals
Excludes:	Any other type of Level Crossing Barrier Pedestal

Different hydraulic packs are fitted to ABCL, AOCL+B, AFBCL and some MCB (check the design details) level crossings. A blue hydraulic pack shall not be fitted to any other type of level crossing.

Any other hydraulic pack other that one coloured blue shall not be fitted to an ABCL, AOCL+B or AFBCL.

See NR/SMS/PartC/LC00 (Level Crossings General) for more details on the two types.

The auto/manual valve on the hydraulic pack shall be in the Auto position for all automatic crossings except AFBCL.

For AFBCL and manually controlled crossings the valve shall be set to Manual.

BEFORE INSTALLATION WORK

1. Check replacement unit is not damaged and is correct type (Mode of Operation).
2. Check existing concrete pedestal base is capable of undergoing the proposed renewals.
3. Check all fixing bolts are secure, free from corrosion and capable of sustaining load.
4. Check existing earth clamps/conductors are in place and there is continuity to an effective earth.
5. Carry out EARTH TEST (DC) or EARTH TEST (AC).
6. Check any circuits that can be isolated to the diagrams and isolate any incoming supplies at source.
7. WIRE COUNT all terminated wiring/cables to the diagrams.
8. Check any cabling corresponds to the diagrams and the cores are correctly labelled (individually) and are unambiguous with other cables.
9. Remove any detachable units i.e. hydraulic power packs, barrier boom arm, counter balance weights (noting positioning and quantity) and store in the transit box provided.
10. Check any Damp Proof Membrane (DPM) is in place.

AFTER INSTALLATION WORK

11. Check pedestal is sitting squarely on base and is level.

12. Check pedestal is held firmly by all four fixing bolts/anchors.

13. Check Barrier Boom is correctly fitted and secure. See NR/SMTH/Part04/LD01 (Replace a Barrier Boom) and NR/SMTH/Part04/EL11 (Replace a Push Button or Switch Unit).

14. Check the earth continuity conductors are refitted, clearly labelled and effective.

15. WIRE COUNT all terminated wiring/cables to the diagrams.

16. Carry out correlation check, where more than cable core/wire has been removed at once.

17. Check the hydraulic pack is correctly installed, is the correct type for the crossing type, it is secure, and any damping devices are effective. See NR/SMTH/Part04/LD02 (Replace a Barrier Power Pack).

18. Check trunnion bolts and spiral pins have been correctly installed for the hydraulic pack to pedestal fastenings.

19. Check that the Boom CR plug units are effective for each boom.

20. Check that any counter balance weights are correctly positioned and effective.

21. Check all fuses, links and red dome nuts are correctly re-installed and supplies to the pedestal are properly reinstated.

22. Check any contacts/bands in all circuits are effective to the final function using an angle meter.

23. Check that any contacts controlled by the relative position/angle of the boom arm are set correctly with angle meter.

24. Carry out EARTH TEST (DC) or EARTH TEST (AC).

25. Check (if provided) any Earth Leakage Detectors (ELD) are reset ‘clear’ at the source location/REB.

26. Check wires and cables are secure and clear of any moving parts or gearing.

27. Check exterior doors of pedestal are secured and any ‘Tamper’ devices are effective. See NR/SMTH/Part04/EL11 (Replace A Push Button or Switch Unit).

28. Check Barrier skirt is fitted correctly and linkage to pedestal is secured. See NR/SMTH/Part04/LD01 (Replace a Barrier Boom).

29. Fully test all Barrier functions and operation NR/SMS/PartC/LC21 (Barrier Machine BR Spec 843) and NR/SMS/PartC/LC10 (Level Crossings Operational Sequences).

30. Check (if provided) protection cage is in place and secure.

31. Check and local control functions are restored to remote or auto working.

32. If practical observe passage of trains in each direction.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LD61		
Replace an LCSS Cincoze DS-1200 – Maintenance PC		
Issue No: 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Cincoze DS-1200 PC
Excludes:	All other types of Maintenance PC

Equipment Identification Image

Figure 1 - Cincoze DS-1200 PC

BEFORE INSTALLATION WORK

1. Check replacement PC is correct type and is not damaged.
2. WIRE COUNT the PC and check for safe insulation and correct labelling.
3. Power down the PC.
4. Disconnect the power supply.
5. Disconnect the cables.
6. Remove the PC and label as faulty.

AFTER INSTALLATION WORK

7. Check the PC is mounted securely.
8. Reconnect the cables and WIRE COUNT the PC.
9. Reconnect the power supply.
10. Power up the PC.
11. Connect to the Network using Maintenance Laptop - Remote Desktop.
12. Log on to LCSS and confirm the status of the components and alarms.
13. Check that the replacement PC unit is correctly labelled.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LE22		
Replace a Vamos Crossing System Sub-Component (Power Equipment)		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Sub-Component parts associated with the Vamos Level Crossing system
Excludes:	All other types of Level Crossing

General

Before any work is undertaken possession of the Vamos Level Crossing system shall be taken. Inform the Signaller that the level crossing system shall be non-operational.

The system shall be powered down for this task by disconnection of the power supply at the unit fuse links. The unit shall not be powered up with any sub-component missing.

BEFORE INSTALLATION WORK

1. Isolate the Vamos equipment from the power supply by switching off both of the circuit breakers.
2. Check the status window shows “0” when in the “Off” position.
3. For all of the items listed in the sub sections that follow check that the replacement sub-component is of the correct type and is not damaged.

Figure 1 - Circuit Breakers

After carrying out the “BEFORE INSTALLATION WORK” the Technician should identify the item to be replaced from the underlined sub sections in this document and carry out the steps associated with that item.

AFTER INSTALLATION WORK

Internal Equipment

<u>Power Supply Circuit Breakers</u>

Before carrying out this task the power supply shall be isolated at a point in the power supply circuit before it arrives at the Vamos location case. You shall prove the circuit breakers are dead before proceeding with their replacement.

4. Disconnect the incoming supply and outgoing cables.
5. Release the module from mounting rail.
6. Mount new unit and check it is securely mounted on the rail.
7. Reconnect incoming and outgoing supply cables.

Figure 2 - Circuit Breakers

Mains Supply Surge Arrestor

Due to the proximity of the incoming power supply before carrying out this task the power supply shall be isolated at a point in the power supply circuit before it arrives at the Vamos location case. You shall prove the surge arrestors are dead before proceeding with their replacement.

8. Disconnect the incoming and outgoing supply cables.
9. Release the unit from mounting rail.
10. Mount new unit and check it is securely mounted on the rail.
11. Reconnect incoming and outgoing supply cables.
12. Check the indication window is green.

Figure 3 - Surge Arrestors

PULS Power Supply Unit

13. Disconnect the incoming supply and outgoing cables.
14. Release the module from mounting rail.
15. Mount new unit and check it is securely mounted on the rail.
16. Reconnect incoming and outgoing supply cables.
17. Power up unit and check the “DC ok” LED is lit.
18. Check the red “overload” LED is not lit (if it is a short circuit is present).

Figure 4 – PULS Power Supply Unit

PULS Buffer Module

19. Disconnect the incoming supply and outgoing cables.

20. Release the module from mounting rail.

21. Mount new unit and check it is securely mounted on the rail.

22. Reconnect incoming and outgoing supply cables.

23. Power up unit and check the “Status” LED is lit. If the “Diagnosis” or “Warning” LED’s are lit these shall be investigated.

24. Check the red “overload” LED is not lit (if it is a short circuit is present).

Figure 5 – PULS Buffer Unit

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LE23		
Replace a Vamos Crossing System Sub-Component (Modular Equipment)		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Sub-Component parts associated with the Vamos Level Crossing system
Excludes:	All other types of Level Crossing

General

Before any work is undertaken possession of the Vamos Level Crossing system shall be taken. Inform the Signaller that the level crossing system shall be non-operational.

The system shall be powered down for this task by disconnection of the power supply at the unit fuse links. The unit shall not be powered up with any sub-component missing.

BEFORE INSTALLATION WORK

1. Isolate the Vamos equipment from the power supply by switching off both of the circuit breakers.
2. Check the status window shows “0” when in the “Off” position.
3. For all of the items listed in the sub sections that follow, check that the replacement sub-component is of the correct type and is not damaged.

Figure 1 - Circuit Breakers

After carrying out the “BEFORE INSTALLATION WORK” the Technician should identify the item to be replaced from the underlined sub sections in this document and carry out the steps associated with that item.

AFTER INSTALLATION WORK

<u>Telemetry Module</u>

4. Disconnect the incoming supply and outgoing cables.
5. Disconnect the antenna.
6. Release the module from mounting rail.
7. Mount new unit and check it is securely mounted on the rail.
8. Remove Sim Card and SD Card.

9. Reconnect incoming and outgoing supply cables.

10. Reconnect the antenna.

11. Replace SIM Card and SD Card.

12 Power up unit (if possible) and check the following green LED's are lit: "Power" "GSM" or "GPRS".

13. Check the green "Accu" LED is not lit (this is not in use).

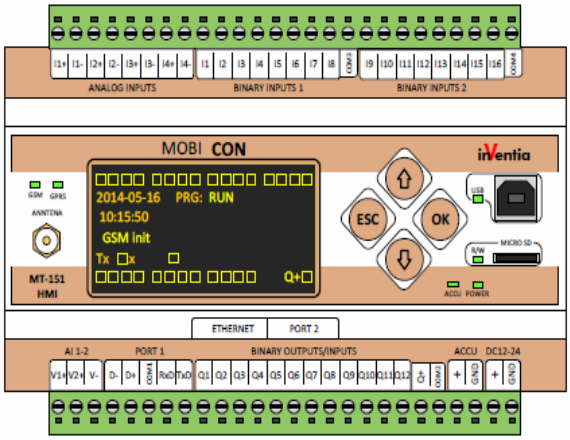


Figure 2 – Telemetry Module

14. Check the interface screen is displaying data.

15. Attach an approved Laptop loaded with the MTC Program and add the crossing details and Dogfish reporting number (if the SIM card has been replaced update Dogfish).

Safety Module

16. Disconnect the incoming supply and outgoing cables.

17. Release the module from mounting rail.

18. Mount new unit and check it is securely mounted on the rail.

19. Reconnect incoming and outgoing supply cables.

20. Power up unit and check the following LED's are lit/flashing either yellow or green:

    a) "SD"

    b) "LF"

    c) "G"

    d) "R"

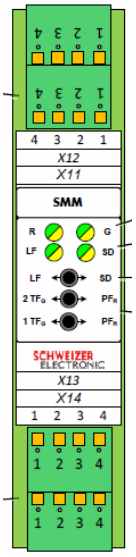


Figure 3 – Safety Module

Actuator Module

21. Disconnect the incoming supply and outgoing cables.

22. Release the module from mounting rail.

23. Mount new unit and check it is securely mounted on the rail.

24. Reconnect incoming and outgoing supply cables.

25. Power up unit and check the following LED's are lit/flashing either yellow or green:

    a) "HW"

    b) "Life"

    c) "Train Detection"

    d) "Out 1"

    e) "Out 2"

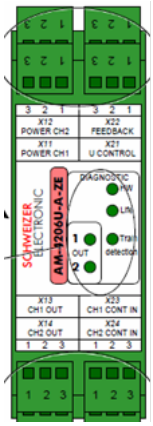


Figure 4 – Actuator Module

Acoustic Signal Generator

26. Disconnect the incoming supply and outgoing cables.

27. Release the module from mounting rail.

28. Mount new unit and check it is securely mounted on the rail.

29. Reconnect incoming and outgoing supply cables.

30. Check the volume levels for both day and night time modes are the same as set on the existing unit

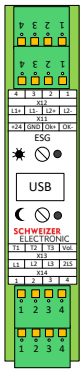


Figure 5 - Acoustic Signal Generator

Backplane (Train Detection)

31. Note the order and position of each IMC board, then remove and store them safely.

32. Disconnect the incoming supply and outgoing cables.

33. Note the position of the parameterization jumpers above each card slot. Check the parameterization jumpers on the replacement backplane match those on the backplane being replaced.

34. Remove the backplane and fit replacement.

35. Reconnect the incoming supply and outgoing cables.

36. Replace the IMC Boards.

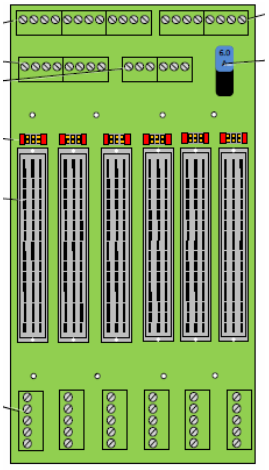


Figure 6 - Backplane

37. Power up unit and check the green power LED's are lit on each card.

38. Carry out NR/SMS/PartB/Test/157 (Frauscher: RSR 123 Wheel Sensor Adjustment - associated with IMC Boards) - Section 3 Wheel Sensor Test (Detection Capability).

Coupling Relays

These relays are not currently in use and therefore shall not be tampered with.

ICM Boards

See NR/SMTH/Part04/AX50 (Replace a Frauscher IMC Board).

BSI005 (Lightning Protection Unit)

See NR/SMTH/Part04/AX44 (Replace an Overvoltage Protection Unit BSI005).

Contracting Terminals/Terminal Blocks

See NR/SMTH/Part04/EL06 (Replace a Terminal Block).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LE24		
Replace a Vamos / Flex Crossing System Sub-Component (External Equipment)		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Sub-Component parts associated with the Vamos Level Crossing system
Excludes:	All other types of Level Crossing

General

Before any work is undertaken possession of the Vamos Level Crossing system shall be taken. Inform the Signaller that the level crossing system shall be non-operational.

The system shall be powered down for this task by disconnection of the power supply at the unit fuse links. The unit shall not be powered up with any sub-component missing.

BEFORE INSTALLATION WORK

1. Isolate the Vamos equipment from the power supply by switching off both of the circuit breakers.
2. Check the status window shows “0” when in the “Off” position.
3. For all of the items listed in the sub sections that follow check that the replacement sub-component is of the correct type and is not damaged.

Figure 1 - Circuit Breakers

After carrying out the “BEFORE INSTALLATION WORK” the Technician should identify the item to be replaced from the underlined sub sections in this document and carry out the steps associated with that item.

AFTER INSTALLATION WORK

<u>LED Red and Green User Visual Indications</u>

4. Disconnect the incoming supply.
5. Remove and replace the LED unit.
6. Reconnect the incoming supply.
7. Check the new unit illuminates by simulating the passage of a train.

Figure 2 - Visual Indications

Warning Speaker

8. Disconnect the incoming supply.

9. Remove and replace the warning speaker unit.

10. Reconnect the incoming supply.

11. Check the new unit sounds the correct warning for both single and a second train approaching, by simulating the passage of train/trains.

12. Check and adjust the sound levels as required.

Figure 3 – Warning Speaker

On Demand Button

13. Disconnect the incoming supply.

14. Remove and replace the button unit.

15. Reconnect the incoming supply.

16. Check the new unit operates correctly and that the red LED is illuminated when the crossing is in “Standby Mode”.

17. Check that when the button is pressed the correct LED red and green user visual indications are displayed.

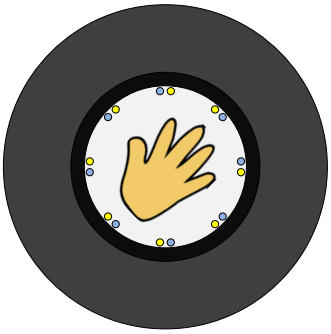


Figure 4 - On Demand Button

END

Includes:	a) Power Supply Circuit Breakers b) Mains Supply Surge Arrestor c) AKKUTEC Battery charger/AC adapter d) Main's filter e) Isolation Transformer
Excludes:	All other Flex Components and types of Level Crossing

GENERAL

Before any work is undertaken possession of the Flex Level Crossing system shall be taken. The Signaller shall be informed that the level crossing system will be non-operational.

The system shall be powered down for this task by disconnection of the power supply at the incoming disconnection links. The unit shall not be powered up with any sub-component missing.

This SMTH Test Plan contains multiple items of equipment, to use it correctly the tester shall carry out the **BEFORE INSTALLATION WORK** and following the completion of the work carry out the **AFTER INSTALLATION WORK** steps for the item replaced.

BEFORE INSTALLATION WORK (All Sub-Components)

1. Check that the replacement sub-component is of the correct type and is not damaged.
2. Isolate Flex equipment from the power supply by disconnection of the incoming supply at the disconnection links.
3. Isolate the corresponding 24V MCB's and the battery back-ups, by removing the fuse in the battery interconnection.
4. Check the status window shows "0" when in the "Off" position, see Figure 1.
5. If applicable, WIRE COUNT the existing wiring to wiring diagram and disconnect outgoing cables.
6. If applicable, check any external wires connected to existing equipment are correctly labelled.
7. If applicable, check existing wiring has safe insulation.

Figure 1 - Incoming supply switch

AFTER INSTALLATION WORK

Power Supply Circuit Breakers

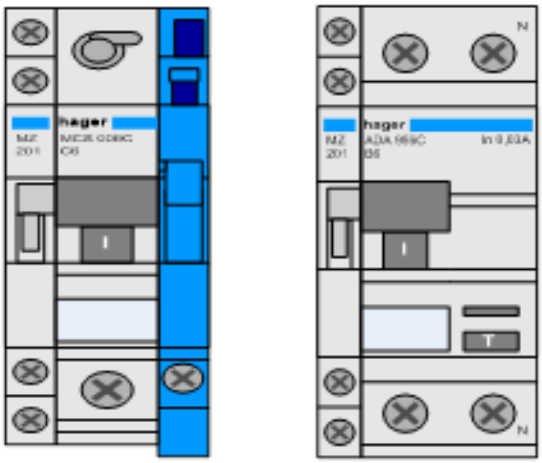


Figure 2 - Miniature Circuit Breakers MCB's and Residual Current Circuit Breakers RCCB's

8. Check Circuit breaker is correctly installed and securely mounted.

9. Check wiring is replaced as labelled and is securely terminated.

10. Carry out a WIRE COUNT to wiring diagram.

11. Power on the circuit breaker and monitor voltage. Confirm it is within specification.

12. Check the operation of circuit breaker by turning it to the off "0" position. Reinstate to the on "1" position.

Mains Supply Surge Arrestor

13. Check surge arrestors are correctly installed and securely mounted.

14. Check wiring is replaced as labelled and is securely terminated.

15. Carry out a WIRE COUNT to wiring diagram.

16. Reinstate power supply that was isolated

17. Check the indication window is green, see Figure 3.

Figure 3 - Mains Supply Surge Arrestor

AKKUTEC Battery charger/AC adapter

18. Check unit is correctly installed and securely mounted.

19. Check wiring is replaced as labelled and is securely terminated.

20. Carry out a WIRE COUNT to wiring diagram.

21. Power up unit and check the “operation” LED is on and green.

22. Simulate a power failure, by disconnecting the battery, and check “fault” led is on and red, see Figure 4.

23. Check that both the condition LEDs are illuminated and displaying green.

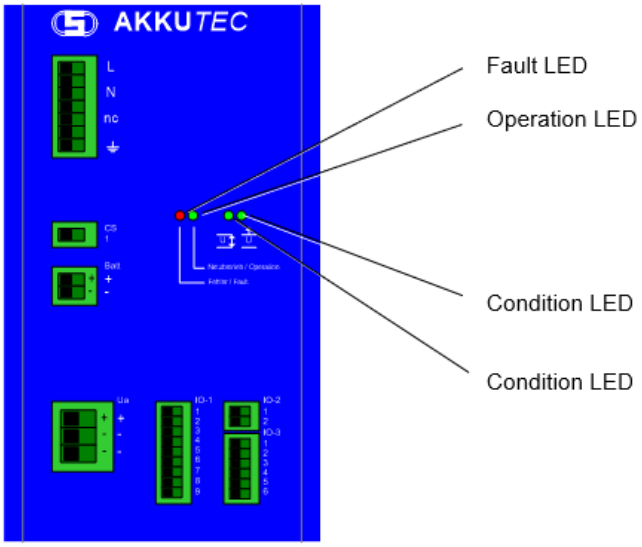


Figure 4 - AKKUTEC Battery charger/AC adapter

Main’s filter

24. Check mains filter is of the type and correctly installed and securely mounted, see Figure 5.

25. Check wiring is replaced as labelled and is securely terminated.

26. Carry out a WIRE COUNT to wiring diagram.

27. Power up the unit and test the input and output voltages are within specification.

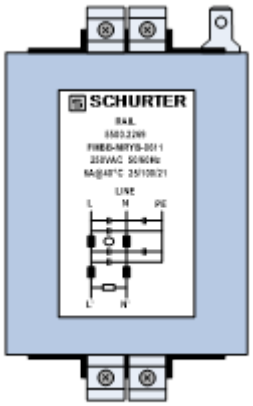


Figure 5 – Main’s Filter

Isolation Transformer

28. Check replacement transformer-rectifier or battery charger is correctly installed.

29. Check wiring is replaced as labelled and is securely terminated.

30. WIRE COUNT replacement transformer-rectifier to the wiring diagram.

31. Check output circuits are disconnected before supply is restored.

32. Test the input and output voltages are correct. The output voltages shall be tested at the busbar, as an additional check that the wiring has been correctly replaced.

33. Reinstate output circuit breakers.

34. Test output voltage is within specification, with the output circuits breakers restored.

END

Includes:	a) Flex Life Diagnostic Unit b) F-CPU c) MPI Adapter d) Insulation Monitoring Device
Excludes:	All other Flex Components and types of Level Crossing.

GENERAL

Before any work is undertaken possession of the Flex Level Crossing system shall be taken. The Signaller shall be informed that the level crossing system will be non-operational.

The system shall be powered down for this task by disconnection of the power supply at the incoming disconnection links. The unit shall not be powered up with any sub-component missing.

This SMTH Test Plan contains multiple items of equipment, to use it correctly the tester shall carry out the BEFORE INSTALLATION WORK and following the completion of the work carry out the AFTER INSTALLATION WORK steps for the item replaced.

BEFORE INSTALLATION WORK (All Sub-Components)

1. Check that the replacement sub-component is of the Correct Type and is Not Damaged.
2. Isolate Flex equipment from the power supply by disconnection of the incoming supply at the disconnection links.
3. Isolate the corresponding 24V MCB's and the battery back-ups, by removing the fuse in the battery interconnection.
4. Check the status window shows "0" when in the "Off" position, see Figure 1.
5. If applicable, WIRE COUNT the existing wiring/cabling to wiring diagram.
6. If applicable, check any external wires connected to existing equipment are correctly labelled.
7. If applicable, check existing wiring has safe insulation.

Figure 1 - Incoming supply switch

AFTER INSTALLATION WORK

Flex Life Diagnostic Unit

ADDITIONAL BEFORE INSTALLATION REQUIREMENTS

8. Disconnect the antenna.

9. Release the GSM module from mounting rail, remove existing SIM card and retain it.

AFTER INSTALLATION

10. Check new unit is correctly installed and securely mounted.

11. Confirm the SIM card has been replaced in GPS unit.

12. Confirm the antenna is correctly installed and secure.

13. Check wiring / cabling is replaced as labelled and is securely terminated.

14. Power up unit and check that the “Power” LED is on and green.

15. Check the interface screen is displaying data, see Figure 2.

16. Send a test SMS message.

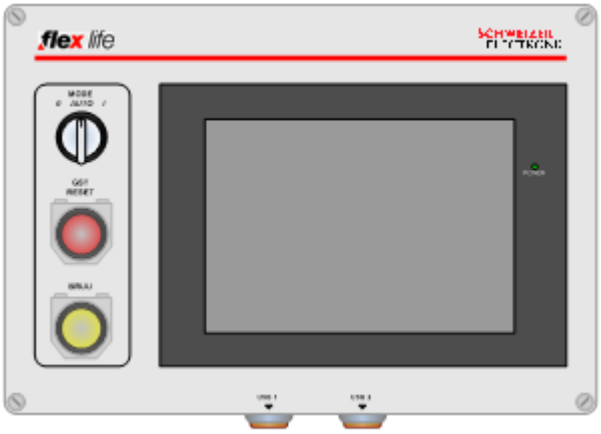


Figure 2 - Flex Life Diagnostic Unit

17. Reset the flex and simulate a failure and confirm the fault is logged on flex life.

F-CPU

ADDITIONAL BEFORE INSTALLATION REQUIREMENTS

18. Remove MMC memory card.

AFTER INSTALLATION

19. Check new unit is correctly installed and securely mounted, see Figure 3.

20. Replace MMC memory card in PLC unit.

21. Check wiring / cabling is replaced as labelled and is securely terminated.

22. Power up unit and move the switch from STOP to RUN and check the following LEDs are illuminated green:

    a) “DC5V”

    b) “RUN”

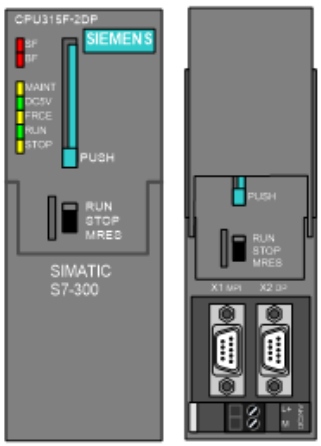


Figure 3 – F-CPU

MPI Adapter

23. Check adapter is correctly installed and securely mounted, see Figure 4.

24. Check wiring /cabling is replaced as labelled and is securely terminated.

25. Power up the MPI adapter and observe the following LEDs are illuminated green:

    a) “Power update”

    b) “Active parameter”

    c) “Connect data”

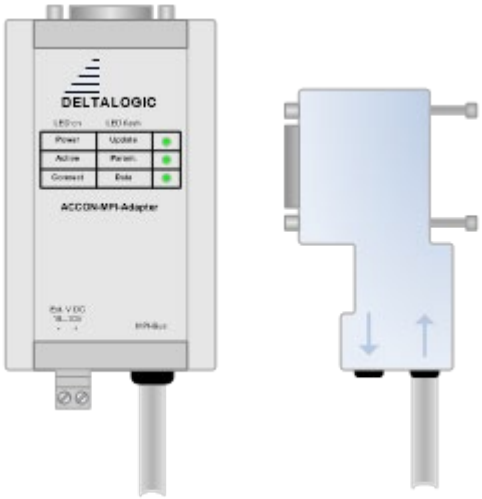


Figure 4 - MPI Adapter

Insulation Monitoring Device

26. Check unit is correctly installed and securely mounted, see Figure 5.

27. Check wiring / cabling is replaced as labelled and is securely terminated.

28. WIRE COUNT replacement unit to the wiring diagram.

29. Check replacement unit operates correctly.

30. Check or test sensitivity of unit and adjust as necessary.

Figure 5 - Insulation Monitoring Device

END

Includes:	a) PLC Interface Module b) Power Module c) Actuator Module d) Optocoupler Module e) Fail-safe digital input/output module F-DI/O f) Standard digital input/ output modules g) Standard Analogue input
Excludes:	All other Flex Components and types of Level Crossing

GENERAL

Before any work is undertaken possession of the Flex Level Crossing system shall be taken. The Signaller shall be informed that the level crossing system will be non-operational.

The system shall be powered down for this task by disconnection of the power supply at the incoming disconnection links. The unit shall not be powered up with any sub-component missing.

This SMTH Test Plan contains multiple items of equipment, to use it correctly the tester shall carry out the **BEFORE INSTALLATION WORK** and following the completion of the work carry out the **AFTER INSTALLATION WORK** steps for the item replaced.

BEFORE INSTALLATION WORK (All Sub-Components)

1. Check that the replacement sub-component is of the correct type and is not damaged.
2. Isolate Flex equipment from the power supply by disconnection of the incoming supply at the disconnection links.
3. Isolate the corresponding 24V MCB's and the battery back-ups, by removing the fuse in the battery interconnection.
4. Check the status window shows "0" when in the "Off" position, see Figure 1.
5. If applicable, WIRE COUNT the existing wiring / cabling to wiring diagram.
6. If applicable, check any external wires connected to existing equipment are correctly labelled.
7. If applicable, check existing wiring has safe insulation.

Figure 1 - Incoming supply switch

AFTER INSTALLATION WORK

PLC Interface Module

ADDITIONAL BEFORE INSTALLATION REQUIREMENT

8. Remove and retain the identification label.

AFTER INSTALLATION

9. Check new unit is correctly installed and secure.

10. Set DP profibus address to the identification label and reinsert to the new Interface module, see Figure 2.

11. Reconnect the incoming power supply and the DSUB socket DP Profibus / F-CPU Interface cable.

12. Power up unit and check the green “ON” LED is illuminated.

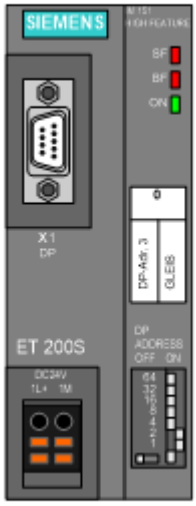


Figure 2 - PLC Interface Module

Power Module

ADDITIONAL BEFORE INSTALLATION REQUIREMENT

13. Check internal fuse and replace as necessary.

AFTER INSTALLATION

14. Check new module is correctly installed and secure, see Figure 3.

15. Reconnect the incoming power supply.

16. Power up and check the following green LEDs are illuminated:

    a) “PWR”

    b) “FSG”

Figure 3 - Power Module

Actuator Module

17. Check new module is correctly installed and secure, see Figure 4.

18. Check the incoming power supply and other cables are connected as labelled, and terminations are tight.

19. Power up unit and check the following LEDs are illuminated / flashing either yellow or green:

    a) “Control 1”

    b) “Control 2”

    c) “Run/ Fail safe”

    d) “Out 1”

    e) “Out 2”

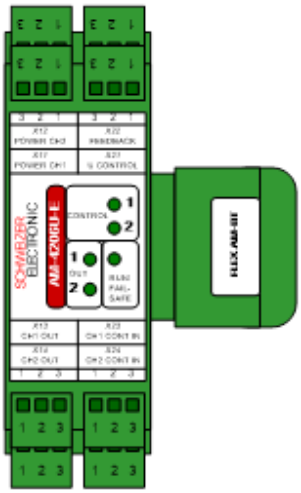


Figure 4 – Actuator Module

Optocoupler Module

20. Check new module is correctly installed and secure, see Figure 5.

21. WIRE COUNT the new optocoupler to wiring diagram.

22. Power up optocoupler and check the LED is lit yellow when energised.

Figure 5 - Optocoupler Module

Fail-safe digital input/output module F-DI/O

ADDITIONAL BEFORE INSTALLATION REQUIREMENT

23. Remove and retain the identification label.

24. Set the new module address dip switches to the identification label.

AFTER INSTALLATION

25. Check new module is correctly installed and secure, see Figure 6.

26. Power up the fail-safe digital input / output module F-DO and observe the following LED's:

    a) "SF" is clear.

    b) "1", "5", "9" and "13" are green.

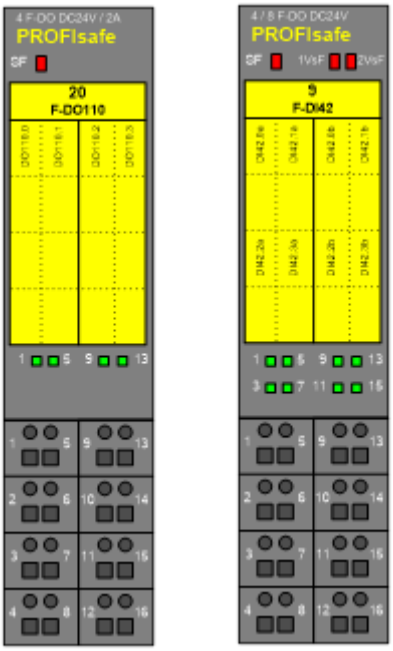


Figure 6 - Fail-safe digital output module (left) and Fail-safe digital input module (right)

Standard digital input/ output modules

ADDITIONAL BEFORE INSTALLATION REQUIREMENT

27. Remove and retain the identification label.

28. Fit the original identification label to the new digital input/output module.

AFTER INSTALLATION

29. Check new module is correctly installed and secure, see Figure 7.

30. Power up the digital input / output module and observe the 8-bit green LEDs correspond with the input / output controls.

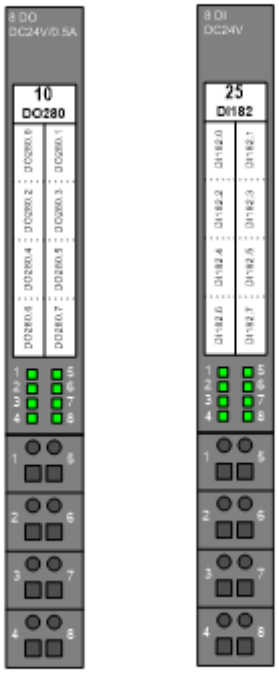


Figure 7 - Digital standard output module DO (left) and standard input module DI (right)

Standard Analogue input

31. Check new module is correctly installed and secure, see Figure 8.

32. WIRE COUNT the new optocoupler to wiring diagram.

33. Power up the module and check the “SF” LED is illuminated.

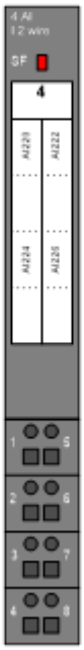


Figure 8 - Standard Analogue input

END

Includes:	a) Safety Relay b) Coupling Relay c) Temperature safety switch d) Heater Thermostat and Heater e) Connecting Terminal f) Acoustic Signal Generator
Excludes:	All other Flex Components and types of Level Crossing

GENERAL

Before any work is undertaken possession of the Flex Level Crossing system shall be taken. The Signaller shall be informed that the level crossing system will be non-operational.

The system shall be powered down for this task by disconnection of the power supply at the incoming disconnection links. The unit shall not be powered up with any sub-component missing.

This SMTH Test Plan contains multiple items of equipment, to use it correctly the tester shall carry out the **BEFORE INSTALLATION WORK** and following the completion of the work carry out the **AFTER INSTALLATION WORK** steps for the item replaced.

BEFORE INSTALLATION WORK (All Sub-Components)

1. Check that the replacement sub-component is of the correct type and is not damaged.

2. Isolate Flex equipment from the power supply by disconnection of the incoming supply at the disconnection links.

3. Isolate the corresponding 24V MCB's and the battery back-ups, by removing the fuse in the battery interconnection.

4. Check the status window shows "0" when in the "Off" position, see Figure 1.

5. If applicable, WIRE COUNT the existing wiring/cabling to wiring diagram.

6. If applicable, check any external wires connected to existing equipment are correctly labelled.

7. If applicable, check existing wiring has safe insulation.

Figure 1 - Incoming supply switch

AFTER INSTALLATION WORK

Safety Relay

8. Check new relay is correctly installed and secure, see Figure 2.

9. Check the incoming power supply and other cables are connected as labelled, and terminations are tight.

10. Power up unit and check that the “K1/ K2” LED are lit/flashing either yellow or green when relay energised.

Figure 2 - Safety Relay

Coupling Relay

11. Check new relay is correctly installed and secure, see Figure 3.

12. Check the incoming power supply and other cables are connected as labelled, and terminations are tight.

13. Power up unit and check that the “24V” LED are lit/flashing either yellow or green when relay energised.

Figure 3 - Coupling Relay

Temperature safety switch

14. Check new relay is correctly installed and secure, see Figure 4.

15. Check the incoming power supply and other cables are connected as labelled, and terminations are tight.

16. Test using the test plug at the top of the module.

Figure 4 - Temperature Safety Switch

Heater Thermostat and Heater

Additional Before Installation Requirement

17. Allow time for the Heater to cool before handling.

After Installation

18. Check new heater and thermostat units are correctly installed and secure, see Figure 5

19. WIRE COUNT the wiring/cabling to wiring diagram.

20. Reconnect the incoming power supply.

21. Whilst monitoring the voltage on the heater terminals, adjust the thermostat and listen for a click that corresponds with loss of voltage on the heater.

22. Adjust the Thermostat unit to zero and verify the heater unit starts to warm.

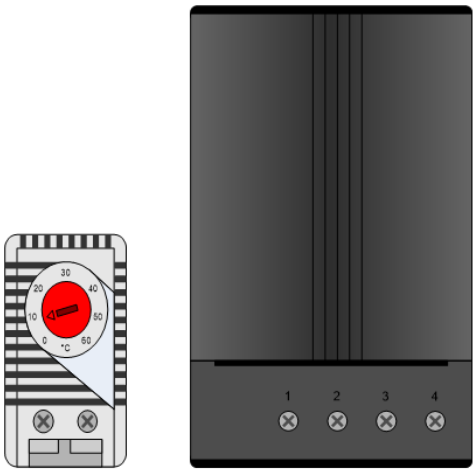


Figure 5 - Heater Thermostat & Heater

23. Re-adjust the Thermostat unit to its working temperature of 25 degrees.

Connecting Terminal

Additional Before Installation Requirement

24. Allow time for the Heater to cool before handling.

After Installation

25. With the wiring disconnected INSULATION TEST replacement terminal block (minimum 2M ohms terminals to earth).

26. Check new terminal block is correctly installed and secure.

27. Check all cables are connected as labelled, and terminations are tight.

28. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.

29. WIRE COUNT replacement terminal block to the wiring diagram.

30. CABLE FUNCTION TEST the affected circuits (terminal blocks for multicore signalling cables only).

31. Check with the Maintenance Test Plan for the item of equipment fed via the terminal block and carry out steps marked with an asterisk *.

Acoustic Signal Generator

32. Check new generator is correctly installed and secure, see Figure 6.

33. Check all cables are connected as labelled, and terminations are tight.

34. Check / adjust the volume levels for both day and night modes.

35. Power up the generator and check the following LEDs are illuminated and green:

    a) “Night”

    b) “Day”

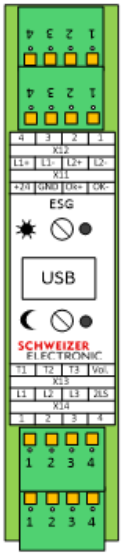


Figure 6 - Acoustic Signal Generator

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LV01		
Replace an Electric Lever Lock		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Electric lock blades, dogs and contacts
Excludes:	All other types of Electric Lock

GENERAL

When a combined lever lock circuit controller is replaced, a combination of this Test Plan and NR/SMTH/Part04/LV02 (Replace a Circuit Controller) shall be used.

BEFORE INSTALLATION WORK

1. Check replacement lever lock is not damaged and is correct type.
2. WIRE COUNT existing lever lock to the wiring diagram.
3. Check existing wiring has safe insulation.
4. INSULATION TEST replacement lever lock (minimum 2M ohms terminals to case).
5. Check existing wiring is correctly labelled.
6. Check existing lever lock is isolated from the supply.

AFTER INSTALLATION WORK

7. Check replacement lever lock and/or mechanical link are correctly installed.
8. Check wiring is replaced as labelled.
9. WIRE COUNT replacement lever lock to the wiring diagram.
10. Check terminations are secure and suitably protected.
11. * Test by breaking each Lock Checking Contact (LCC) in turn, and observing the circuit function de–energises **(LEVER LOCKS FITTED WITH LCC ONLY).**
12. Check lock operates correctly (economiser, integral contacts).
13. * Check any ‘force down’ feature operates correctly.
14. Check wires and cables are clear of moving parts and covers.
15. Check new split pins are correctly installed.
16. EARTH TEST (DC) or EARTH TEST (AC) replacement lever lock circuits where designed to be earth free.

17. Check lever is correctly locked in the positions specified.

18. Check or arrange for correct labelling of unit (colour, numbering).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LV02		
Replace a Circuit Controller		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	All circuit controllers associated with signals, Slots, Level crossings, Lever frames, Contact box, Depression bars, Lever controller bands/contacts and Associated drives
Excludes:	Circuit controllers associated with point detector, AB Type 803 Style F Rotating Cam Switch

GENERAL

When a combined lever lock circuit controller is replaced, a combination of this Test Plan and NR/SMTH/Part04/LV01 (Replace an Electric Lever Lock) shall be used.

BEFORE INSTALLATION WORK

1. Check replacement circuit controller is not damaged and is correct type (band configuration, normally in/out).
2. WIRE COUNT existing circuit controller to the wiring diagram.
3. Check existing wiring has safe insulation.
4. INSULATION TEST replacement circuit controller (minimum 2M ohms terminals to case).
5. Check existing wiring is correctly labelled.
6. Check existing circuit controller is isolated from the supply.

AFTER INSTALLATION WORK

7. Check that all bands, including spares, are in position (SGE and WESTINGHOUSE M4 ONLY).
8. Check replacement circuit controller and/or mechanical links are correctly installed.
9. Check new split pins are correctly installed.
10. Check wiring is replaced as labelled.
11. WIRE COUNT replacement circuit controller to the wiring diagram.
12. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
13. Check terminations are secure and suitably protected.
14. If the circuit controller is the “Ultra Electronics” version then carry out NR/SMS/PartB/Test/049 (Ultra Circuit Contact Box Set-up procedure).

15. Test that each affected contact/band only makes and breaks in the appropriate positions as specified in the wiring diagrams.

16. Check each function operated by the replacement circuit controller operates correctly.

17. The Maintenance Test Plan/s for the equipment fed by the equipment should be checked and any requirement marked with an asterisk "✱"carried out.

18. Check wires and cables are clear of moving parts and covers.

19. EARTH TEST (DC) or EARTH TEST (AC) all circuits controlled by the circuit controller where designed to be earth free.

20. Check or arrange for correct labelling of unit (colour, numbering).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LV03		
Replace a Plunger		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Sealed releases and Emergency releases Plungers
Excludes:	All other types of push button and electrical switches

BEFORE INSTALLATION WORK

1. Check replacement plunger is not damaged and is correct type.
2. WIRE COUNT existing plunger to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring is correctly labelled.
5. Check existing plunger is Isolated from the supply.

AFTER INSTALLATION WORK

6. Check replacement plunger is correctly installed.
7. Check wiring is replaced as labelled.
8. WIRE COUNT replacement plunger to the wiring diagram.
9. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
10. Check terminations are secure and suitably protected.
11. Check wires are clear of moving parts.
12. Check plunger is clear of moving parts.
13. EARTH TEST (DC) or EARTH TEST (AC) supply where designed to be earth free.
14. * Test for correct operation.
15. * Check plunger is correctly sealed **(SEALED RELEASE PLUNGERS ONLY).**
16. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LV04		
Replace a Key Release Instrument		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	One train staff instruments, Ground frame key release instruments, Crank handle release instruments
Excludes:	Token instruments

BEFORE INSTALLATION WORK

1. Check replacement instrument is not damaged and is correct type (configuration).
2. Check that the internal wiring of the replacement instrument corresponds to the internal wiring of the redundant instrument.
3. Check that the contact arrangement of the replacement instrument corresponds functionally to the contact arrangement of the redundant instrument.
4. WIRE COUNT the existing instrument to the wiring diagram.
5. Check existing wiring has safe insulation.
6. INSULATION TEST replacement instrument (minimum 2M ohms terminals to case).
7. Check existing wiring is correctly labelled.
8. Check existing instrument is isolated from supply.
9. Check key is removed from redundant instrument.
10. Check replacement instrument is set to the same key position as the instrument to be replaced.

AFTER INSTALLATION WORK

11. Check key is replaced into the replacement instrument.
12. Check replacement instrument is correctly installed.
13. Check wiring is replaced as labelled.
14. WIRE COUNT replacement instrument to the wiring diagram.
15. Check wires and cables are clear of moving parts.
16. EARTH TEST (DC) or EARTH TEST (AC) circuits where designed to be earth free.
17. Check key can only be withdrawn from the instrument when release is given.
18. Check that the key, once withdrawn, can be replaced back into the instrument and that any function released by the withdrawal of the key is now cancelled.

19. Check or arrange for correct labelling of instrument.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LV05		
Replace a Mechanical Interlocking Component		
Issue No: 06	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

GENERAL

When replacement of a lever or lever component requires the disarrangement of interlocking, a combination of this Maintenance Test Plan and NR/SMTH/Part04/LV06 (Replace a Lever or Lever Component) shall be used.

Affected locking includes: all locking affected by the removal or potential release of any part which could alter the setting or integrity of the locking. This could vary from the need to test only levers interlocked with the lever being worked on, up to the need to test the whole frame.

Any locking which has had holding down straps or covers removed shall be considered as 'affected' and therefore shall be tested.

Where complete locking trays have not had their covers removed and no connection into the tray has been disturbed, then the locking within that tray may be considered as 'not affected' and need not be tested.

BEFORE INSTALLATION WORK

1. Carry out correlation check to locking chart for all affected locking.

   Levers associated with the affected locking shall be in their usual position in the frame before work starts.

   If anything less than a complete frame test is proposed, then the scope of the proposed testing shall be documented and independently checked.

2. Check electrical equipment driven by affected locking is isolated from the supply.

3. Check existing affected locking is correctly labelled.

4. Check replacement locking is not damaged and is correct type.

5. Check replacement key/tablet lock has correct configuration and all key/tablets in the system operate lock correctly.

AFTER INSTALLATION WORK

6. Check replacement locking is correctly labelled and installed.

7. Carry out correlation check to locking chart for all affected locking.

8. Check new pins/split pins are correctly installed.

   Remaining steps shall only be carried out after components designed to hold locking in place, have been secured.

9. Check with the Maintenance Test Plan for Lever Locks and Circuit Controllers and carry out steps marked with an asterisk "✱" (locking components associated with electric locks or circuit controllers only).

10. Check that all affected levers operate correctly with adequate stroke and without undue strain.

11. Carry out MECHANICAL LOCKING FUNCTION TEST on the affected levers.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LV06		
Replace a Lever or Lever Component		
Issue No: 06	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Catch handle, Catch rod, Catch block, Spring, Quadrant, Cam/Crank/Rocker
Excludes:	Gate drive levers, Electric lock blades and Dogs

General

When replacement of lever or lever component requires the disarrangement of interlocking, a combination of this Maintenance Test Plan and NR/SMTH/Part04/LV05 (Replace a Mechanical Interlocking Component) shall be used.

BEFORE INSTALLATION WORK

1. Check replacement item is not damaged and is correct type.

2. Check electrical equipment connected to lever is isolated from the supply.

AFTER INSTALLATION WORK

3. Check replacement item is correctly labelled.

4. Check new pins and/or split pins are correctly installed.

5. Check lever is held in the frame until the catch handle is fully operated for all working positions.

6. Carry out MECHANICAL LOCKING FUNCTION TEST to affected levers.

7. Check with Maintenance Test Plan for Lever Locks and Circuit Controllers and carry out steps marked with an asterisk "✱" (LEVERS ASSOCIATED WITH ELECTRIC LOCKS OR CIRCUIT CONTROLLERS ONLY).

8. Check lever/lever component operates correctly with adequate stroke and without undue strain.

9. Test that the apparatus controlled by the replacement lever/lever component operates correctly with adequate stroke and without undue strain.

10. Check or arrange for correct labelling of unit, (colour, numbering).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LV07		
Replace a AB Type 803 Style F Rotating Cam Switch		
Issue No: 06	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	AB type 803 style F rotating cam switches associated with mechanical signals and AHBCs
Excludes:	All other types of rotating cam switch

General

The front cover of these switches shall not be removed on site except for incident investigation as the unit is hermetically sealed.

BEFORE INSTALLATION WORK

1. Check replacement circuit controller is not damaged and is correct type and is fitted with a cable of correct length.

2. WIRE COUNT location end of existing circuit controller to the wiring diagram.

3. INSULATION TEST replacement circuit controller and cable from free end of cable (minimum 2M ohms cable to case and core to core). It may be necessary to rotate the cam contacts for the core being tested.

4. Check existing cable terminals are correctly labelled.

5. Check existing circuit controller is isolated from the supply.

AFTER INSTALLATION WORK

6. Remove existing circuit controller and cable complete.

7. Check replacement circuit controller and/or mechanical links are correctly installed.

8. Check new split pins are correctly installed.

9. Check cable is terminated in accordance with the cable terminal labels.

10. WIRE COUNT location end of replacement circuit controller to the wiring diagram.

11. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.

12. Adjust each band to the settings specified in the writing diagram using the adjuster screws on the front of the unit.

13. Test that each contact only makes and breaks in the correct positions as specified in the wiring diagrams.

14. Check each function operated by the replacement circuit controller operates correctly.

15. If the affected contact is associated with circuitry going to a point detector, microswitch or track feed circuit carry out steps marked with an asterisk "✱"on the Maintenance Test Plan for the point detector/microswitch.

16. Check all cables are secure and clear of moving parts.

17. EARTH TEST (DC) or EARTH TEST (AC) all circuits controlled by the circuit controller where designed to be earth free.

18. Check or arrange for correct labelling of unit including safety label covering can adjuster screws.

19. Check security cover is in place and padlocked.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LV08		
Replace a Microswitch sub-component within Ultra circuit Controller		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Only Ultra circuit controllers
Excludes:	All other circuit controllers

BEFORE INSTALLATION WORK

1. Check replacement microswitch is not damaged and is the correct type.
2. Check existing wiring has safe insulation.
3. Check existing wiring is correctly labelled.

AFTER INSTALLATION WORK

4. Check replacement microswitch is correctly installed.
5. Check wires are clear of moving parts and covers.
6. Test that the effected microswitch only makes and breaks in the positions as specified in the wiring diagrams.
7. Check each function operated by the circuit controller operates correctly.
8. EARTH TEST (DC) or EARTH TEST (AC) all circuits and supplies controlled by the circuit controller.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/LV09		
Replace a Lever frame Key		
Issue No. 01	Issue Date: 04/03/17	Compliance Date: 31/05/17

Includes:	Token Key, Annettes key, single line staffs
Excludes:	Other key release instruments.

This work does not require any electrical disconnections.

Colour Codes (for token keys ONLY)

A configuration coloured Red
B configuration coloured Blue
C configuration coloured Green
D configuration coloured Yellow

BEFORE INSTALLATION WORK

1 Check replacement Token Keys is not damaged.
2 Check that configuration is correct and that it is correctly painted. Token key only
3 Check that annex key is engraved correctly to diagram .

AFTER INSTALLATION WORK

4 Check replacement Keys can operate correctly in all release boxes and or instruments as appropriate.
5 Return old Keys to your SM(S) for disposal

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/LV10		
Replace a Lever frame key lock		
Issue No. 05	Issue Date: 04/03/17	Compliance Date: 31/05/17

Includes:	Annettes key lock, Token key lock
Excludes:	Other key locks

! This work does not require any electrical disconnections

Before Installation Work

1 Check replacement Lock is not damaged and is correct type.

2 Check that the key is correct to diagram.

After Installation Work

3 Check replacement Lock is correctly installed.

4 Check that the replacement Lock can only be released by the appropriate Key.

5 Check lock slide, when withdrawn is clear of lock face.

6 Check plunger travel cannot damage casting

7 Check that the Key cannot be removed from the Lock with the lever not fully normal (or reverse if appropriate).

8 Check that the Lever is locked in the appropriate position with the Key removed.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/LV11		
Re-allocate a Band		
Issue No: 01	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	All Circuit Controllers Associated with Signal Box Lever Frames
Excludes:	All Other Types of Circuit Controller

GENERAL

Obtain permission from SFI Level 2 before undertaking this task.

BEFORE INSTALLATION WORK

1. Check the re-allocated band is the correct item of equipment.
2. Check re-allocated band is correct type.
3. Check re-allocated band is spare and not damaged.
4. Check all other bands of the affected item are not damaged.
5. WIRE COUNT existing band to the wiring diagram.
6. Check existing wiring has safe insulation.
7. Check that the re-allocated bands make and break in the correct positions, as specified in the wiring diagram.
8. Check existing wiring is correctly labelled for both the original band position and temporary re-allocation.
9. Check existing band is isolated from the supply.

AFTER INSTALLATION WORK

10. Check terminations are secure and suitably protected.
11. Check wiring is replaced as temporarily labelled.
12. Check wiring diagrams show the alteration.
13. WIRE COUNT re-allocated band to the amended wiring diagram.
14. Check any links and red dome nuts, or equivalent, are correctly replaced and secure.
15. Test that the function performed by the band replaced operates correctly.
16. The maintenance test plan/s for the equipment fed by the re-allocated band shall be checked and any requirements marked with an * carried out.

17. Check wires are clear of any moving parts and not subject to mechanical damage.

18. EARTH TEST (DC) or EARTH TEST (AC), where designed to be earth free.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/MS01		
Replace a PM SOM24 MAU		
Issue No. 02	Issue Date: 01/09/18	Compliance Date: 01/12/18

Includes:	PM, SOM24, MAU
Excludes:	WestLock Trackside System (See WL07), WestLock, WestCad Equipment, PMB, Surge Protection Unit, Surge Suppression Unit

***** INDEPENDENCE EXEMPT *****

Liaison with the signaller is required and the appropriate possession is required before changing any PM.

Replacing a standalone PM shuts down the object controller and interlocking.

If a standalone PM is or both PMs in a pair are to be changed, it is necessary to check the correct technicians controls and lockout device status are reapplied to the PM(s) after changing.

Care should be taken not to touch the pins on the rear connector of any of these units.

BEFORE RE-INSTALLATION WORK

1. Check replacement module is Not Damaged and is Correct Type. Pay particular attention to check the 3 rows of pin connectors are undamaged.
2. Check replacement module mark and mod state is correct (local restrictions).
3. Check replacement module is sealed.
4. Use the TF(L) or TF(R) to record the state of technicians controls and the state of any patrolman's lockout that have been applied to the PM that is about to be changed. Liaise with the signaller to confirm the status of lockouts devices.
5. If replacing a MAU, note the position of the Optical Fibre cables and disconnect them from the unit taking care to protect the ends of the fibres.
6. If the PM to be replaced is the on-line unit of a Hot Standby Pair, use HOT STANDBY TEST NR/SMS/Test156 to change to the off line PM.

AFTER INSTALLATION WORK

7. Before installing any module check it is correctly orientated before insertion into the racking as mechanical and / or electrical damage may be caused.
8. Check replacement module is Correctly Installed

PM ONLY

a) If both PMs of a Hot standby pair illuminate their green STANDBY OK LED then no further action is required.

The reboot process may take up to 15 minutes to reach this state.

b) If the off-line PM of a Hot standby pair does not illuminate it's green STANDBY OK LED or a single PM has been installed, then it is necessary to reconfigure the technicians controls by use of the TF(L) or TF(R) and the state of any patrolman's lockout by operating the affected patrolman's lockout.

Full details of how to carry out reconfiguration is contained in Westrace documentation. If you have any doubt about how to carry out these requirements STOP, and ask your SM(S) for guidance.

Use the TF(L) or TF(R) to check the state of technician's controls that have been re-applied against the listing taken at step 05.

Liaise with the signaller to confirm the status of lockouts devices that have been re-applied against the listing taken at step 05.

Use the TF(L) or TF(R) to enable the interlocking/ level crossing functionality (if appropriate) contained within the PM.

c) Check replacement PM can operate in hot standby mode with its twin if facility provided [Hot Standby Test (NR/SMS/Test156)].

9. Check replacement module operates correctly [PM, SOM24, MAU only].

Operates correctly means observing the correct indications on the replaced unit itself and confirming correct operation of one function operated by the SOM24.

For example, a signal's aspect can be changed, points operated normal and reverse, etc.

10. Check or arrange for Correct Labelling of unit.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/MS02		
Replace an Invensys Rail Object Controller TPWS, or Points Equipment Panel		
Issue No: 03	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	TPWS Panel, Points Equipment Panel
Excludes:	Individual TPWS modules (use AP01) or relays on points equipment panels (use EL08).

GENERAL

It is possible to replace the TPWS Panel or Points Equipment Panel without removing the mounted equipment. However, it is recommended that the TPWS modules or relays are removed separately to reduce weight.

BEFORE INSTALLATION WORK

1. Check replacement panel is not damaged and is correct type.

2. Check replacement panel mark and mod state is correct (local restrictions).

3. Check replacement panel is sealed.

AFTER INSTALLATION WORK

4. Check replacement panel is correctly installed (plug coupled cables).

5. Check replacement module operates correctly.

NOTE: *Check correct operation means observing the correct operation of the panel itself and confirming correct operation of each TPWS module or relay within the unit.*

6. Check or arrange for correct labelling of unit.

NOTE: *Particular attention should be given to the labelling of closed switch rails and point numbering.*

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/MS03		
Remove and Refit a Fibre Optic Patch Cord, Fibre Optic Patch Panel, Ethernet cables Fibre Optic lead.		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	All fibre optic patch cords, Fibre Optic Patch Leads Fibre Optic Enclosure, Ethernet cables
Excludes:	Ethernet switches MAU(MS01) DISAC(TMTH CAB004)

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.

Preplanning is essential before carrying out the requirements of this test plan.

Liaise with the Signaller to agree a possession(s) of all affected signalling equipment.

BEFORE INSTALLATION WORK

1. Check the replacement cable is the correct type, length and is undamaged.
2. WIRECOUNT the equipment and connections to the wiring diagram.
3. Check equipment and connections are correctly labelled.
4. Obtain a list of faults from the TF(L) or TF(R) and check that the task to change the equipment and connections can be undertaken without effect on the pre-planned arrangements.

AFTER INSTALLATION WORK

5. Check replaced equipment and / or connections have not been damaged whilst disconnected and are correctly installed.
6. Check equipment and connections are replaced as labelled.
7. WIRECOUNT the equipment and connections to the wiring diagram.
8. Check or arrange for correct labelling of equipment and connections.

9. Obtain a list of faults from the TF(L) or TF(R).

   Check that the task to change the fibre optic equipment has not introduced additional faults onto the system, other than those that are listed as having occurred and cleared as a direct result of changing the fibre optic equipment subject to this test plan.

10. Check all modules fed by the equipment and the connections operate correctly, and that their normal indications are illuminated.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/MS05		
Replace a Surge Protection Unit, Surge Suppression Unit		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Surge Protection Unit, Surge Suppression Unit
Excludes:	Westlock, WestCAD Equipment, PMB, PM, SOM24, MAU

GENERAL

Liaise with the Signaller before carrying out this work.

BEFORE INSTALLATION WORK

1. Check replacement module is not damaged and is correct type.

2. Check replacement module mark and mod state is correct (local restrictions).

3. Check replacement module is sealed if required.

AFTER INSTALLATION WORK

4. Check replacement module is correctly installed.

5. Wait 60 seconds and check the Surge Protection has not tripped or that the Surge Suppression units have not changed colour.

6. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/MS06		
Replace a Switch Rack		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Switch Rack
Excludes:	Surge Suppression Unit (MS05) Individual Isolators and MCBs

The complete Switch Rack is heavy and manual handling precautions should be in place whilst removing and replacing it.

Liaise with the Signaller as a possession is required before changing the Switch Rack.

BEFORE INSTALLATION WORK

1. Check replacement switch rack is not damaged and is correct type.
2. Isolate internal and external circuits by operating all isolators.
3. Isolate the switch rack to be changed by disconnecting the incoming DNO cable to the PB.
4. Check replacement switch rack plug coupler is free from any signs of corrosion, arcing and is in good mechanical condition and have safe insulation.

AFTER INSTALLATION WORK

5. Check replacement switch rack is correctly installed.
6. Check Surge suppression units are correctly installed.
7. Reconnect input DNO cable to PB.
8. Re-operate all isolators to internal circuits.
9. The battery shall remain isolated from external circuits at his stage.
10. Check status of battery and charger by checking LEDs on charger rack module(s).
11. Test battery output voltage with the output disconnected.
12. Reconnect battery to external circuits.
13. Carry out NR/SMS/PartB/Test/053 (ELD Function Test) or NR/SMS/PartB/Test/051 (Busbar Earth Test) on all power supplies.
14. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/MS07		
Replace a Battery Pack		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Modular Signalling System battery pack
Excludes:	All other battery packs

***** INDEPENDENCE EXEMPT *****

GENERAL

This unit contains a 230V a.c. Supply.

Battery packs used in the Invensys Modular Signalling System are very heavy. Correct manual handling procedures shall be considered at all times.

Care should be taken when placing the unit on the grillage of an OC installation. The pins that support the pack on a flat surface might protrude through the grillage thus causing Mechanical and / or Electrical damage.

BEFORE INSTALLATION WORK

1. Check replacement battery rack is not damaged and is correct type.
2. Isolate battery from the charger and external circuits by operating the isolator on the charger rack and battery.
3. Check existing PB connector and replacement battery pack connector are free from any signs of corrosion, arcing and is in good mechanical condition.

AFTER INSTALLATION WORK

4. Check replacement battery pack is correctly installed.
5. Reconnect battery to charger and input circuits by operating the isolator on the charger rack.

   If the 230v a.c supply has been lost to the Power Box at any stage during the work the red button on the charger card should be pressed. This is controlled soft start facility for the charging circuit.

6. Check status of battery and charger by checking LEDs on charger module.
7. Test output voltage.
8. Reconnect battery to external circuits.

9. Carry out NR/SMS/PartB/Test/055 (Secondary Cell Test).

This test should be carried out after sufficient time has elapsed to allow the battery to build up charge.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/MS08		
Replace an individual Power Rack Module		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Invensys Rail Power Box (PB) AC/DC PSU, Charger, Isolator Charger Battery MCB, Isolator PSU, PSU GK50-1, Alarm Card
Excludes:	Complete Power Rack

BEFORE INSTALLATION WORK

1. Check replacement module is not damaged and is correct type.

   The output voltage and power of the replacement module shall be as specified for the PB.

2. Isolate the module to be changed from its input power supply and its outputs.

3. Check existing PB module connector and replacement module connector are free from any signs of damage, corrosion, arcing and is in good mechanical condition and have Safe Insulation.

AFTER INSTALLATION WORK

4. Check replacement module is correctly installed.

5. Reconnect module to supply and external circuits.

6. Check status of module by checking status LEDs.

7. Carry out NR/SMS/PartB/Test/053 - ELD Function Test or NR/SMS/PartB/Test/051 - Busbar Earth Test on the affected power supplies.

8. Carry out NR/SMS/PartB/Test/055 - Secondary Cell Test.

9. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/MS10		
Replace a Charger Rack		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Charger Rack
Excludes:	Individual Charger Rack modules

Liaise with the Signaller as a possession is required before changing the charger rack.

Replacing the complete charger rack requires the PB to be isolated from its external output circuits. The DNO supply cable may be left coupled.

BEFORE INSTALLATION WORK

1. Check replacement charger rack is not damaged and is correct type.

2. Isolate the charger rack to be changed from its internal and external circuits by operating all isolators and MCBs.

3. Check replacement charger rack plug coupler is free from any signs of corrosion, arcing and is in good mechanical condition and have safe insulation.

AFTER INSTALLATION WORK

4. Check replacement charger rack is correctly installed.

5. Re-operate all isolators to internal circuits.

   The battery shall remain isolated from external circuits at his stage.

6. Check status of battery and charger rack modules by checking LEDs on charger rack module(s).

7. Test battery output voltage with its output disconnected.

8. Reconnect battery to external circuits.

9. Carry out NR/SMS/PartB/Test/053 (ELD Function Test) or NR/SMS/PartB/Test/051 (Busbar Earth Test) on all affected power supplies.

10. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/MS11		
Replace a Power Box Temperature Sensor		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Invensys Rail : Power Box (types 1, 2 and 3) Temperature Sensor
Excludes:	All other types of Temperature Sensor

GENERAL

The removal of a Battery Pack or part of the Temperature Sensor (Figure 1) might cause a loss of power from the power box. Before attempting any maintenance on the equipment, obtain the necessary permission from the Signaller.

Fully consider and understand the consequence of any interruption.

The temperature Sensor is located behind the behind the upper battery pack on PB1 and PB2 and behind the upper battery pack on the charger rack side of the PB3.

IDENTIFICATION

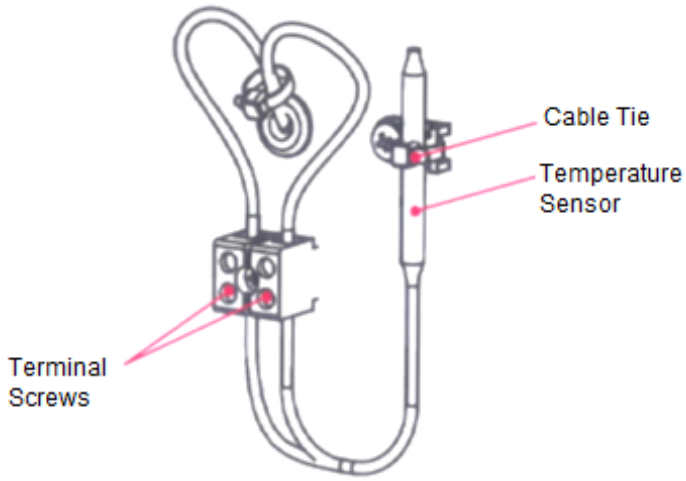


Figure 1 – Temperature Sensor

BEFORE INSTALLATION WORK

1. Check that the replacement Temperature Sensor is of the correct type (check part numbers match) and not damaged.

2. Isolate and remove the battery pack.

AFTER INSTALLATION WORK

The leads from the cable sensor are not polarity sensitive but care should be taken not to let the sensor or cable tie drop behind the other equipment.

3. Check the cable tie holding the sensor is tight and the sensor secure.

4. Reconnect battery pack to charger and input circuits by operating the isolator on the charger rack.

   If the 230v a.c supply has been lost to the Power Box at any stage during the work the red button on the charger card shall be pressed. This is controlled soft start facility for the charging circuit.

5. After replacing the battery pack check status of battery and charger by checking LEDs on charger module.

6. Test output voltage.

7. Reconnect battery to external circuits.

8. Check that the system is now fully operational.

9. Report to your SM(S) that the sensor has been replaced.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/MS12		
Replace an Invensys Rail Modular Technicians Facility PC		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Invensys Rail : Modular Technicians Facility PC (Local)
Excludes:	All other types of Technician Facility / Technicians Terminal

Liaise with the Signaller before carrying out this work.

Electrostatic precautions shall be taken when handling the evaluation board and/or the board rack.

ASSET IDENTIFICATION IMAGE

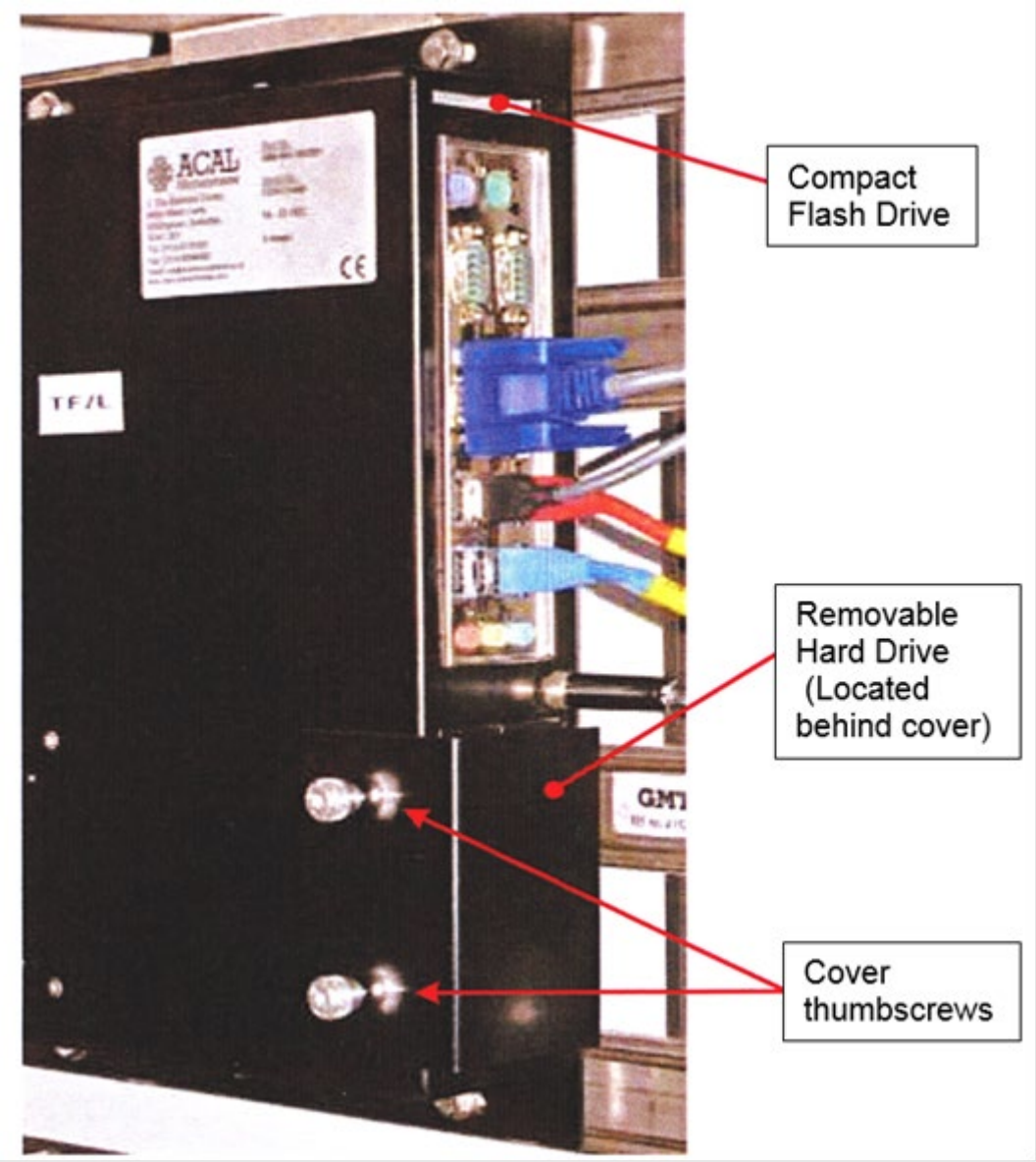


Figure 1 – Technicians Facility PC

BEFORE INSTALLATION WORK

1. Check that the replaced PC is of the correct type and not damaged. This should include a check of the Mod state to confirm it is the same or later.
2. Record the serial number of the replacement unit.
3. Isolate the power supply using the MCB.
4. Note the positions of all cables and which ports they are connected to.
5. Check the cables and wires are correctly labelled.
6. Unplug the cables from the PC.
7. Remove and retain the compact flash card.
8. Remove and retain the fixing securing the PC to the bracket and withdraw the PC.

AFTER INSTALLATION WORK

9. Insert the retained compact flash card into the replacement PC.
10. Secure the PC in position using the retained fixings.
11. Check the cables are in the correct position and then re-connect.
12. Re-apply the power supply using the associated MCB.
13. Check the replacement switch is correctly installed.
14. Perform the required test to ensure the system is operational.
15. Check or arrange for correct labelling of unit.
16. Inform the SM(S) that the unit has been changed and of the replacement unit's serial number.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/MS13		
Replace a Rextron KAG12 Switch		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Rextron KVM KAG 12 Switch
Excludes:	All other types of Digital Video Switch

GENERAL

Liaise with Signaller before carrying out this work.

Electrostatic precautions shall be taken when handling the evaluation board and/or the board rack

IDENTIFICATION

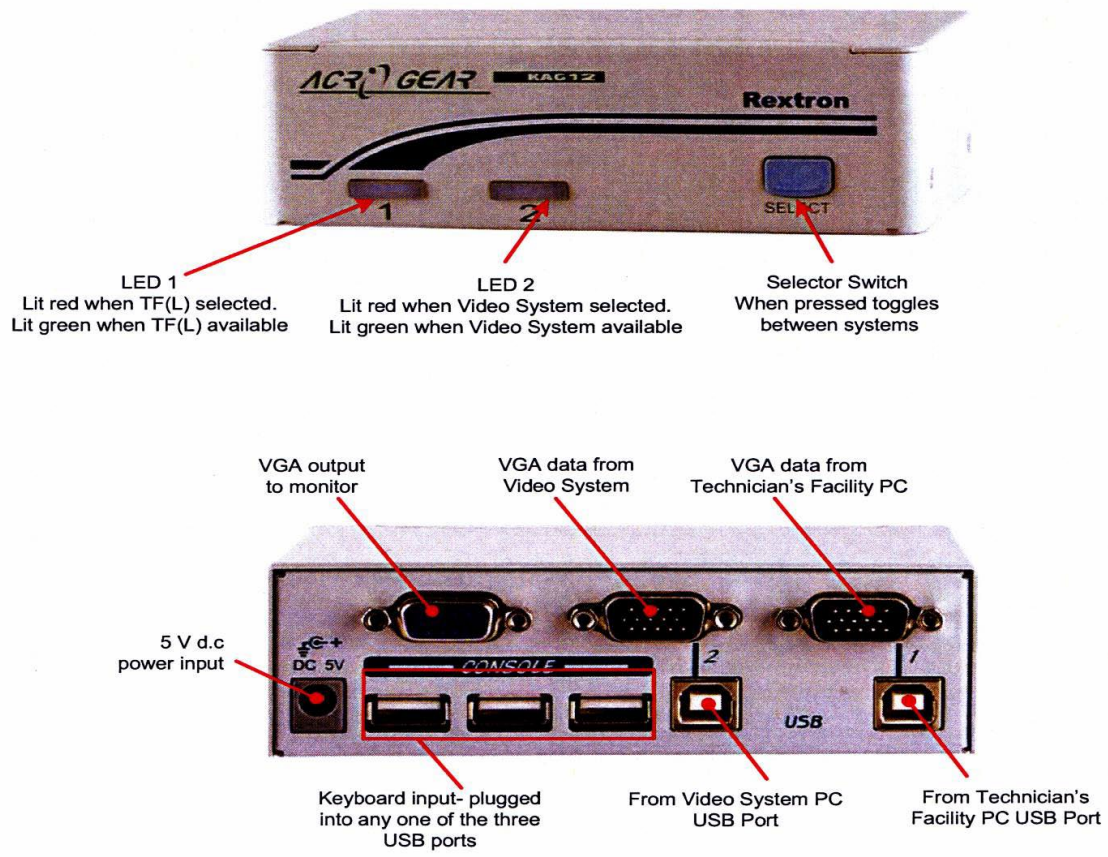


Figure 1 - Rextron KVM KAG 12 Switch

BEFORE INSTALLATION WORK

1. Check that the replaced switch is of the correct type and not damaged.

2. Isolate the power supply by removing the power input plug.

3. Note the positions of the cables connected to the switch ports. Check the cables and wires are correctly labelled.

4. Unplug the cables from the switch.

AFTER INSTALLATION WORK

5. Check the cables are in the correct position and then re-connect.

6. Check the replacement switch is correctly installed.

7. Reconnect the power supply.

8. Check both the Technician Facility and Digital Video Recorder are responding correctly.

9. Check or arrange for correct labelling of unit.

10. Inform the SM(S) that the unit has been changed and of the replacement unit's serial number.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/MS14		
Replace an Object Controller		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Invensys Rail : Modular Signalling Object Controllers (S) (P) (A) (G) (I)
Excludes:	All other Object Controllers and Invensys Modular Signalling Feeder Pillars and Power Boxes

GENERAL

Visible light is used for transmitting data in the fibre optic system and is emitted within a tiny beam size, however the intensity is to 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.

The change of any Fibre Optic Equipment will affect the correct operation of the signalling equipment either:

a) Directly controlled from the Object Controller/Modular Equipment Housing.

b) Indirectly, equipment located remotely from the site that requires the fibre optic equipment to be changed.

Preplanning is essential before carrying out the requirements of this test plan.

The SM(S) will advise you as to the extent of the potential effects on signalling and telecommunications assets.

Liaise with the Signaller before carrying out any work that will effect signalling equipment.

BEFORE INSTALLATION WORK

1. Check the replacement Object Controller is not damaged, is the correct type and has the same or later mod state.

2. Isolate the supply to the Object Controller.

DURING WORK

3. Remove and retain the following WESTRACE Modules and place in antistatic bags (If fitted).

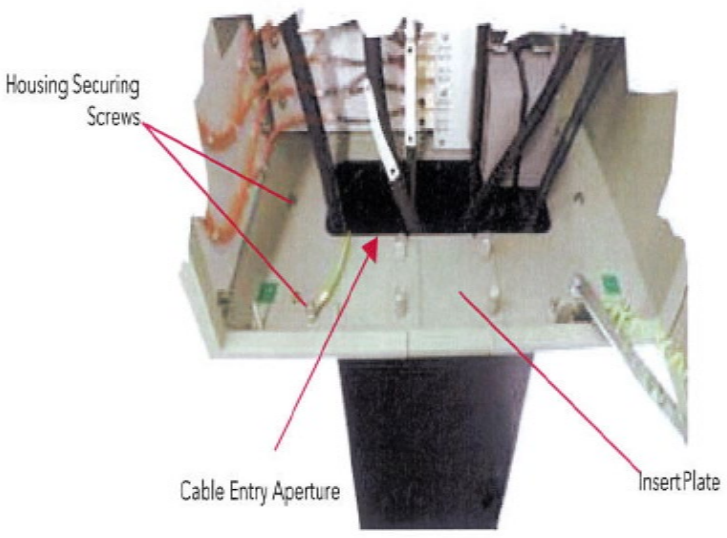


Figure 1 – Object Controller Housing

4. Remove the address configuration plug from beneath the Compact Housing and insert it into the correct location in the replacement Object Controller.

5. Remove and retain any plug-in items such as Surge Arrestors, TPWS modules, Relays etc being careful to keep them clean and undamaged.

6. Remove the Insert Plate (See Figure 1).

7. Reach into the cable entry aperture and release the pedestal door catch.

8. Disconnect the earth lead, retaining fixings.

9. Check each cable is labelled, note its position.

10. Disconnect each cable in turn if available fit plug coupler protection caps.

    Care shall be taken when moving Fibre Optic cables as they are easily broken and can suffer excessive transmission loss if bent.

    Laser light: Do not look into the unprotected fibres or point them at other people.

11. Place each cable in an individual plastic bag to protect it from moisture and remove it from the housing.

    All Object Controller housings are heavy and require more than one person to lift.

12. Remove and retain the fixings securing the housing to the pedestal and lift it clear.

13. Replace the insert plate.

14. Locate the new controller on to the pedestal and secure it in place.

AFTER INSTALLATION WORK

15. Remove the Insert plate and with the exception of the Power Cables reconnect the other cables in their correct locations.

16. Connect the earth lead.

17. Refit the WESTRACE Modules.

18. Refit all of the remaining plug in units which were removed from the original controller.

19. Reconnect the power cables.

20. Refit the insert plate.

21. Check for normal running.

    c) If the housing includes PM(s), the WESTRACE starts automatically. Wait for the WESTRACE to complete start-up sequence and then check the PM(s) for normal running.

    d) If the housing has no PMs fitted, check the SOM and MAUs LEDS for normal running.

22. Close and lock the Object Controller housing door.

23. Inform the SM(S) that the unit has been changed and the serial number of the replacement unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/MS15		
Replace a Feeder Pillar		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Invensys Rail: Modular Signalling Feeder Pillar
Excludes:	All other Feeder Pillars

GENERAL

This unit contains a 230V a.c. Supply.

Liaise with the Signaller before carrying out this work.

BEFORE INSTALLATION WORK

1. Check the replacement Object Controller is not damaged, is the correct type and has the same or later mod state.
2. Isolate the supply to the Feeder Pillar from the DNO.

DURING WORK

3. Remove the “Insert Plate” on both the current and replacement Pillars.
4. Reach into the cable entry aperture and release the pedestal door catch.
5. Disconnect the earth lead, retaining fixings.
6. Check each cable is labelled, note its position.
7. Disconnect each cable in turn. If available fit plug coupler protection caps.
8. Place each cable in an individual plastic bag to protect it from moisture and remove it from the housing.

Feeder Pillar housings are heavy and require more than one person to lift

9. Remove and retain the fixings securing the housing to the pedestal and lift it clear.
10. Replace the insert plate.
11. Locate the new Feeder Pillar on to the pedestal and secure it in place .

AFTER INSTALLATION WORK

12. Connect the earth lead.
13. Refit the insert plate.
14. Reconnect the Feeder Pillar to the DNO.
15. Check incoming and outgoing supply voltages.

16. Check all connected equipment has powered up.

17. Close and lock the Feeder Pillar housing door.

18. Inform the SM(S) that the unit has been changed and the serial number of the replacement unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/MS16		
Replace a Power Box		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Invensys Modular Signalling Power Box PB1 and PB2
Excludes:	Invensys Modular Signalling Power Box PB3

GENERAL

This unit contains a 230V a.c. Supply

Liaise with the Signaller before carrying out this work.

BEFORE INSTALLATION WORK

1. Check the replacement Power Box is not damaged, is the correct type and has the same or later mod state.
2. Isolate the supply to the Power Box.
3. Isolate all outgoing supplies.

DURING WORK

4. Remove the Insert Plate.
5. Reach into the cable entry aperture and release the pedestal door catch.
6. Disconnect the earth lead, retaining fixings.
7. Check each cable is labelled, note its position.
8. Noting their position, disconnect each cable that enters from the bottom of the housing, wrapping each one in a plastic bag to keep the connector clean and dry and remove the cables from the housing.

Both Battery and Power Boxes are heavy and require more than one person to lift.

9. Remove the Battery Packs as detailed in NR/SMTH/Part04/MS07 (Replace a Battery Pack).
10. Remove the Switch Rack as detailed in NR/SMTH/Part04/MS06 (Replace a Switch Rack).
11. Remove the Charger Rack as detailed in NR/SMTH/Part04/MS10 (Replace a Charger Rack).
12. Remove and retain the fixings securing the housing to the pedestal and lift it clear.
13. Locate the new controller on to the pedestal and secure it in place.

AFTER INSTALLATION WORK

14. Replace the Switch Rack as detailed in NR/SMTH/Part04/MS06 (Replace a Switch Rack).

15. Replace the Charger Rack as detailed in NR/SMTH/Part04/MS10 (Replace a Charger Rack).

16. Replace the Battery Packs as detailed in NR/SMTH/Part04/MS07 (Replace a Battery Pack).

17. Connect the earth lead.

18. Reconnect the cables.

19. Refit the insert plate.

20. Reconnect the incoming supply to the Power Box.

21. Reconnect the outgoing supplies.

22. Check for normal running.

23. Close and lock the Power Box housing door.

24. Inform the SM(S) that the unit has been changed and the serial number of the replacement unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/NW02		
Replace an Ethernet Extender Unit		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	Longspan Ethernet Extender Unit
Excludes:	All other types of Ethernet Extender Unit

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 – Base Side

Figure 2 - Camera Side

BEFORE INSTALLATION WORK

1. Check that the replacement Extender Unit is of the Correct Type and is Not Damaged.
2. Check the replacement is the correct version (modification level).
3. Verify the location of the faulty Extender Unit.
4. Location Case Only: Isolate the supply to the Extender Unit and verify this by using a volt meter on the input terminals.
5. WIRE COUNT the Extender Unit and check all the wires have safe insulation and are correctly labelled.
6. Remove the wires from the Extender Unit and insulate them.
7. Remove the Extender Unit and label it as faulty.

AFTER INSTALLATION WORK

8. Check that the replaced Extender Unit is securely mounted.
9. WIRE COUNT the Extender Unit and check all cables are correctly installed and secure.
10. Location Case Only: Reconnect the power supply and check the input voltages are within the specified tolerance.

11. Check the unit is working using the SRCM.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/NW03		
Replace an GE RSTi Modbus TCP- IP Network Adapter		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	GE RSTi Modbus TCP- IP Network Adapter STXMBE001
Excludes:	All other types of GE RSTi Modbus TCP- IP Network Adapter

Appropriate electrostatic precautions shall be taken when equipment. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Images

Figure 1 - A single Network Adapter

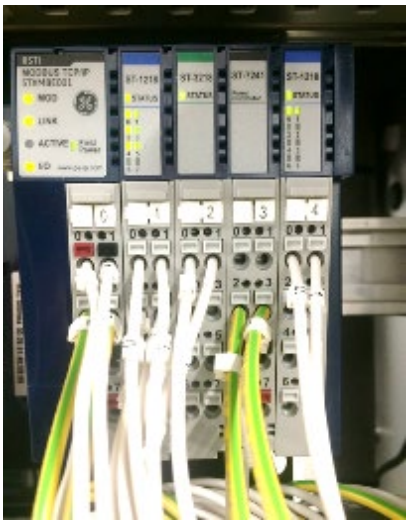


Figure 2 - An adapter with ST Modules

BEFORE INSTALLATION WORK

1. Check that the replacement Network Adapter is of the Correct Type and version (modification level).

2. Check the replacement is Not Damaged.

3. Verify the location of the faulty Extender Unit.

4. Isolate the supply to the Network Adapter and verify this by using a volt meter on the input terminals.

5. WIRE COUNT the Network Adapter Module and check all the wires have safe insulation and are correctly labelled.

6. If there is no damage to the wiring Module Connector, remove connector from Module.

7. Remove the Network Adapter and label it as faulty.

AFTER INSTALLATION WORK

8. Check that the replaced Network Adapter is securely mounted.

9. WIRE COUNT the Network Adapter and check all cables are correctly installed and secure.

10. Reconnect the power supply and check the input voltages are within the specified tolerance.

11. Carry out configuration as shown in ASM Configuration Documentation.

12. Check the unit is working (MOD, Link, IO & Field Power LED's should be lit).

    The Active Indication LED does flicker when in use.

13. Check at least one function controlled by each module operates correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/NW04		
Replace an GE RSTi ST Module Non-Configurable		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	RSTi ST-7241 Expansion Field Power Distribution module RSTi ST-1218 Digital Input 8 points Positive Logic module RSTi ST-3218 Analogue Input, 8 channels module RSTi ST 2328 24Vdc Digital Output Module RSTi ST 3214 Analogue Input Module RSTi ST 2748 Isolated Relay Output Module
Excludes:	All other types of RSTi ST Module

Appropriate electrostatic precautions shall be taken when equipment. Where provided electrostatic discharge points (ESD) shall be used.

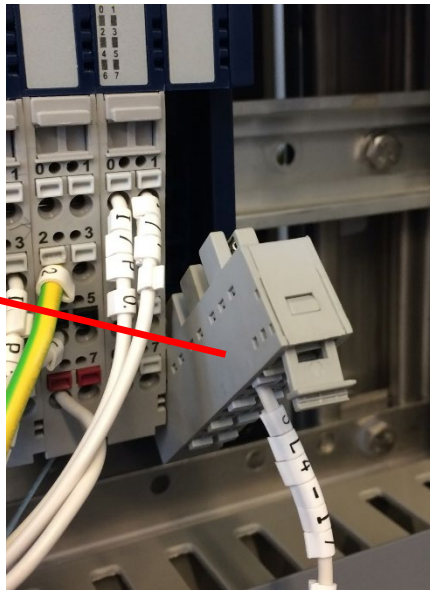
Equipment Identification Images

Figure 1 - Five RSTi ST Modules fitted to a TCP-IP Network Adapter

BEFORE INSTALLATION WORK

1. Check that the replacement ST Module is of the Correct Type and version (modification level).
2. Check the replacement is Not Damaged.
3. Verify the location of the faulty ST Module.
4. Isolate the supply to the ST Module, verify this by using a volt meter on the input terminals.
5. Check all the wires have safe insulation and are correctly labelled.

6. If there is no damage to the wiring Module Connector, remove connector from Module.



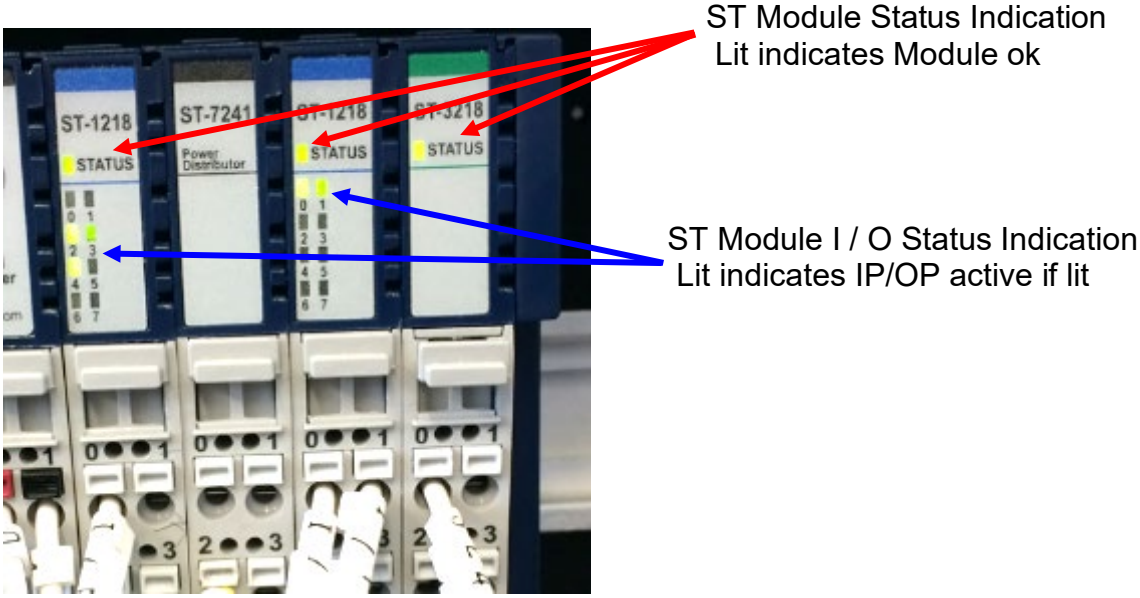
7. Remove the ST Module and label it as faulty.

AFTER INSTALLATION WORK

8. Check that the replaced ST Module is securely mounted.

9. Reconnect the power supply to TCP-IP Network Adapter (including ST 7241 if used) and check the input voltages, refer to design for voltages.

10. Check the unit is working (Status LED lit, I/O may also be active).



11. Check at least one function controlled by each module operates correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/NW05		
Replace an GE RSTi ST Module Configurable		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	RSTi ST 5444 4 Channel PWM Output Source Module
Excludes:	All other types of RSTi ST Module

Appropriate electrostatic precautions shall be taken when equipment. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Images

Figure 1 - RSTi ST Modules configurable fitted to a TCP-IP Network Adapter

BEFORE INSTALLATION WORK

1. Check that the replacement ST Module is of the Correct Type and version (modification level).

2. Check the replacement is Not Damaged.

3. Verify the location of the faulty ST Module.

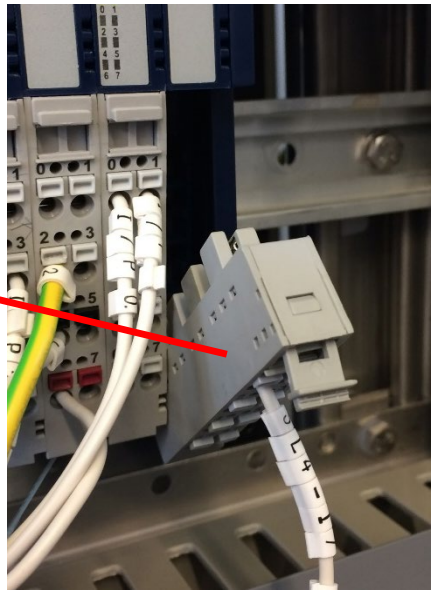
4. Isolate the supply to the TCP-IP Network Adapter and the ST Module, verify this by using a volt meter on the input terminals.

5. WIRE COUNT the TCP-IP Network Adapter and the ST Module.

6. Check all the wires have safe insulation and are correctly labelled.

7. If there is no damage to the wiring Module connector, remove connector from Module.

Module Connector



8. Remove the ST Module and label it as faulty.

AFTER INSTALLATION WORK

9. Check that the replaced ST Module is securely mounted.

10. WIRE COUNT the TCP-IP Network Adapter and the ST Module, check all cables are correctly installed and secure.

11. Reconnect the power supply and check the input voltages are within the specified tolerance.

12. Carry out Configuration as shown in ASM Calibration Documentation.

13. Check the unit is working.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/NW06		
Replace CISCO SFP Transceiver Module		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	GLC-FE-100LX-RGD SFP GLC-LX-SM-RGD SFP GLC-FE-100LX SFP GLC-FE-100FX SFP
Excludes:	All other Transceiver Modules

Appropriate electrostatic precautions shall be taken when equipment. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 - CISCO Transceiver Module

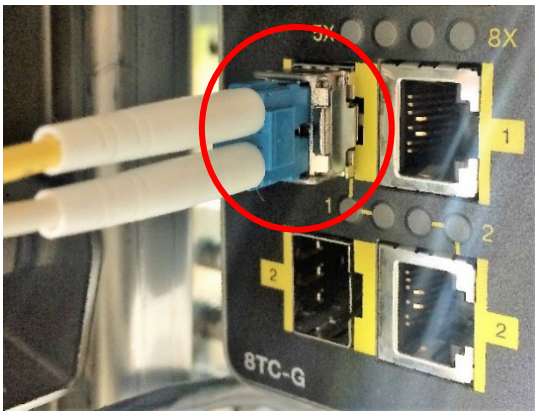


Figure 2 - CISCO Transceiver Module located in switch

BEFORE INSTALLATION WORK

1. Check that the replacement module is of the Correct Type and Version (modification level).
2. Check the replacement is Not Damaged.
3. Verify the location of the faulty module.
4. Check all cables are correctly labelled.

5. Disconnect the cable and fit an “End Cap” in protect the fibre optic cable from contamination.

6. Remove module and label as faulty.

AFTER INSTALLATION WORK

7. Check the replaced module is securely mounted.

8. Remove the “End Cap” and visually check for contamination of the fibre.

9. Reconnect the cable.

10. Check one of the functions passing through the CISCO Network is working correctly.

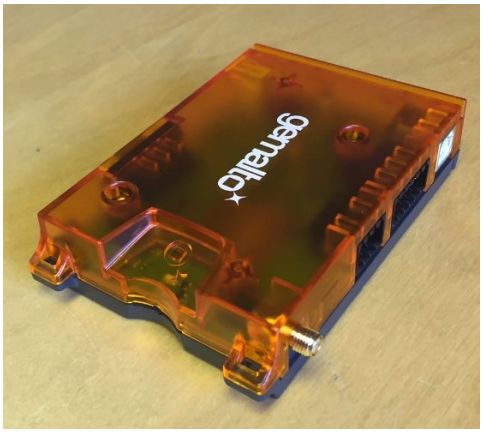
END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/NW07		
Replace a StackWatch Modem		
Issue No: 01	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Stackwatch Modem
Excludes:	All other types and styles of Modem

For further information See NR/SMS/Appendix/26 (General Information on the Fuel Cell System).

Equipment Identification Image



Modem View 1 Modem View 2

Figure 1 – StackWatch Modem

BEFORE INSTALLATION

1. Check that the replacement Modem is of the correct type, version (modification level).
2. Check the replacement unit is not damaged.
3. Disconnect the power supply.
4. WIRE COUNT existing modem to the wiring diagram.
5. Check existing wiring has safe insulation.
6. Check existing wiring is correctly labelled.
7. Remove the SIM Card and transfer it to the replacement modem.
8. Remove the Modem and label it as faulty.

AFTER INSTALLATION

9. Check the Modem is securely fitted.

10. Check each cable connection is tight and secure.

11. Reconnect the power supply.

12. Check the red LED is illuminated.

    This indicated there is network connection.

13. Carry out the Configuration of the StackWatch Modem as shown in Appendix A.

14. The replaced unit should be returned to the depot for recycling.

APPENDIX A - Configuration of the Stackwatch Modem

This process shall only be carried out by a person holding the "level 2" competency related to this equipment, if at any point during the process you are unsure of what you are seeing or the actions you should take, you should immediately stop work and seek advice.

For further information See NR/SMS/Appendix/26 (General Information on the Fuel Cell System).

Equipment Identification Image

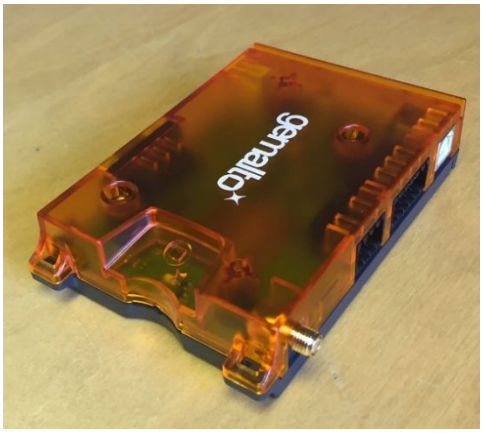


Figure 2 – StackWatch Modem

CONFIGURATION PROCESS

1. Open an internet browser (such as Edge, Chrome or Firefox) and navigate to:

http://portal.fuelcellsystems.co.uk

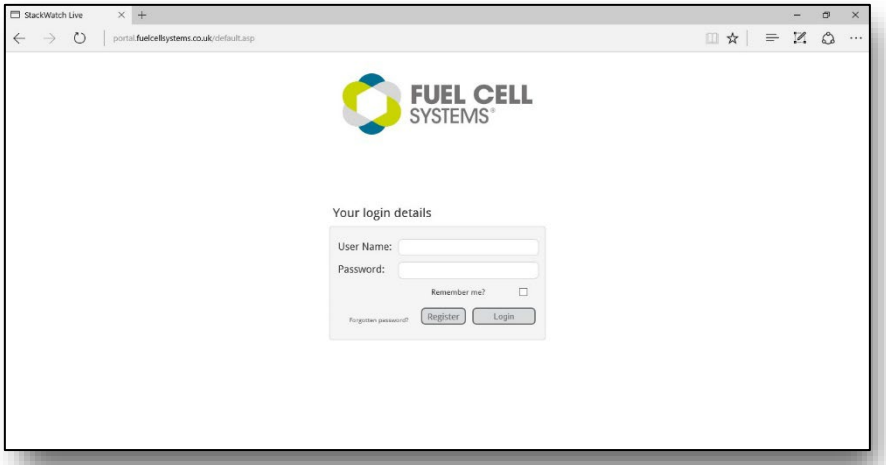


Figure 3 – Log In Screen

2. Log in with your user name and password (See Figure 3).

3. Once you are logged into StackWatch, you are presented with a screen similar to the one shown in Figure 4 for each piece of equipment you have monitored.

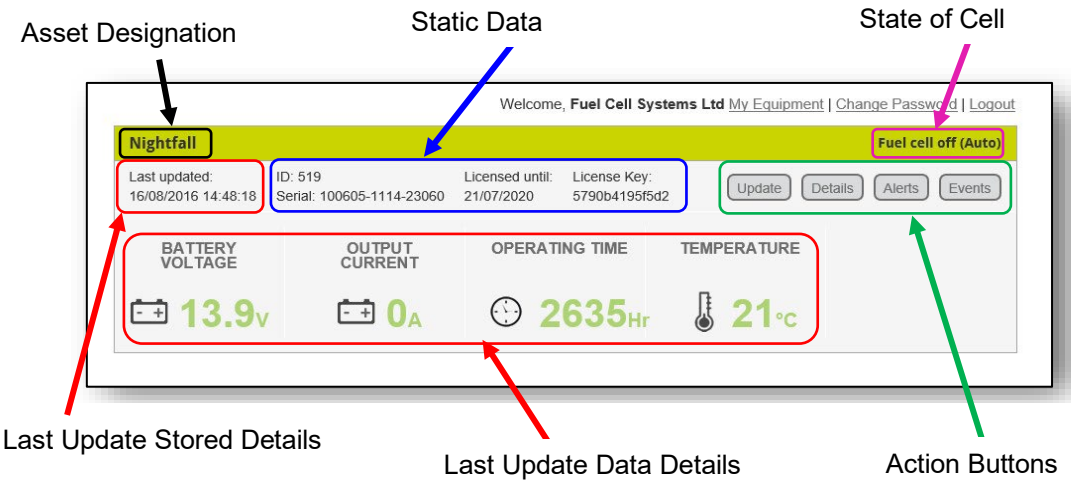


Figure 4 - Asset Detail Screen

4. This screen gives the following information:

a) Asset Designation - Asset Name (Local Name).

b) State of Cell - What state the Fuel Cell is in. (On – Off – Auto – Manual).

c) Static Data – Serial numbers, licence dates, License Key and unit ID.

Heading	Description
ID	The unique ID assigned to this equipment.
Serial Number	The Serial Number of the fuel cell unit we expect to be monitoring.
Licensed Until	The date that the service license expires.
License Key	The service license for the monitoring of each piece of equipment.

Table 1 – Additional Information

4.1 Action Buttons

Button	Action
Update	Places the unit into the Stackwatch dial queue to retrieve the latest data (in advance of the next automatic update).
Details	Displays the Details page providing more information on the unit.
Alerts	Allows you to add and remove recipients of email and SMS alerts.
Events	Displays the event log for this unit.

Table 2 – Button Actions

4.2 Last Update Stored Details - This is the date and time the Fuel Cell updated its Date Details.

4.3 Last Update Data Details - These are the last data details received from the Fuel Cell.

5. Figure 5 shows the "Details" Page which gives the ability to interrogate the data.

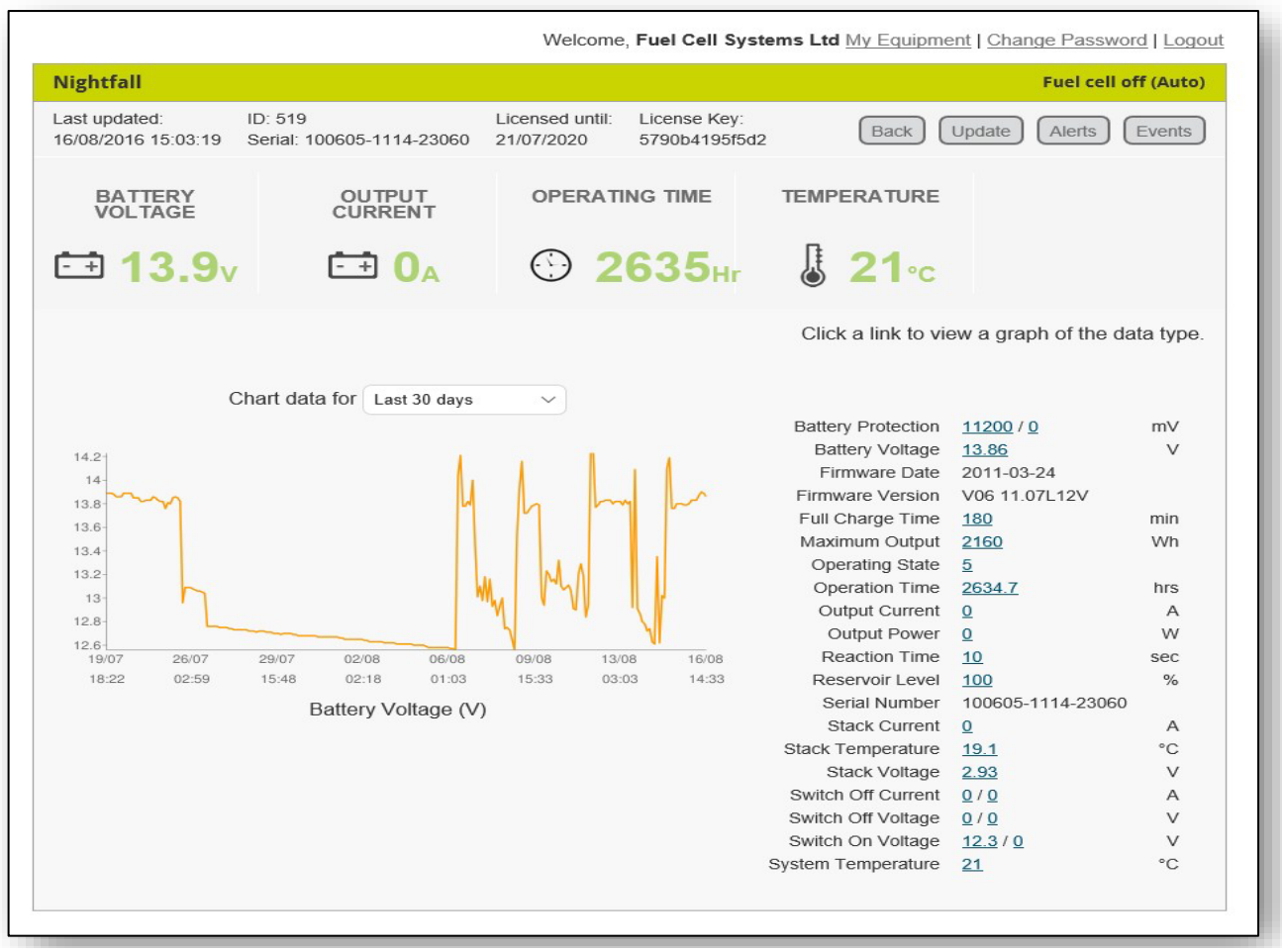


Figure 5 – The Details Page

The right-hand side displays the last values stored by StackWatch.

By clicking on any item, a graph appears on the left-hand side showing the historic data.

You can change the time period this is displayed over by using the drop-down menu above the graph.

6. Figure 6 shows the "Notifications" Page which allows the automatic notification from the system to be configured and amended as required.

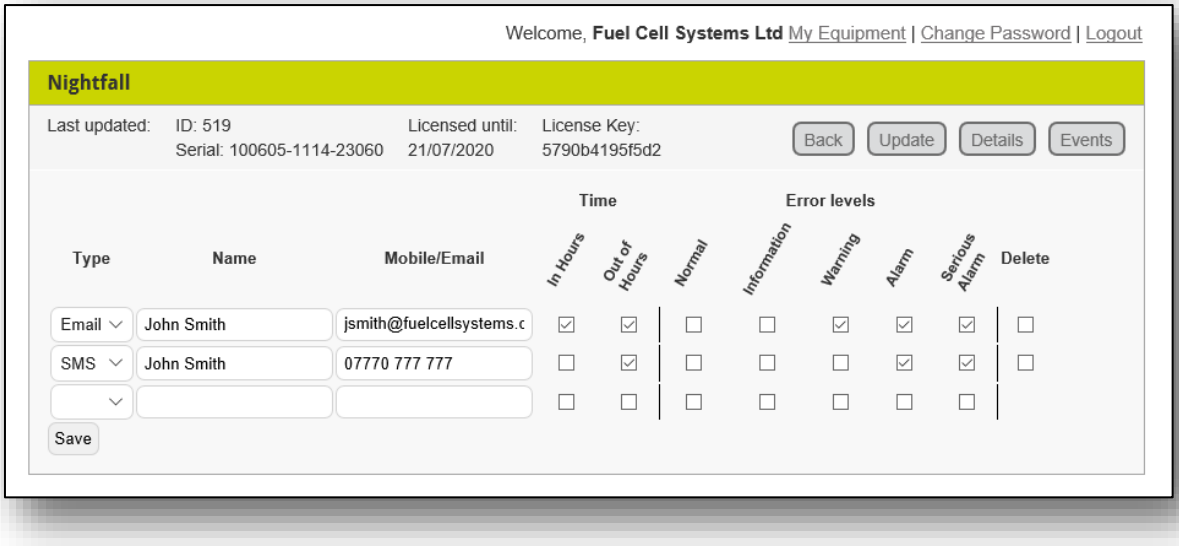


Figure 6 – Notifications Page

Heading	Description
Type	Email or SMS notifications.
Name	Name of the person receiving the notification.
Mobile/email	Either a mobile number or email address.
In hours / Out of hours	Tick to receive messages in and out of business hours. (0900 – 1700).
Normal / Information / Warning / Alarm / Serial Alarm	Tick to receive alerts for the different levels of alarm.
Delete	Tick to delete this contact.
Save	Saves the above information.

Table 3 – Notification Setup Options

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/NW08		
Replace a Dell KMM Rack Mounted Monitor		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	Dell DKMM LED 185 KMM rack mounted monitor
Excludes:	All other types of rack mounted monitors

Appropriate electrostatic precautions shall be taken when equipment. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 - KVM Monitor: Front view, stored position

Figure 2 - KVM Monitor: Top view, extended position

BEFORE INSTALLATION WORK

1. Check that the replacement KMM monitor is of the Correct Type version (modification level).
2. Check the replacement is not damaged.
3. Verify the location of the faulty KMM monitor.
4. Disconnect the KMM monitor power supply unit.
5. Disconnect the VGA connector(s) and PC jack plug. Check all the wires are correctly labelled.
6. Remove the KMM monitor and label it as faulty.

AFTER INSTALLATION WORK

7. Check that the replaced KMM monitor is securely mounted.

8. Reconnect the VGA connector(s) and PC jack plug to the KMM monitor and check all cables are correctly installed and secure.

9. Reconnect the power supply.

10. Check the KMM monitor LED power indicator, Red when the power is connected, Blue when the screen is opened.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/NW09		
Replace a Dell KVM Switch		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	Dell KVM SV831DUSBUK Switch
Excludes:	All other types of switch

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 - Dell KVM Switch: Front view

Figure 2 - Dell KVM Switch: Rear view

BEFORE INSTALLATION WORK

1. Check that the replacement KVM switch is of the Correct Type and version (modification level).
2. Check the replacement is not damaged.
3. Verify the location of the faulty KVM switch.
4. Disconnect the KVM switch power supply unit.
5. WIRE COUNT the unit and check cables for safe insulation.
6. Disconnect the VGA DIL connectors and PC jack plug connectors. Check all the wires are correctly labelled.
7. Remove the KVM switch and label it as faulty.

AFTER INSTALLATION WORK

8. Check that the replaced KVM switch is securely mounted.

9. Reconnect the VGA DIL connectors and PC jack plug connectors to the KVM switch and check all connectors are correctly installed and secure.

10. WIRE COUNT the unit.

11. Reconnect the power supply.

12. Check on the front of the KVM switch that the power indicator is illuminated.

END

Includes:	Brandrex FPCC1SXXX48LC2 Patch Panel
Excludes:	All other types of patch panel

The patch panel is used only for fibre optic cables and is unpowered.

Equipment Identification Image

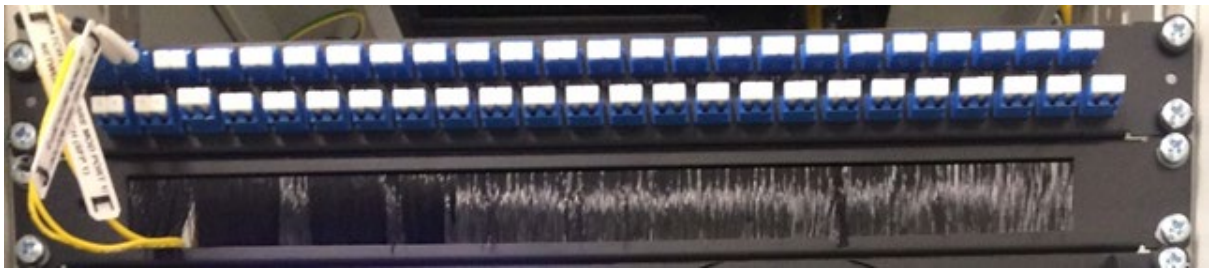


Figure 1 - Brandrex Patch Panel

BEFORE INSTALLATION WORK

1. Check that the replacement patch panel is of the Correct Type and version (modification level).
2. Check the replacement is not damaged.
3. Verify the location of the faulty patch panel.
4. WIRE COUNT the cables and check for safe insulation.
5. Check all the patch cables are correctly labelled.
6. Disconnect the patch cables from the patch panel (apply dust covers).
7. Remove the patch panel and label it as faulty.

AFTER INSTALLATION WORK

8. Check that the replaced patch panel is securely mounted.
9. Reconnect all the patch cables (remove dust covers)
10. WIRE COUNT the patch panel and check the cables are correctly installed and secure.
11. Check there are no “link faults” showing on the SRCM.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/NW11		
Replace a Network / Ethernet Switch		
Issue No: 03	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	CISCO IE2000, CISCO CGS2520, CISCO IE4000, CISCO WS-C3750X, CISCO 3850, CISCO IE-3010, RuggedCom 1500, RuggedCom 1510, RuggedCom i802 Westermo Lynx L106, Westermo TD-36, Westermo L110-F2G, Amplicon ex43008, CISCO WS 2960 CISCO C9300L and MOXA N Port 6650.
Excludes:	All other types of network switch

***** NOT INDEPENDENCE EXEMPT IF CONFIGURATION IS REQUIRED *****

Asset Identification Images

CISCO IE 2000

CISCO CGS2520

CISCO WS-C3750X

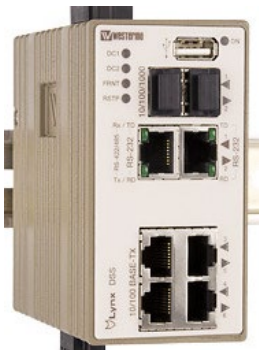
CISCO IE4000

CISCO 3850

RuggedCom 1500

RuggedCom 1510

RuggedCom i802



Westermo Lynx L106

Amplicon ex43008

Westermo TD-36

CISCO WS 2960

CISCO IE-3010

Westermo L110-F2G

MOXA N Port 6650

CISCO C9300L

Figure 1 - Types of Network / Ethernet switch

Appropriate electrostatic precautions shall be taken. Where provided electrostatic discharge points (ESD) shall be used.

BEFORE INSTALLATION WORK

1. Check that the replacement switch is of the correct type and is not damaged.

2. Check the replacement is the correct version (firmware modification level).

3. Verify the location of the faulty switch.

4. Isolate the supply to the switch and verify where possible by using a volt meter on the input terminals.

   NOTE: *In some locations the power supply is duplicated, in which case both power supplies should be isolated.*

   NOTE: *In some cases, switches can be replaced without powering down the switch. This should only be undertaken after confirming that this is acceptable for the system being worked on.*

5. WIRE COUNT the switch and check all the wires/cables have safe insulation and are correctly labelled.

6. Remove the cables from the switch and insulate them (for fibre cables install dust covers).

   NOTE: *Some switches require these disconnections to be carried out following a set sequence.*

7. If provided: Remove SD card from the faulty unit and place it into the replacement unit.

   NOTE: *If the SD card is found to be faulty refer to the "Configuration Procedure" in the site-specific equipment manuals.*

8. Remove the switch and label it as faulty.

AFTER INSTALLATION WORK

9. Check that the replaced unit is securely mounted.

10. Replace the wires/cables into the unit.

    NOTE: *Some switches require these reconnections to be carried out in a different sequence from the disconnection sequence.*

11. WIRE COUNT the unit and check all cables are correctly installed and secure.

12. Reconnect the power supply if disconnected in step 4.

CONFIGURATION

13. If the unit requires configuration. Carry out the requirements as described in the site-specific equipment manuals.

NOTE: *At some locations the unit might have been pre-configured in which case this step is not required.*

TEST

14. When the configuration procedure has been completed, check one of the functions passing through the replaced unit is working correctly.

15. Check any monitoring equipment to verify the unit is functioning as expected.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/NW12		
Replace a Network Time Protocol (NTP) Server		
Issue No: 01	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Time & Frequency Solutions M210 NTP Rackmount Server
Excludes:	All other NTP Servers and the M210 NTP Antenna

Appropriate electrostatic precautions shall be taken when working on this equipment. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 - M210 NTP Server (Front)

Figure 2 - M210 NTP Server (Back)

BEFORE INSTALLATION WORK

1. Check that the replacement unit is the correct type and version is not damaged.

   Use the Maintenance Workstation or ASM Configuration Documentation to verify the replacement module is the correct version.

2. Check the replacement unit is the correct version (hardware and firmware).

3. Verify the location of the faulty unit.

4. Switch off the power using the switch on the back of unit.

5. Isolate the supply to the unit.

6. WIRE COUNT the unit and check all the wires have safe insulation and are correctly labelled.

7. Remove the wires from the unit and insulate them in the following sequence:

   a) Power.

   b) Cat5e Cables.

8. Remove the unit from the cubicle and label it as faulty.

AFTER INSTALLATION WORK

9. Check that the replaced M210 Server unit is securely mounted in the cubicle.

10. WIRE COUNT the M210 NTP Server unit and check all cables are correctly installed and secure.

11. Reconnect the wires to unit in the following sequence:

    a) Cat5e Cables.

    b) Power.

12. Reconnect the supply.

13. Switch on the power using the switch on the back of the M210 NTP Server unit.

14. Carry out Configuration as shown in the ASM Configuration Documentation - Configure a Time & Frequency Solutions M210 NTP Server.

15. When the configuration procedure has been completed check that the Server unit is tracking a minimum of 3 Satellites.

Figure 3 - Display indicating tracking 4 Satellites

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/NW13		
Replace a Network Time Protocol (NTP) Antenna		
Issue No: 2	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	M210 NTP Rackmount Server Antenna
Excludes:	All other NTP Equipment

***** INDEPENDENCE EXEMPT *****

Appropriate electrostatic precautions shall be taken when using this equipment. Where provided electrostatic discharge points (ESD) shall be used.

Equipment Identification Image

Figure 1 - Antenna (External)

Figure 2 - Antenna (Internal)

BEFORE INSTALLATION WORK

1. Check that the replacement antenna is of the correct type and is not damaged.
2. Verify the location of the faulty antenna.
3. Isolate the antenna connection from the rear of the M210 NTP server unit.
4. Check all the cables to the antenna have safe insulation and are correctly labelled.
5. Remove the wires from the antenna and insulate them.
6. Remove the M210 NTP server antenna from the mounting position and label it as faulty.

AFTER INSTALLATION WORK

7. Check that the replaced antenna is securely mounted in the correct position.
8. Check all the cables to the antenna are correctly installed and secure.
9. Re-connect the antenna connection to the rear of the M210 NTP server unit.

10. Check that the M210 NTP Server unit is tracking a minimum of 3 Satellites.

Figure 3 – Display indicating tracking 4 Satellites

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/OD01		
Replace an MCB-OD RADAR Scanner		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Complete Replacement of Honeywell YD136C series RADAR scanner
Excludes:	All other OD systems

GENERAL

Before any work is undertaken the following shall be undertaken:

a) Crossing Placed in XCU or LCU Mode or auto lower inhibited by Signaller.

b) Return to normal OD operation shall not occur unless the equipment has passed all tests and is fit for use.

The unit might be supplied with a plug coupler (YD136C1) connection or non-plug coupled (YD136C2).

Due to the Set-up process being too complex to describe in SMTH format, reference shall be made to the Installation and Setup Manual for RADAR to complete the stages referred to in this SMTH test plan.

BEFORE INSTALLATION WORK

1. Check that the affected scanner is correctly isolated. Slip the disconnection links for the affected scanner tail cable (non-plug coupled) and also disconnect the plug coupler (plug coupled version).

2. Check that the replacement scanner is of the correct type and is not damaged.

3. WIRE COUNT the existing scanner cable to the wiring diagram (non-plug coupled version).

4. Check after first removing all wires from the scanner terminals (non-plug coupled version) or with plug coupler disconnected (plug coupled version) the existing cables to equipment room have safe insulation.

5. Check the existing wiring is correctly labelled.

AFTER INSTALLATION WORK

6. WIRE COUNT the replacement scanner cable to the wiring diagram (non-plug coupled version).

7. Check the replacement scanner is correctly installed and secure.

8. Check that the cable is correctly labelled, secured and correctly routed.

9. Check that the beam height is correct (Installation and Set Up Manual).

10. Check the Surveillance Area created is correct (Installation and Set Up Manual).

11. Remove any litter and vegetation near the scanner and within the Surveillance Area.

12. Test the replacement scanner (Walk Tests from Installation and Setup Manual) and record the test measurements on a new Record Card.

13. With the Signallers' permission, restore the crossing to automatic OD operation.

14. Observe that the crossing has successfully restored to normal operation by observing the next train if possible.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/OD02		
Replace a Level Crossing LIDAR Scanner		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	LIDAR scanners used at level crossings e.g. RLS3060 and RLS3060SH
Excludes:	All other OD systems.

Before any work is undertaken the following shall be undertaken:

a) Crossing Placed in XCU/CCU or LCU Mode or auto lower inhibited by signaller as appropriate for the level crossing type.

b) Return to normal operation using OD equipment shall not occur unless the equipment has passed all tests and is fit for use.

The unit may be supplied with a plug coupler connection or non-plug-coupled version.

Both plug coupled and non-plug coupled versions have an Ethernet connection in addition to the power/relay output cable. This connects via a standard RJ45 plug via a weatherproof connection box.

Reference shall be made to the Installation and Setup Manual for LIDAR in order to complete the stages referred to in this SMTH test plan.

BEFORE INSTALLATION WORK

1. Check that the affected scanner is correctly isolated. Slip the disconnection links for the affected scanner tail cable (non-plug coupled) and disconnect the plug coupler (plug coupled version).

2. Check that the replacement scanner is of the correct type and is not damaged.

3. WIRE COUNT the existing scanner cable to the wiring diagram (non-plug coupled version).

4. Check after first removing all wires from the scanner terminals (non-plug coupled version) or with plug coupler disconnected (plug coupled version) the existing signalling cable has safe insulation.

5. Check the existing wiring is correctly labelled.

AFTER INSTALLATION WORK

6. WIRE COUNT the replacement scanner cable to the wiring diagram (non plug coupled version).

7. Check the replacement scanner is correctly installed and secure.

8. Check that the cable is correctly labelled, secured and correctly routed.

9. Check that the beam height is correct (Installation and Set Up Manual).

10. Check the Detection Area created is correct (Installation and Set Up Manual).

11. Remove any litter and vegetation near the scanner and within the Detection Area.

12. Test the replacement scanner (Carry out the “Walk Tests” from Installation and Setup Manual) and Record the test measurements on a new Record Card.

13. With the Signallers’ permission, restore the crossing to operation using the OD equipment.

14. Observe that the crossing has successfully restored to normal operation by observing the next train if possible.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/OD03		
Replace an MCB-OD RADAR Scanner Replaceable Component		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Replacement of Honeywell YD136C series RADAR scanner reference reflector and Line Replaceable Components as defined in the Repair Manual
Excludes:	All other OD systems. RADAR Range Finder, RADAR Radom

GENERAL

Before any work is undertaken the following shall be undertaken:

a) Crossing Placed in XCU or LCU Mode or auto lower inhibited by Signaller.

b) Return to normal OD operation shall not occur unless the equipment has passed all tests and is fit for use.

Due to the Set-up process being too complex to describe in SMTH format, reference shall be made to the RADAR Repair Manual and Installation and Setup Manual for RADAR to complete the stages referred to in this SMTH test plan.

BEFORE INSTALLATION WORK

1. Check that the replacement component is of the correct type and is not damaged.

AFTER INSTALLATION WORK

2. Check the replacement component is correctly installed and secure.

3. Remove any litter and vegetation near the scanner and within the Surveillance Area.

4. Test the replacement component (Repair Manual) and record the test measurements on a new record card.

5. With the Signallers' permission, restore the crossing to automatic OD operation.

6. Observe that the crossing has successfully restored to normal operation by observing the next train if possible.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PA01		
Replace Rodding, Drives, Lock and Detector Equipment		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Switch extension pieces, Lock stretcher bars, lock and detector rods, Pins, Insulations, and Gate stops
Excludes:	Drive stretcher bars, Fixed stretcher bars, Adjustable stretcher bars, Electric detectors, Signal down rods and Gate locks

BEFORE INSTALLATION WORK

1. Check replacement item is not damaged and is correct type.

AFTER INSTALLATION WORK

2. Check replacement item is correctly installed.

3. Check that rodding rollers and stools are firmly installed.

4. Check any insulation, shims and self-alignment washers are correctly installed.

5. Check lock nuts, pins and/or new split pins are correctly installed (top roller, cranks).

6. Check that the apparatus operated by the replacement items functions correctly in the correct direction with satisfactory stroke and without undue strain on fittings, cranks, and stools.

POINTS ONLY:

7. Check the switch opening is correct, see NR/SMS/Part/Z02 (Point: Reference Values).

MECHANICAL POINT DETECTOR ONLY:

8. Check dummy blades/spacers are present where required.

POINTS ONLY:

9. Carry out the correct Detection Test from (NR/SMS/Test/010 to 013, 18) and record the test measurements on the record card, together with the reason for the test.

MECHANICAL DETECTOR WHERE LOCK FITTED ONLY:

10. Check that with the point/bridge not locked, the signal blades are obstructed by the lock detector blade and that the relevant signal arm cannot move more than 5 degrees from horizontal (consider climatic conditions).

POINTS ONLY:

11. Carry out the correct Facing Point Lock Test from (NR/SMS/Test/001 to 005) and record the test measurements on the record card, together with the reason for the test.

SWING / LIFT BRIDGES ONLY:

12. Check the bridge lock.

GATES ONLY:

13. Check that all gates lock correctly and securely into the gate stop. Check that the gates cannot override the stops. Check that the gates cannot be manually pushed over the stops.

GATES ONLY:

14. Check that gates cannot be operated from either fully across railway or fully across road positions while they are locked by the correct locking lever.

DETONATOR PLACER ONLY:

15. Check that lever is free to operate and correctly places detonator on railhead.

HYDRO PNEUMATIC POINTS ONLY:

16. Check point operates in specified time (Mk1-3, 17-20 seconds, or Mk4, 15-30 seconds).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PA02		
Replace or Adjust a Point Stretcher Bar		
Issue No: 07	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Drive stretcher bars, Fixed stretcher bars, Adjustable stretcher bars
Excludes:	Tubular Stretcher Bars, Lock stretcher bars

GENERAL

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.

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.

If any defects are found, other than a single loose nut and bolt, the whole assembly shall be replaced. Where an individual nut and bolt require replacement, they can be replaced individually but always as a pair.

BEFORE INSTALLATION WORK

1. **REPLACEMENT ONLY**. Check that the replacement stretcher assembly is not damaged and is correct type for the point system and position.

2. Check that the bolt threads, bar threads, and contact faces of the nuts are not damaged, rusty, dirty, and do not have grease on them as this impairs the locking action. Clean and de-grease as necessary or replace with new ones.

3. Measure the track gauge 100mm in front of the toes and at every stretcher bar position. For gauge details see NR/SMS/PartZ/Z02 (Point – Reference Values). If the points are out of gauge by -2mm/+6mm then the SM(T) shall be informed to prompt any corrective maintenance required.

4. **FIXED STRETCHER BARS ONLY**. Where the track gauge is correct or the SM(T) has authorised continuance of the wide to gauge track, the fixed stretcher bar shall be measured and drilled according to the formula detailed in NR/L2/TRK/6100/Mod03 (Installing Stretcher Bars and setting them to the correct length) to maintain the required free wheel clearance and residual switch opening for the point system.

5. F**IXED STRETCHER BARS ONLY**. Check all stretcher bar lengths to confirm correct fit of the switch rail to the stock rail. Intermediate stretchers shall not be marked and drilled until both drive and rear stretchers have been checked for free wheel clearance and residual switch opening according to the formula detailed in NR/L2/TRK/6100/Mod03 (Installing Stretcher Bars and setting them to the correct length).

6. **ADJUSTABLE STRETCHER BARS ON NON HPSA POINT SYSTEMS, REPLACEMENT ONLY.** Check that the assembly has been correctly pre-built as detailed in NR/L2/TRK/6100/Mod06 (35mm Adjustable Stretcher Bars).

7. **ADJUSTABLE STRETCHER BARS ON HPSA POINT SYSTEMS, REPLACEMENT ONLY.** Check that the assembly has been correctly pre-built as detailed in NR/L2/SIG/11400.

DURING WORK

8. **FIXED STRETCHER BARS ONLY**. Installation and nut tightening shall be undertaken as detailed in NR/L2/TRK/6100/Mod05 (Fixed Stretcher Bars).

9. **ADJUSTABLE STRETCHER BARS ON NON HPSA POINT SYSTEMS ONLY**. Adjustment shall be carried out according to the formula detailed in NR/L2/TRK/6100/Mod03 (Installing Stretcher Bars and setting them to the correct Length) – 5.2 (Calculating the required free wheel clearance), to maintain the required Free Wheel Clearance and Residual Switch Opening for the point system.

    Installation and nut tightening shall be undertaken as detailed in NR/L2/TRK/6100/Mod06 (35mm Adjustable Stretcher Bars).

10. **ADJUSTABLE STRETCHER BARS ON HPSA POINT SYSTEMS ONLY**. Adjustment shall be carried out according to the formula detailed in NR/L2/TRK/6100/Mod03 (Installing Stretcher Bars and setting them to the correct Length) – 5.2 (Calculating the required free wheel clearance), and residual switch opening for the point system.

    Installation and nut tightening shall be undertaken as detailed in NR/L2/SIG/11400.

AFTER INSTALLATION WORK

11. Check that the replaced/adjusted stretcher is correctly installed.

12. **FIXED STRETCHER BARS ONLY**. Check that all fastenings are using M20 bolts with Hardlock nuts. Check the female (convex) nuts with a with a torque wrench/spanner set to 200Nm.

13. **ADJUSTABLE STRETCHER BARS ON NON HPSA POINT SYSTEMS ONLY.** Check that the assembly has been correctly installed and/or set up as detailed in NR/L2/TRK/6100/Mod06 (35mm Adjustable Stretcher Bars).

14. **ADJUSTABLE STRETCHER BARS ON HPSA POINT SYSTEMS ONLY**. Check that the assembly has been correctly installed and/or set up as detailed in NR/L2/SIG/11400.

15. Check the insulations, where required, are correctly installed on the correct side.

    For all 6ft-mounted supplementary drives and 4ft-mounted supplementary drives with clamp locks, all stretcher bar insulations shall be in line with the soleplate insulation. For point machine operated 4ft mounted supplementary drives, the 2nd and subsequent stretcher bars shall be fitted with the insulations on the same side of the track. This avoids the risk of track circuit failure if the channel rod sag and come into contact with stretcher bars.

16. Check clearance between stretcher and bottom of stock rail for all extended stretcher bars, see NR/SMS/PartZ/Z02 (Point – Reference Values).

17. Check the switch opening is correct at the toe, see NR/SMS/PartZ/Z02 (Point – Reference Values).

18. Measure by use of the S&C gauge that the free wheel passage, free wheel clearance, and residual switch opening are correct throughout the length of the switch for the switch type and gauge of the track NR/SMS/PartC/PF01 (Point Fittings) and NR/SMS/PartZ/Z02 (Point – Reference Values). Record the results on the NR/SMS record card.

19. Check that the point drive is set correctly.

20. Check points by manual operation for freedom of movement throughout travel in both directions (N-R & R-N).

21. **SYSTEMS WITH SUPPLEMENTARY DRIVE ONLY**. Check that the supplementary drive remains effective with no signs of binding, excess wear, or distortion NR/SMS/PartC/PF02 (Mechanical Supplementary Drives).

    Any slack on adjustment in the supplementary drive shall not cause mechanical pressure forcing the switch tips away from the switch rail.

22. Test (gauge) the point detection (Detection tests (NR/SMS/PartB/Test/010 to 013 and 18)) and record the test measurements on the NR/SMS record card, together with the reason for the test.

23. **SYSTEMS WITH SUPPLEMENTARY DETECTION ONLY.** Test (gauge) the supplementary detection, see NR/SMS/PartB/Test/016 (Detection Test (Supplementary Detectors) and record the test measurements on the NR/SMS record card, together with the reason for the test.

24. Test (gauge) the facing point lock Facing Point Lock Test (NR/SMS/PartB/Test/001 to 005) and record the test measurements on the NR/SMS record card, together with the reason for the test.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PA03		
Replace a Crank or Signal Wheel		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Compensator, gate crank, gate heel drive and signal wire adjuster
Excludes:	Lever frame components

BEFORE INSTALLATION WORK

1. Check replacement item is not damaged and is correct type.

2. Check supporting stool is correct height.

AFTER INSTALLATION WORK

3. Check replacement item is correctly installed.

4. Check item is secure on the supporting stool and that the supporting stool is itself secure.

5. Check item moves freely throughout its travel.

6. Check new pins and/or split pins are correctly installed.

7. Check that chains and slings are correctly fitted (SIGNAL WHEEL OR WIRE ADJUSTER ONLY).

8. Check that the equipment operated by the crank or wheel functions in the correct direction with an acceptable amount of stroke and without undue strain on fittings or stools.

9. There should ideally be 7.5" of stroke at the lever tail (6.5" for point rodding), but this can vary by 2" over every 100 yards of wire, depending on temperature.

   For long distance signals a draught wheel is used to double the stroke for details see NR/SMS/PartC/SG00 (Signals: General) - Wire Adjustment.

10. If the crank is associated with Point Detection then a Detection Test shall be carried out NR/SMS/Test/010 to 013, 18. Record test results on the record card, together with the reason for the test.

11. For Points Only – Carry out NR/SMS/Test/001 to 005 (Facing Point Lock Test) and record the test measurements on the record card, together with the reason for the test (POINTS ONLY).

12. Check all gates lock into any gate stop (GATES ONLY).

13. Check that gates cannot be operated from either fully across the railway or fully across the road positions while they are locked by the correct locking lever (GATES ONLY).

14. Check lever is free to operate and correctly places detonator on railhead (DETONATOR PLACER ONLY).

15. Check bridge detection (SWING/LIFT BRIDGES ONLY).

16. Check point operates in specified time (Mk1to3 -17 to 20 seconds, or Mk4 - 15 to 30 sec), (HYDRO PNEUMATIC POINTS ONLY).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PA04		
Replace or Adjust a Tubular Stretcher Bar		
Issue No: 04	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Tubular Stretcher Bars
Excludes:	Fixed Stretcher Bars, Adjustable Stretcher Bars, Lock Stretcher Bars

GENERAL

Details for the installation of Tubular Stretcher Bars can be found in NR/L2/TRK/6100/Mod04 Tubular Stretcher Bars.

BEFORE INSTALLATION WORK

1. Check that the replacement Tubular Stretcher Bar is not damaged and is correct Type for the point system and position.

2. Check that the replacement motion unit is not damaged and is correct type for the point system.

3. Check that the bolts are not damaged and are correct type for the point system and position.

4. Measure the track gauge 100mm in front of the toes and at every stretcher bar position. For gauge details see NR/SMS/PartZ/Z02 (Point – Reference Values). If the nominal values are out of specification by -2mm/+6mm then the Section Manager (Track) shall be informed to prompt any corrective maintenance required.

5. Check that the tubular stretcher bar assembly has been correctly prebuilt as detailed in NR/L2/TRK/6100/Mod04 (Tubular Stretcher Bars).

DURING WORK

6. Where the track gauge is correct or the Section Manager (Track) has authorised continuance of the wide to gauge track, the tubular stretcher bar assembly shall be adjusted according to the formula detailed in NR/L2/TRK/6100/Mod03 (Installing Stretcher Bars and setting them to the correct length) to maintain the required free wheel clearance and residual switch opening for the point system.

7. Observe that the installation and nut tightening is undertaken as detailed in NR/L2/TRK/6100/Mod04 (Tubular Stretcher Bars).

AFTER INSTALLATION WORK

8. Check that the tubular stretcher bar assembly is correctly installed – (Primary and Secondary Locking Functions).

9. Apply a check torque to all fastenings (motion unit to switch rail and motion unit to tube), see NR/SMS/PartZ/Z02 (Point – Reference Values).

10. Check that the insulations are correctly installed (motion unit, drive and supplementary drive positions).

11. Check the clearance between kicking strap and the bottom of the stock rail (front stretcher bar positions only), see NR/SMS/PartZ/Z02 (Point – Reference Values).

12. Check the switch opening is correct at the toe, see NR/SMS/PartZ/Z02 (Point – Reference Values).

13. Measure by use of the S&C gauge that the free wheel passage, free wheel clearance and residual switch opening are correct through the length of the switch for the switch type and gauge of the track, see NR/SMS/PartZ/Z02 (Point – Reference Values).

    Record the results on the NR/SMS record card.

14. Check that the point drive is set correctly.

15. Check the points by manual operation for freedom of movement throughout travel in both directions (N-R & R-N).

16. **SYSTEMS WITH SUPPLEMENTARY DRIVE ONLY**. Check that the supplementary drive remains effective with no signs of binding, excess wear or distortion, see NR/SMS/PartC/PF02 (Mechanical Supplementary Drives).

    Any slack on adjustment in the supplementary drive shall not cause mechanical pressure forcing the switch tips away from the switch rail.

17. Test (gauge) the point detection, see NR/SMS/PartB/Test/011 (Detector Tests (Electrical Detectors) or NR/SMS/PartB/014 (Lock and Detector Full Test (Clamp lock)) and record the test measurements on the NR/SMS record card together with the reason for the test.

18. **SYSTEMS WITH SUPPLEMENTARY DETECTION ONLY**. Test (gauge) the supplementary detection, see NR/SMS/PartB/Test/016 (Detection Test (Supplementary Detectors)) and record the test measurements on the NR/SMS record card together with the reason for the test.

19. Test (gauge) the facing point lock, see NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)) or NR/SMS/PartB/Test/003 (Facing Point Lock Tests (Clamp lock)) and record the test measurements on the NR/SMS record card together with the reason for the test.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PB01		
Replace a Complete Clamp Lock Body		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	RCPL Mk 1 and Mk 2, IBCL (Mk 2 and Mk 3)
Excludes:	Chair locks, clamp lock detector and lock arm assembly

GENERAL

Mk1 RCPL lock bodies shall only be used as replacements where the layout prevents fitment of later versions.

BEFORE INSTALLATION WORK

1. Check replacement clamp lock body is not damaged.
2. WIRE COUNT existing microswitch assembly to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring is correctly labelled.
5. Check motor and detection are isolated from the supply.

AFTER INSTALLATION WORK

6. Check replacement clamp lock body is correctly installed.
7. Check tab washers and self-locking nuts are correctly installed.
8. Check that Spirol pins are flush with the clamp lock body (Mk 1 EQUIPMENT ONLY).
9. Check support brackets where fitted are secure and not damaged (Mk 1 EQUIPMENT ONLY).
10. Check wiring is replaced as labelled.
11. Check tail cable cores are on the correct terminals (EXCEPT FOR MOULDED CABLE).
12. WIRE COUNT replacement microswitch assembly to the wiring diagram.
13. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
14. Check terminations are secure and suitably protected.
15. Check wires and cables are secure and clear of moving parts and will not be chaffed by vibration of cover.

16. EARTH TEST (DC) or EARTH TEST (AC) detection circuits during normal and reverse power operation.

17. Test facing point lock NR/SMS/Part B/Test/003 (Facing Point Lock Tests – Clamp Lock) and record the test measurements on the appropriate NR/SMS record card, together with the reason for the test.

18. Test (gauge) clamp lock detection NR/SMS/Part B/Test/013 (Detection Test – Clamp Lock) and record the test measurements on the appropriate NR/SMS record card, together with the reason for the test.

19. POINT DETECTION AND CORRESPONDENCE TEST affected ends.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/PB02		
Replace a Hydraulic Power Pack		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Clamp lock, and Derailer power packs
Excludes:	Barrier power packs

GENERAL

All replacement hydraulic power packs shall be fitted with level indicator and snorkel valve.

BEFORE INSTALLATION WORK

1. For Missing Equipment Only: Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Check replacement hydraulic power pack is not damaged and is correct type.
3. Check concrete pedestal is not damaged, is secure and reasonably level.
4. WIRE COUNT existing hydraulic power pack to the wiring diagram.
5. Check existing wiring has safe insulation.
6. Check existing hydraulic hoses are not damaged and are the correct length.
7. INSULATION TEST replacement hydraulic power pack (minimum 2M ohms terminals to case).
8. Check existing wiring and hydraulic hoses are correctly labelled.
9. Check existing hydraulic power pack is Isolated from the supply.

AFTER INSTALLATION WORK

10. Test to ascertain any air has been excluded from the hydraulic system before continuing. Check the system for air NR/SMS/PartB/Test/015 (Clamp Lock: Test for air in the system).
11. Check replacement hydraulic power pack is correctly installed.
12. Check wiring is replaced as labelled.
13. WIRE COUNT replacement hydraulic power pack to the wiring diagram.
14. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
15. Check wires and cables are secure and clear of moving parts.

16. Check hydraulic hoses are replaced as labelled.

17. Check hydraulic hoses are free of fixed and moving parts such that they are not chafing whilst flexing in normal operation, and that all connections are secured by locking wires.

18. Check hydraulic hose locking wires are correctly fitted.

19. EARTH TEST (DC) or EARTH TEST (AC) supplies during normal and reverse power operation.

20. Check the direction lever is locked in the neutral position when the Power/Manual switch is set to power.

21. Check points, or derailer, move in the correct direction under power operation.

22. Check points, or derailer, move in the correct direction when pumped manually and do not respond to power operation whilst set to manual.

23. Check hydraulic hoses and joints for leaks and that the fluid level is correct.

24. Check or arrange for, correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PB03		
Replace a Hydraulic Actuator		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Clamp locks, Trainstops, Hydraulic Derailers, Hydraulic barrier rams, BR-WR barrier top & bottom ram brackets and pins
Excludes:	Train Operated Points, Other barrier ram brackets and pins

BEFORE INSTALLATION WORK

1. Check replacement hydraulic actuator is not damaged and is correct type.

   All replacement hydraulic actuators shall preferably be of the self-bleeding type.

2. Check existing hydraulic hoses are correctly labelled.

3. Check existing hydraulic hoses are not damaged.

4. During installation work check top ram pin moves freely in ram (BARRIERS ONLY).

AFTER INSTALLATION WORK

5. Test to ascertain any air has been excluded from the hydraulic system before continuing. See NR/SMS/PartB/Test/015 (Clamp Lock: Test for air in the system).

6. Check replacement hydraulic actuators are correctly installed.

7. For barriers, check top and bottom ram brackets correct way up. See the barrier equipment standard for critical dimensions.

8. Check split pins and/or self-locking nuts are correctly installed.

9. Check security of hydraulic actuator.

10. Check barrier ram pins move freely in the ram (BR-WR-TYPE BARRIERS ONLY).

11. Check top ram pin is prevented from turning in its frame (Mk.1 PENGUIN BARRIERS ONLY).

12. Check hydraulic hoses are installed as labelled.

13. Check hydraulic hoses are clear of moving parts.

14. Check any locking wires are correctly fitted.

15. Check apparatus moves freely in the correct direction on manual operation.

16. Check the tip force and damping are correct according to the type of barrier (see the barrier equipment standard), (BARRIERS ONLY).

17. Check wires and cables are clear of moving parts.

18. Check apparatus moves in the correct direction on power.

19. Check hydraulic hoses and joints for leaks and that the fluid level is correct.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PB04		
Replace a Hose		
Issue No: 08	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Clamp locks, Hydraulic Derailer, Hydraulic barrier, BR-WR barrier, trainstop, Electro-pneumatic points, Chair lock and Hydraulic supplementary drive pipes
Excludes:	Missing or physically separated hoses

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check replacement hose is not damaged and is correct type and length.

3. Check apparatus connectors associated with the existing hose are correctly labelled. **(**WHEN MORE THAN ONE HOSE IS DISCONNECTED).

4. Check air supply is disconnected (ELECTRO-PNEUMATIC APPARATUS ONLY).

AFTER INSTALLATION WORK

5. Test to ascertain any air has been excluded from the hydraulic system before continuing (ELECTRO-HYDRAULIC APPARATUS ONLY).

6. Check replacement hose is correctly installed.

7. Check hoses are installed as labelled.

8. Check hydraulic hoses are free of fixed and moving parts such that they do not chafe whilst flexing in normal operation.

9. Check any locking wires are correctly fitted.

10. Check apparatus moves freely in the correct direction on manual operation.

11. Check apparatus moves in the correct direction on power.

12. Check hoses and joints for leaks.

13. Check fluid level is at the correct level on the gauge. (ELECTRO-HYDRAULIC APPARATUS ONLY).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PB05		
Replace an Electric Point Detector or Microswitch		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Clamp lock, Train operated points, Individual microswitches, Microswitch assembly, All separate electrical detectors, Chair locks
Excludes:	Clamp lock body, Clamp lock detector and arm assembly

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Check replacement detector/microswitch is not damaged and is correct type.
3. WIRE COUNT existing detector/microswitch to the wiring diagram.
4. Check existing wiring has safe insulation.
5. INSULATION TEST replacement detector/microswitch (minimum 2M ohms terminals to case).
6. Check existing wiring is correctly labelled.
7. Check existing detector or microswitch is isolated from the electrical supply.
8. Check air supply is disconnected (CHAIR LOCKS ONLY).

AFTER INSTALLATION WORK

9. Check replacement detector or microswitch is correctly installed.
10. Check any self-locking nuts are correctly installed.
11. Check wiring is replaced as labelled.
12. WIRE COUNT replacement detector/microswitch to the wiring diagram.
13. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
14. Check terminations are secure and suitably protected.
15. Check wires and cables are secure and clear of moving parts.
16. Identify and carry out the correct Facing Point Lock from the following: NR/SMS/PartB/Test/001 to 005 and record the test measurements on the record card, together with the reason for the test (DETECTORS WITH INTEGRAL FACING POINT LOCKS ONLY).

17. Identify and carry out the correct Detection Test from the following: NR/SMS/PartB/Test/010 to 013 or 018 and record the test measurements on the record card, together with the reason for the test.

18. EARTH TEST (DC) or EARTH TEST (AC) detection circuits during normal and reverse power operation.

19. POINT DETECTION AND CORRESPONDENCE TEST affected ends.

20. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PB06		
Replace a Clamp Lock Detector and Lock Arm Assembly		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Clamp lock detector blade, Adjustable cam, Lock arm bracket, Lock arm, Lock arm pivot pin, Phosphor bronze bush, Drive lock slide, Coupling bar, First stretcher bar
Excludes:	Lock body, microswitches, Fixed stretcher bars, Adjustable stretcher bars

BEFORE INSTALLATION WORK

1. Check replacement item is not damaged and is correct type.

AFTER INSTALLATION WORK

2. Check replacement item is correctly installed.

3. Check all new split pins and self-locking nuts are correctly installed.

4. Check points manually for freedom of movement throughout travel.

5. Carry out NR/SMS/PartB/Test/003 (Facing Point Lock Tests (Clamp Lock)) and record the test measurements on the record card, together with the reason for the test.

6. Carry out NR/SMS/PartB/Test/013 (Detection Test (Clamp Lock) and record the test measurements on the record card, together with the reason for the test.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PB07		
Replace A Break Out Device As Used Within Hy-Drive System		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Hy-drive system only
Excludes:	All other Break Out devices

BEFORE INSTALLATION WORK

1. Check replacement Break Out Device is not damaged.

AFTER INSTALLATION WORK

2. Check the Break Out Device is correctly installed.

3. Check the Break Out Device has not been operated.

4. Test (gauge) SO Unit detection, carry out NR/SMS/PartB/Test/009 (Detection Test (SO Hydraulic Supplementary Point Drive System) and record the test measurements on the NR/SMS record card, together with the reason for the test.

5. If the Break out Device being replaced is at the rearmost SO unit then measure by use of the S&C gauge that the Free Wheel Passage & Free Wheel Clearance are correct at that position.

   For the switch type and gauge of the track NR/SMS/PartC/PF01 (Point Fittings) and Point Reference Values NR/SMS/PartZ/Z02 (Point – Reference Values). Record the results on the NR/SMS record card.

END

Includes:	Hy-drive system
Excludes:	All other point operating equipment

BEFORE INSTALLATION WORK

1. Test the gauge of the points 100mm in front of the toe and at each SO Unit position. For NR60 Inclined S&C the gauge shall be 1435mm.

   If the points are out of gauge by more than -2mm/+6mm then inform the Section Manager (Track) to enable them to decide what action shall be taken.

2. Check existing break out devices are not damaged.

3. Check replacement SO Unit is not damaged and is the correct stroke length.

4. Check existing SO Unit is isolated from the supply.

5. Check existing hydraulic hoses are correctly labelled.

6. Check existing hydraulic hoses are not damaged.

7. Check the Excalibur fixings are not damaged.

8. Check the existing plug couplers are not damaged.

9. Check the existing cables are not damaged.

AFTER INSTALLATION WORK

10. Check replacement SO Unit is correctly installed and that the packing plates and plastic cones are in place, see Figure 1.

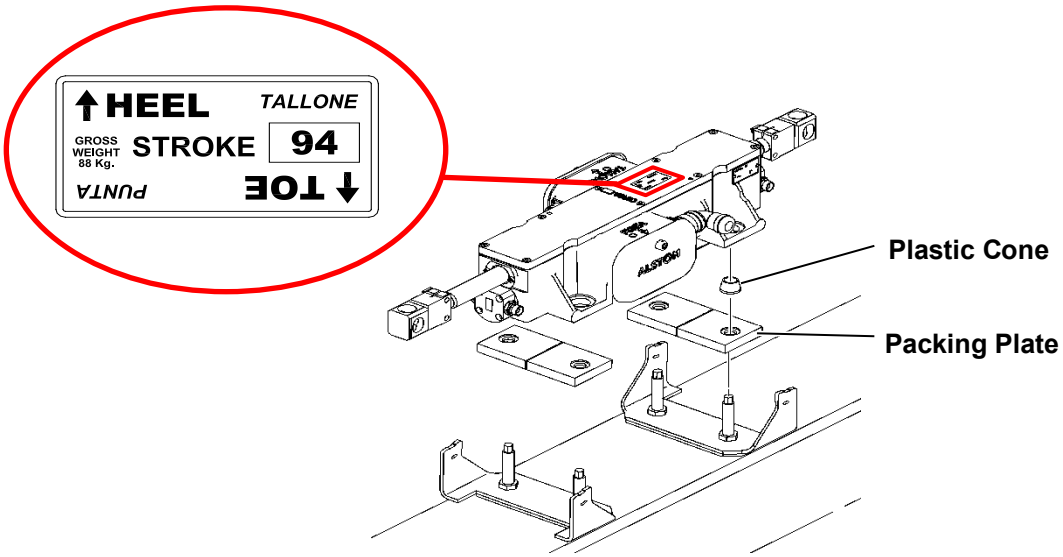


Figure 1 – Mounting an SO Unit

11. Check the plug connector so that no metallic dust, moisture or other contaminants exists between the two halves before reconnecting.

12. Check the plug coupler has correctly fastened, an audible click is heard when the coupler snaps home. A strap wrench could be used if the connection is difficult to access.

13. Check cables are clear of moving parts.

14. Check hydraulic hoses are installed as labelled.

15. Check hydraulic hoses are clear of moving parts.

16. Check that the SO fixing nuts have been torque tightened to 250Nm.

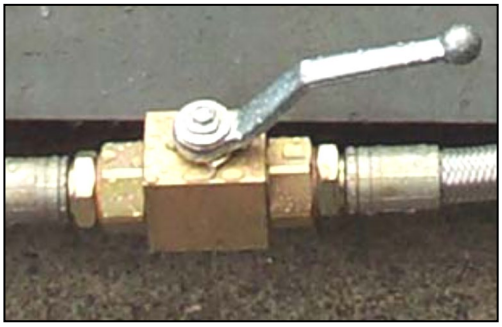
17. Test that air has been removed from the hydraulic system:

    a) Open the by-pass valve and then manually operate the points in one direction for at least 90 seconds.

    b) Close the by-pass valve and operate the points to the opposite position.

    c) Reopen the by-pass valve and manually operate the points in one direction for a further 90 seconds. Finally close the by-pass valve to return to normal operation.

“Closed” Position (Normal Operation)



“Opened” Position (Bleeding the system)

Figure 2 – By-pass valve positions

18. Check apparatus moves freely in the correct direction on manual operation.

19. Check apparatus moves in the correct direction on power.

20. Check hydraulic hoses and joints for leaks and that the fluid level is correct.

21. Check the cover has been replaced and that the fixing nuts have been torque tightened to 160Nm.

22. EARTH TEST (DC) or EARTH TEST (AC) detection circuits during normal and reverse power operation.

23. Measure by using an S&C gauge that the free wheel passage, free wheel clearance, and residual switch opening are correct throughout the length of the switch, for the switch type and gauge of the track.

24. Carry out NR/SMS/PartC/PF01 (Point Fittings) and Point Reference Values NR/SMS/PartZ/Z02 (Point – Reference Values) and record the results on the record card.

25. Test facing point lock NR/SMS/PartB/Test/003 (Facing Point Lock Tests (Clamp lock)) and record the test measurements on the record card, together with the reason for the test.

26. Test (gauge) clamp lock detection NR/SMS/PartB/Test/013 (Detection Test (Clamp Lock)) and record the test measurements on the record card, together with the reason for the test.

27. Test (gauge) SO Unit detection NR/SMS/PartB/Test/009 (Detection Test (SO Hydraulic Supplementary Point Drive System) and record the test measurements on the record card, together with the reason for the test.

* 28. Carry out POINT DETECTION AND CORRESPONDENCE TEST on the affected ends.

29. The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse position (twice if possible) to observe correct operation.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PB09		
Replace a Hy-drive Bypass Valve		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Alstom SO hydraulic supplementary drive system
Excludes:	All other types of hydraulic supplementary drive

The by-pass valve is located at the rear SO unit and is used to direct the flow of hydraulic oil to allow the system to be bled. The original by-pass valve is positioned underneath the cover of the rear SO unit. Hy-drive Mk 2 has a revised design and now the by-pass valve is housed in a lockable cover attached the rear SO cover. The operation of the valve has not changed. The cover should not be able to close if the valve is left in the bleed position – open.

Mk 1 by-pass valves cannot be upgraded to the Mk 2 valve design because the bearer may not have the extra holes required to secure the lockable cover. The cover shall be locked by a RKB221 padlock.

BEFORE INSTALLATION WORK

1. Check replacement valve with attached hose is not damaged and is correct type.

AFTER INSTALLATION WORK

2. Test to ascertain any air has been excluded from the hydraulic system before continuing. Bleeding of air, which is important for the reliable operation of the SO Units, is achieved by:

   a) Opening the By-Pass Valve;

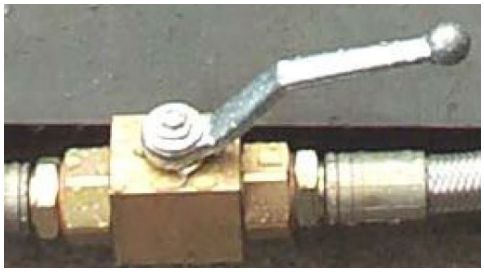


Figure 1 – Open Position

   b) Manually operating the points in only one direction (either Normal or Reverse) for at least 90 seconds;

   c) Close By-Pass valve (see Figure 18), operate switches one way and re-open By- Pass valve;

   d) Repeat the manual operation of the points in the same direction as before for 90 seconds;

   e) Close the By-Pass Valve;

Figure 2 – Closed Position

NOTE: *It is advisable to bleed longer switches SG, G and H for 120 seconds.*

3. Check replacement valve is correctly installed.

4. Check hoses are installed as labelled.

5. Check hydraulic hoses are free of fixed and moving parts such that they will not chafe whilst flexing in normal operation.

6. Check apparatus moves freely in the correct direction on manual operation.

7. Check apparatus moves in the correct direction on power.

8. Check hoses and joints for leaks.

9. Check fluid level is sufficient.

10. Check that the valve is closed and locked.

NOTE: *To lock the By-pass valve into position when work is complete. This is done by removing the handle completely, and turning the washer 90 degrees, and then re-assembling the handle. If this is done correctly, the handle cannot turn and is locked in the closed position.*

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PB18		
Remove and Refit Hydraulic Derailer Unit		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Hydraulic Derailers powered by SPX Hydraulic Pumps and Actuators. (Type BRB 817)
Excludes:	All other types of Derailer

GENERAL

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.

Figure 1 Hydraulic Derailer

BEFORE INSTALLATION WORK

1. Check replacement Derailer unit is not damaged and is the correct type.

2. Check the Derailer power pack has been isolated from the supply.

AFTER INSTALLATION WORK

3. Check replacement Derailer is correctly installed.

4. Check the torque settings of the nuts for the bolts holding the derailer mechanism to the rail at 80Nm.

5. Carry out the mechanical set up and test requirements as shown in NR/SMS/PartB/Test/020 (Hydraulic Derailer (Type BRB 817) Tests) - Section 1.

6. Carry out the Detection, Motor Cut out and correspondence test as shown in NR/SMS/PartB/Test/020 (Hydraulic Derailer (Type BRB 817) Tests) - Sections 2, 3 and 4.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PC02		
Replace an Electric Motor		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Point machine, Boom gate, BR-WR style hydraulic barrier, Electro–mechanical barriers, Hydraulic power pack integral motor, Signal machines
Excludes:	Hydraulic pump

BEFORE INSTALLATION WORK

1. Check replacement electric motor is not damaged and is correct type.
2. WIRE COUNT existing electric motor to the wiring diagram.
3. Check existing wiring has safe insulation.
4. INSULATION TEST replacement electric motor (minimum 2M ohms terminals to case).
5. Check existing wiring is correctly labelled.
6. Check existing electric motor is isolated from the supply.

AFTER INSTALLATION WORK

7. Check replacement electric motor is correctly installed.
8. Check wiring is replaced as labelled.
9. WIRE COUNT replacement electric motor to the wiring diagram.
10. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
11. Check terminations are secure and suitably protected.
12. Check wires and cables are secure and clear of moving parts.
13. Test for correct polarity **(DC MOTORS ONLY).**
14. EARTH TEST (DC) or EARTH TEST (AC) electric motor.
15. Check that the apparatus moves in the correct direction under power.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PC03		
Replace a HW2000 Point Machine Clutch		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	HW 2000 point machine
Excludes:	HW 1000 point machine clutch

BEFORE INSTALLATION WORK

1. Check replacement clutch is not damaged and is correct type.
2. WIRE COUNT existing clutch to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing clutch is isolated from the supply.

AFTER INSTALLATION WORK

5. Check replacement clutch is correctly installed.
6. Check wiring is replaced as labelled.
7. WIRE COUNT replacement clutch to the wiring diagram.
8. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
9. Check terminations are secure and suitably protected.
10. Check wires are secure and clear of moving parts.
11. EARTH TEST (DC) or EARTH TEST (AC) circuits and supplies during normal and reverse operation.
12. * Test clutch for correct operation. Carry out a clutch slip current test as shown in NR/SMS/PartC/PC05 (Point Machine HW Style).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PC04		
Replace an Ansaldo T72 Point Machine VCC 'C' Arm Assembly		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	'C' arm assembly, shims, Hammer head bolts, Consumable wear components, Roller stabiliser
Excludes:	Lock frame assembly, Detector, brass plunger, Hollow bolt assembly

General

- Shims and a 4mm diameter drill are required.

BEFORE INSTALLATION WORK

1. Check replacement 'C' arm assembly is complete with wear pads and is not damaged and is correct type.
2. Check each replacement hammer head bolt assembly is complete with two plain and two spring washers, castellated nut and split pin and is not damaged (two assemblies required for each 'C' arm assembly).
3. Check replacement roller stabiliser components are not damaged.
4. Check replacement pads/plastic sleeve are not damaged.
5. WIRE COUNT existing detector to the wiring diagram.
6. Check existing wiring has safe insulation.
7. Check existing wiring is correctly labelled.
8. Check detection is Isolated from the supply.

AFTER INSTALLATION WORK

9. Check replacement 'C' arm assembly is correctly installed.
10. Check each replacement hammer head bolt/washers/nut/split pin assembly is correctly installed.
11. Check replacement roller stabiliser components are correctly installed.
12. Check replacement pads/plastic sleeve are correctly installed.
13. Check VCC detector assembly is correctly installed.
14. Check VCC coupling rod is correctly installed and adjusted.
15. Check tab washers, nuts and split pins are correctly installed.
16. Check wiring is replaced as labelled.

17. WIRE COUNT the new detector to the wiring diagram.
18. Check tail cable cores are on the correct terminals.
19. Check terminations are secure and suitably protected.
20. Check wires and cables are secured clear of moving parts.
21. Check points manually for freedom of movement throughout travel.
22. Carry out NR/SMS/PartB/Test/005 (FPL Test (VCC Lock).
23. Carry out NR/SMS/PartB/Test/007 (Detection Test (VCC Detector).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PC05		
Replace an Ansaldo T72 Point Machine VCC Lock Frame Assembly		
Issue No: 02	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Lock frame assembly, Detector, Brass plunger, Hollow bolt assembly
Excludes:	'C' arm assembly, Shims, Hammer head bolts, Consumable wear components, Roller stabiliser

General

If 'C' arm assembly is disconnected see also NR/SMTH/Part04/PC04 (Replace an Ansaldo T72 Point Machine VCC 'C' Arm Assembly).

Split pins shall not be re-used, confirm replacement pins (4mm diameter x 32mm) are readily available.

BEFORE INSTALLATION WORK

1. Check replacement VCC lock frame assembly is not damaged and is correct type.
2. Check replacement hollow bolt assembly is complete with spring washer and nut and is not damaged.
3. Check replacement brass plunger is not damaged and is correct type.
4. WIRE COUNT existing detector to the wiring diagram.
5. Check existing wiring has safe insulation.
6. Check existing wiring is correctly labelled.
7. Check detection is isolated from the supply.

AFTER INSTALLATION WORK

8. Check replacement VCC lock frame assembly is correctly installed (VCC Clamp Lock Installation Manual Section 1).
9. Check replacement hollow bolt assembly is correctly installed (VCC Clamp Lock Installation Manual Section 1).
10. Check plastic sleeve. Renew if worn deeper than 1mm.
11. Check 'C' arm assembly is correctly installed (VCC Clamp Lock Installation Manual section 2).
12. Check each hammer head bolt/washers/nut/split pin assembly is correctly installed NR/SMTH/Part04/PC04 (Replace an Ansaldo T72 Point Machine VCC 'C' Arm Assembly) and VCC Clamp Lock Installation Manual section 2.

13. Check replacement brass plunger is correctly installed NR/SMS/Appendix/02 (General Information on Ansaldo Signalling Equipment) and VCC Detector Maintenance Manual section 2.

14. Check VCC detector assembly is correctly installed and adjusted. NR/SMS/Appendix/02 and VCC Detector Maintenance Manual section 1.

15. Check VCC coupling rod is correctly installed and adjusted (VCC Clamp Lock Maintenance Manual section 2).

16. Check tab washers, nuts and split pins are correctly installed.

17. Check wiring is replaced as labelled.

18. Check tail cable cores are on the correct terminals

19. Check terminations are secure and suitably protected

20. Check wires and cables are secured clear of moving parts.

21. Check points manually for freedom of movement throughout travel.

22. Test (gauge), carry out NR/SMS/PartB/Test/005 (FPL Test (VCC Lock).

23. Test (gauge), carry out NR/SMS/PartB/Test/007 (Detection Test (VCC Detector)).

24. POINT DETECTION AND CORRESPONDENCE TEST affected ends.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PC06		
Replace an Ansaldo T72 Point Machine VCC Detector Unit		
Issue No: 02	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	AnsaldoT72 Point Machine
Excludes:	Clamp lock, train operated points, individual micro-switches, micro-switch assembly, all separate electric detectors, chair locks

BEFORE INSTALLATION WORK

1. Check replacement VCC detector assembly is not damaged and is correct type and hand.
2. WIRE COUNT existing detector to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring is correctly labelled.
5. Check detection is isolated from the supply.

AFTER INSTALLATION WORK

6. Check replacement VCC detector assembly is correctly installed.
7. Check tab washers, nuts and split pins are correctly installed.
8. Check wiring is replaced as labelled.
9. Check terminations are secure and suitably protected.
10. Check wires and cables are secured clear of moving parts.
11. Adjust detector cam stroke tappet screw NR/SMS/PartB/Test/007 (Detection Test T72 with VCC Detector).
12. Check, whilst manually operating points, correct operation of detector.
13. Check points manually for freedom of movement throughout travel.
14. Test (gauge) NR/SMS/PartB/Test/005 (Facing Point Locks Tests (T72 with VCC Lock)).
15. Test (gauge) NR/SMS/PartB/Test/007 (Detection Test T72 with VCC Detector).
16. As applicable, carry out NR/SMS/PartB/Test/016 (Detection Test (Supplementary Detectors)).
17. POINT DETECTION AND CORRESPONDENCE TEST affected ends.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PC07		
Replace a WRSL Style 63 Point Machine Circuit Controller		
Issue No: 02	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Circuit controllers fitted to WRSL style 63 point machines
Excludes:	All other types of circuit controller

GENERAL

Because of the nature of the work this test plan calls on the Maintenance Testers to check the installer. This means that the Maintenance Tester needs to directly observe that the person doing the installation work (The Installer) carries out the task as described.

For information on the installation of Style 63 Point Machine Circuit Controller, refer to SMS/Appendix/32.

BEFORE INSTALLATION WORK

1. Check replacement circuit controller is not damaged and has a test certificate from the manufacturer or servicing agent.
2. WIRE COUNT existing circuit controller to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check the point machine is isolated (drive fuse and detection fuses removed).

AFTER INSTALLATION WORK

5. Check wiring is replaced as labelled.
6. WIRE COUNT replacement circuit controller to the wiring diagram.
7. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
8. Check terminations are secure and suitably protected.
9. Check wires are secure and clear of moving parts.
10. Replace fuses. EARTH TEST (DC) or EARTH TEST (AC) circuits and supplies during normal and reverse operation.
11. Test (gauge) point detection, carry out NR/SMS/PartB/Test/011 (Electrical Detection Test (Machine)) and record the test measurements on the NR/SMS record card, together with the reason for the test (circuit controller replacement).
12. Test facing point lock, carry out NR/SMS/PartB/Test/001 (FPL Test (Machine)) and record the test measurements on the NR/SMS record card, together with the reason for the test (circuit controller replacement).

13. POINT DETECTION AND CORRESPONDENCE TEST affected ends.

14. Check snubbing is effective by observing pulleys at the end of the stroke.

NOTE: *With the snubbing performing correctly, pulleys stop rapidly and easily. If the snubbing is faulty, the driveslide continues to its end stop, causing 'wind up' of the ballscrew and the pulleys reverse their rotation for a few degrees after stopping.*

15. Forward the certificate of conformity for the new Circuit Controller to the SM(S).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PC08		
Replace a HW2000 Point Machine Variable Resistor		
Issue No: 02	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Variable Resistor fitted to HW 2000 style Point Machines
Excludes:	All other Variable Resistors

BEFORE INSTALATION

1. Check replacement resistor in not damaged and is the correct type.
2. WIRE COUNT existing resistor to wiring diagram.
3. Check the existing wiring for safe insulation.
4. Check existing variable resistor is isolated from the supply.

AFTER INSTALLATION WORK

5. Check replacement resistor is correctly installed.
6. Check the wiring is labelled.
7. WIRE COUNT replacement resistor to wiring diagram.
8. Check any links, red dome nuts or equivalent, are correctly replaced and secure.
9. Check terminations are secure and suitably protected.
10. Check wires are secure and clear of moving parts.
11. EARTH TEST (DC) or EARTH TEST (AC) circuits and supplies during normal and reverse operation.
12. Test Clutch for correct operation, carry out NR/SMS/PartC/PC05 (Point Machine HW Style).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PC09		
Replace a HW Style Point Machine Gearbox		
Issue No: 04	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	HW 1000 and HW 2000 point machines
Excludes:	All other point operating equipment types

BEFORE INSTALLATION WORK

1. Check replacement gearbox is not damaged and is of correct type.

2. Check point motor is isolated from the supply.

AFTER INSTALLATION WORK

3. Check replacement gearbox is correctly installed.

4. Check wires and cables are secure and clear of moving parts.

5. Check the replacement gearbox operates smoothly and without undue strain during manual operation.

6. Check the point end moves in the correct direction whilst under power with adequate stroke and without undue strain on fittings.

7. Test clutch for correct operation, see clutch slip current test (NR/SMS/PartC/PC05 (Point Machine HW Style) - Steps 11.4 and 11.5.

8. Test (gauge) point detection, carry out NR/SMS/PartB/Test/011 (Detector Tests (Electrical Detectors)) and record the test measurements on the appropriate NR/SMS record card, together with the reason for the test.

9. Test facing point lock, carry out NR/SMS/PartB/Test/001 (FPL Test (Machine) and record the test measurements on the appropriate NR/SMS record card, together with the reason for the test.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PC10		
Upgrade a HW1121 Point Machine Snubbing Resistor		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	HW 1121 snubbing resistor 4 Ohm to 3 Ohm conversion
Excludes:	All other snubbing resistors

BEFORE INSTALLATION WORK

1. Check replacement resistor is not damaged and is a 3 Ohm type.
2. WIRE COUNT existing component terminals to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring is correctly labelled.
5. If not monitored by ELD, carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests).
6. Check existing component is isolated from the supply.
7. Measure and record the existing escapement, (using Appendix A) see Figure 1.

Figure 1 – Photo of Escapement Measurement

The HW1121 point machine has a throw of 152mm. The escapement measurement added to the switch rail opening at the drive stretcher bar equals the total machine throw. Wear in Roller Bearing, Throw Bar, Drive Rod Coupling Lug or Overdriving results in the sum of the measurements being less that 152mm

8. Measure and record left and right-hand switch rail openings at drive stretcher bar (using Appendix A).
9. Renew operation contacts and set contact (Figure 2) gap.

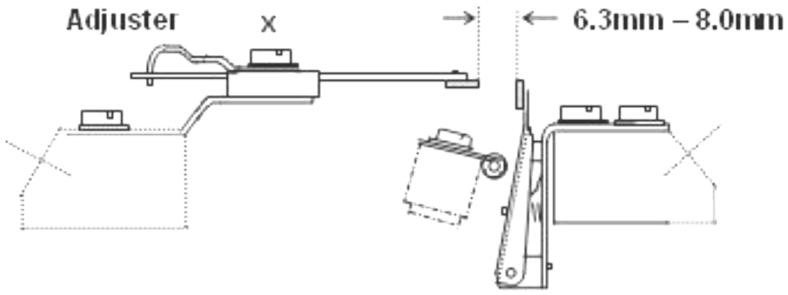


Figure 2 – Contact Gap

10. Measure and record both snubbing circuits resistance (using Appendix A).

    This is expected to be less than 5.7ohms.

    To do this unplug snubbing diode block and connect meter (see Figure 3):

    a) Bottom male pins (1&4) when D5-D6 contacts made.

    b) Top male pins (3&6) when C3-C4 contacts made.

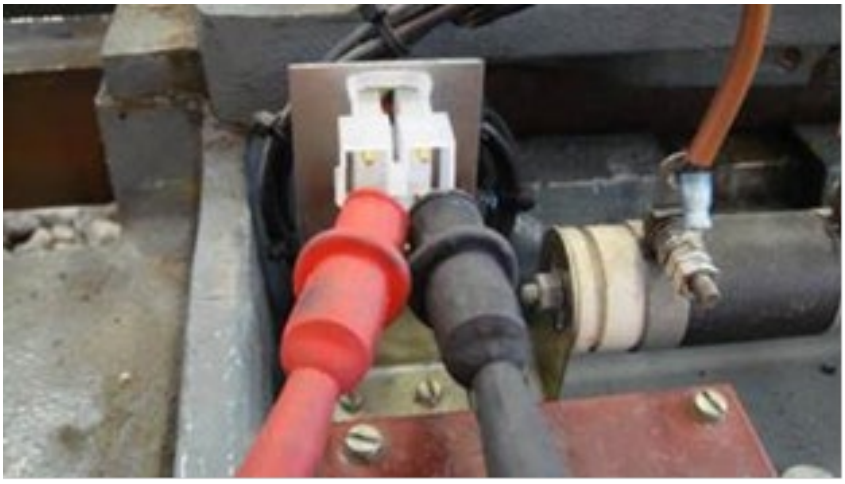


Figure 3 – Snubbing Circuit Resistance Testing Connections

11. Install the 3 Ohm replacement resistor and affix the label ‘Modified Resistor Fitted’ to the top of the point machine gearbox cover.

AFTER INSTALLATION WORK

12. Check replacement resistor is correctly installed.

13. Check wiring is replaced as labelled.

14. Check terminations are secure and suitably protected.

15. Re measure and record snubbing circuit resistance (using Appendix A).

16. WIRE COUNT replacement resistor terminals to the wiring diagram.

17. Check that the points operated by the replacement items functions correctly in the correct direction with necessary stroke and without undue strain on fittings and the front stretcher.

18. Check replacement contacts is correctly installed.

19. Check wiring is replaced as labelled.

20. WIRE COUNT replacement contact to the wiring diagram.
21. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.

22. Check terminations are secure and suitably protected.

23. Test that the replacement contact only makes and breaks in the correct positions as specified in the wiring diagram.

    There shall no undue strain (flex) on the front stretcher. If required adjust the amount of point drive.

24. Check, measure and record escapement (using Appendix A).

25. Check wires and cables are secure and clear of moving parts.

26. Check function operated by the replacement contact operates correctly.

27. If not monitored by ELD, Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests).

28. Carry out NR/SMS/PartB/Test/001 (FPL Test (Machine) and record the test measurements on the NR/SMS record card, together with the reason for the test.

29. Check that the label ‘Modified resistor fitted’ has been fixed to the gearbox cover.

30. Complete HW1121 point machine 3 Ohm snubbing resister record fitment form (Appendix A) and return to SM(S).

APPENDIX A - HW1121 Point Machine 3 Ohm snubbing resister fitment record

Equipment Details

Signal Box or Control Centre	
Point Number	
Point End	
Serial Number of Point Machine	
Date of conversion	

Before Checks

Snubbing Circuit resistance checks		
C3-C4 made		Ohms
D5-D6 made		Ohms

Escapement		mm
Left Hand Switch Opening		mm
Right Han Switch Opening		mm

After Checks

Snubbing Circuit resistance checks		
C3-C4 made		Ohms
D5-D6 made		Ohms

Escapement		mm
Left Hand Switch Opening		mm
Right Han Switch Opening		mm

This form is to be returned to the SM(S) on completion of the work.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PC11		
Replace an HW Style Throw Bar Assembly		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	HW Style Throw Bar
Excludes:	All other types of Throw Bar

Before installation

1. Check replacement throw bar is not damaged and is the correct type.
2. Check the machine is isolated from its supply.

After installation

3. Check keeper plates are present and are not damaged.
4. Check throw bar is correctly installed & greased.
5. Check locking bar moves freely within the replacement throw bar.
6. Check the throw bar coupling connection and drive rod are correctly installed.
7. Check cables and wiring are secure and free of moving parts.
8. Check replacement throw bar operates smoothly and without undue strain during manual operation.
9. Check the point end moves in the correct direction whilst under power with adequate stroke and without undue strain on fittings.
10. Carry out NR/SMS/PartC/PC05 (Point Machine HW Style) - steps 10.5 and 10.6.
11. Carry out NR/SMS/PartB/Test/011 (Electrical Detection Test (Machine)) and record measurements on the record card along with the reason for test.
12. Carry out (NR/SMS/PartB/Test/001) (Facing Point Locks Tests, Machines) and record the measurements on the record card, along with the reason for the test.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PC51		
Replace a Complete Point Machine		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Electric and electro–pneumatic point machines, Chair locks, Separate AC point controller units
Excludes:	Any other type of point operating equipment (POE)

BEFORE INSTALLATION WORK

1. Check replacement unit is not damaged and is correct type (internal configurable wiring and straps).
2. WIRE COUNT existing unit to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring (and hoses for EP machines and chair locks) are correctly labelled.
5. Check replacement controller contacts are in the correct position (matching existing), (SEPARATE AC POINT CONTROLLER UNITS ONLY).
6. Check existing unit is isolated from the electrical supply.
7. Check air supply is disconnected (ELECTRO-PNEUMATIC MACHINES AND CHAIR LOCKS ONLY).

AFTER INSTALLATION WORK

8. Where any plug coupler is used check that no metallic dust exists between the two halves before reconnecting the plug couplers.
9. Check replacement unit is correctly installed.
10. Check wiring (and hoses for EP machines and chair locks) are replaced as labelled.
11. WIRE COUNT replacement unit to the wiring diagram.
12. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
13. Check terminations are secure and suitably protected.
14. Check wires and cables are secure and clear of moving parts.
15. Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests) section 1 or 4 depending on whether the points are electronically monitored.
16. Carry out Test NR/SMS/PartB/Test/011 (Electrical Detection Test - Machine) and record the results on the record card, together with the reason for the test (CHAIR LOCKS, ELECTRIC AND ELECTRO-PNEUMATIC POINT MACHINES ONLY).

17. Carry out NR/SMS/Test/001 (FPL Test - Machine) and record the results on the record card, together with the reason for the test (CHAIR LOCKS, ELECTRIC AND ELECTRO-PNEUMATIC POINT MACHINES ONLY).

18. Carry out a POINT DETECTION AND CORRESPONDENCE TEST of the affected ends.

Separate AC point controller units shall be treated as a separate affected end for correspondence and detection tests.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PC81		
Replace a Unistar HR Machine		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Unistar HR Point Machines
Excludes:	Any other type of point operating equipment (POE)

BEFORE INSTALLATION WORK

1. Check replacement unit is not damaged and is correct type and set for correct stroke (External and internal data plate).

2. Check existing unit is isolated from the electrical supply.

3. Check existing plug coupled cables have safe insulation.

4. Check existing wiring and hydraulic are correctly labelled.

AFTER INSTALLATION WORK

5. Where any plug coupler is used check that no metallic dust exists between the two halves before reconnecting the plug couplers.

6. Check replacement unit is correctly installed.

7. Check installation is in accordance with NR/SMS/PartZ/Z02 (Point - Reference Values).

8. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.

9. Check plug coupled cables and hydraulic hoses are secure and clear of moving parts.

10. Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests) section 1 or 4 depending on whether the points are electronically monitored.

11. Where the machine being replaced is fitted at the toe of the points, carry out NR/SMS/Test/270 (Facing Point Lock Tests (Unistar HR) and record the results on the record card, together with the reason for the test.

12. For any machine being replaced, carry out NR/SMS/Test/271 (Detection Test (Unistar HR)) and record the results on the record card, together with the reason for the test.

13. POINT DETECTION AND CORRESPONDENCE TEST the affected ends.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PC82		
Replace a Unistar HR Pump Unit		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Unistar HR Power Packs
Excludes:	Barrier, Clamp lock, and Derailer power packs

GENERAL

All replacement hydraulic power packs shall be fitted with level indicator and overpressure cut off relief valves.

BEFORE INSTALLATION WORK

1. For Missing Equipment Only: Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Check replacement hydraulic power pack is not damaged and is correct type.
3. Check concrete pedestal is not damaged, is secure and reasonably level.
4. Check existing plug coupled leads are undamaged.
5. Check existing hydraulic hoses are not damaged and are the correct length.
6. Check existing plug coupled leads and hydraulic hoses are correctly labelled.
7. Check existing hydraulic power pack is Isolated from the supply.

AFTER INSTALLATION WORK

8. Bleed the system to ascertain any air has been excluded from the hydraulic system before continuing.
9. Check replacement hydraulic power pack is correctly installed. Pedestal securing fastenings and power pack fastenings torqued to values given in NR/SMS/PartZ/Z02 (Point - Reference Values).
10. Check plug coupled leads are replaced as labelled and gland plates / hood latches secured.
11. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
12. Check wires and cables are secure and clear of moving parts.
13. Check hydraulic hoses are replaced as labelled.
14. Check hydraulic hoses are free of fixed and moving parts such that they are not chafing whilst flexing in normal operation, and that all connections are secured by locking wires.

15. Check points move in the correct direction under power operation.

16. EARTH TEST (DC) or EARTH TEST (AC) supplies during normal and reverse power operation.

17. Check points move in the correct direction when pumped manually and do not respond to power operation whilst set to manual.

18. Check advisory LEDs illuminate and correspond to direction of movement selected (Normal/Reverse).

19. Check Direction Indication plates adjacent to manual selection switch and on Advisory LEDs are installed correctly to reflect the Normal lie of the points.

20. Check hydraulic hoses and joints for leaks and that the fluid level is correct.

21. Check or arrange for, correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PD01		
Replace an Electro-Pneumatic (EP) Valve		
Issue No: 06	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	EP points, chair locks, trainstop
Excludes:	All other Electro-Pneumatic equipment

BEFORE INSTALLATION WORK

1. Check replacement EP valve is not damaged and is correct type.
2. WIRE COUNT existing EP valve to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring is correctly labelled.
5. Check existing EP valve is isolated from the electrical supply.
6. Check air supply to existing EP valve is disconnected.

AFTER INSTALLATION WORK

7. Where any plug coupler is used, check that no metallic dust exists between the two halves before reconnecting the plug couplers.
8. Check replacement EP valve is correctly installed.
9. Check wiring and hoses are replaced as labelled.
10. Checkpoints move in the correct direction when operated manually **(EP POINTS ONLY).**
11. WIRE COUNT replacement EP valve to the wiring diagram.
12. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
13. Check terminations are secure and suitably protected.
14. Check wires and cables are secure and clear of moving parts.
15. EARTH TEST (DC) or EARTH TEST (AC) EP valve.
16. Carry out NR/SMS/PartB/Test/011 (Electrical Detection Test – Machine) and record the test measurements on the NR/SMS record card, together with the reason for the test **(EP POINTS ONLY)**.
17. Test (gauge) point detection **(CHAIR LOCKS ONLY).**
18. Check EP valve position corresponds to position of trainstop arm **(TRAINSTOPS ONLY).**

19. Test detection corresponds with the arm position for both up and down positions of the trainstop arm **(TRAINSTOPS ONLY)**.

20. Check points move in the correct direction under power operation **(POINTS/CHAIR LOCKS ONLY).**

21. Check pneumatic hoses and joints for leaks.

22. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PD02		
Replace an Electro-Pneumatic (EP) Piston		
Issue No: 06	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Pneumatic pump motor
Excludes:	All other pump motors

BEFORE INSTALLATION WORK

1. Check replacement EP piston is not damaged and is correct type.
2. Check existing air hoses are correctly labelled.
3. Check air supply to existing EP piston is disconnected.

AFTER INSTALLATION WORK

4. Where any plug coupler is used, check that no metallic dust exists between the two halves before reconnecting the plug couplers.
5. Check replacement EP piston is correctly installed.
6. Check air hoses are replaced as labelled.
7. Check air hoses are secure and clear of moving parts.
8. Check air hoses and joints for leaks.
9. Check that the points move in the correct direction under power operation.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PD03		
Replace an Electro-Pneumatic (EP) Slide Bar Assembly		
Issue No: 06	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Electro-Pneumatic (EP) Slide Bar
Excludes:	All other Slide Bars

BEFORE INSTALLATION WORK

1. Check replacement assembly is not damaged and is correct type.

2. Check air supply is disconnected and exhausted.

AFTER INSTALLATION WORK

3. Where any plug coupler is used, check that no metallic dust exists between the two halves before reconnecting the plug couplers.

4. Check replacement assembly is correctly installed.

5. Check that points move in the correct direction under power operation.

6. Carry out, NR/SMS/PartB/Test/001 (FPL Test (Machine) and record the test measurements on the NR/SMS record card, together with the reason for the test.

END

Includes:	HPSS (HPSA point machine); Electronic Control Unit (ECU), motor, brake, toe and supplementary ail position sensors, power isolation switch, internal HPSA cables, supplementary cables, and tail cables
Excludes:	Gearbox, supplementary sensor mounting bracket (offset / standard), drive shaft, PowerLink supplementary drives, stretcher bar

GENERAL

Ask the Signaller to operate points, to check the correct points are being tested and thus eliminate confusion or doubt.

Liaise with the Signaller to apply a safe system of work and have a safe method of communicating with the Signaller to avoid injury whilst placing and removing gauges, it is recommended that the 3.5mm Hands-Free FPL Gauge is used.

Brake Assembly

Do not operate the brake lever(s) when the brake is removed; this misaligns the brake mechanism.

Motor Assembly

Do not strike the motor during removal or replacement as the motor contains sensitive electrical parts. It is advisable to prise the motor free and not to use a hammer.

ECU

Do not sit or place heavy objects on the ECU; this damage’s the shock absorbing mounts.

Insulation Testing

Do not insulation test the motor, ECU or Rail Position Sensors as they contain sensitive electronic components. Disconnect these units before insulation testing the associated cables.

Rail Position Sensors (LVDTs)

There are two types of Rail Position Sensor(s), Insulated and Non-Insulated. Check that the correct type is fitted and is compatible with the Sensor Drive Bracket. Do not install a Non-Insulated Sensor (Toe or Supplementary) with an ‘Insulated’ Drive Bracket, See Figure 1, as this can lead to detection performance issues.

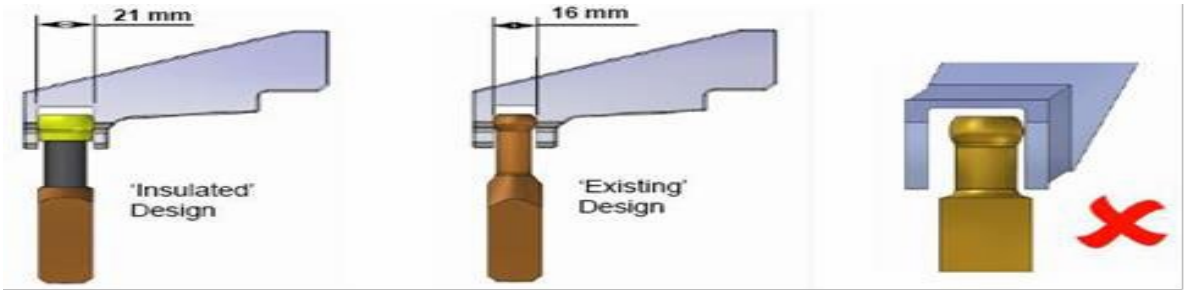


Figure 1 – LVDT's

Supplementary Sensor Bracket Mounting

If a Supplementary Sensor is being replaced and the existing mounting bracket is the 3mm thick / 2 hole mounting design, then this shall be replaced with the 5mm thick / 4 hole mounting bracket (Standard) design and Test PH03 carried out in addition to Test PH01. See Figure 2.

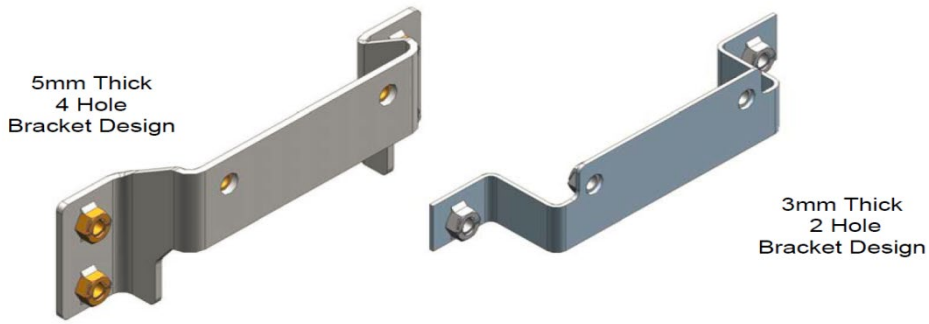


Figure 2 – Mounting Brackets

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check the replacement unit is not damaged and is correct type.

3. Check the replacement plug coupler cables are not damaged, the correct type and the plug couplers are free from damage and foreign bodies.

4. Check the existing wiring has safe insulation.

5. Check the existing wiring is correctly labelled.

6. Check the existing unit is isolated from the electrical supply.

AFTER INSTALLATION WORK

7. Check the replacement unit is correctly installed.

* 8. Check O-rings, clips, packing shims, washers, spring washers, rubber gaiters, insulators, cable protection seals, and cable ties are correctly installed (where applicable).

9. Check all bolts are correctly installed to the values stated in NR/SMS/PartZ/Z02 (Point Reference Values).

10. Check the wiring is replaced correctly and secure.

11. Check all plug couplers are correctly seated and secure.

12. Check that all wires and cables are secure and clear of any moving parts.

13. Check the replacement item operates correctly and without undue strain during manual operation.

* 14. Check that the switch openings are correct NR/SMS/PartZ/Z02 (Point Reference Values).

* 15. Test (gauge) Facing Point Lock NR/SMS/PartB/Test/004 (Facing Point Lock Test).

* 16. Test (gauge) Supplementary Sensor Integrity and Detection (HPSS Tests (NR/SMS/PartB/Test/008) if required. (Where multiple supplementary sensors or ECU or cables have been changed).

* 17. Test following replacement of a single supplementary sensor, as follows:

    a) Using the HPSA Handset, carry out the ECU Datum Reset procedure as detailed in NR/SMS/PartC/PC51 (Appendix A). Check that the correct number of pairs of supplementary sensors is selected during this procedure.

    b) Power operate the points (if required) to check that the open switch rail is on the side of the replaced sensor.

    c) Place an 8mm (CEN54) or 10mm (RT60) gauge between the open switch and stock rails. It is strongly recommended that the Hands-Free Detection Gauge (PADS No.086/035401) is used, to avoid injury.

    d) Ask the Signaller to power operate the points to close the switch rail against the gauge and stock rail. Ask what detection, if any, is given.

18. POINT DETECTION AND CORRESPONDENCE TEST affected ends.

    The point detection test shall be undertaken as detailed in NR/SMS/PartB/Test/008 (HPSS Tests) - Supplementary Sensor Integrity and Detection Test (where Supplementary Detectors or ECU or cables have been changed).

19. EARTH TEST (DC) or EARTH TEST (AC) detection circuits during normal and reverse power operation.

20. Check or arrange for correct labelling of unit.

END

Includes:	HPSA point machine, gearbox, drive shaft, carriage, carriage shafts, drive arms, drive brackets, drive pins
Excludes:	Electronic Control Unit (ECU), motor, brake, toe and supplementary rail position sensor assembly, supplementary sensor mounting bracket (offset / standard), power isolation switch, internal HPSA cables, and tail cables

GENERAL

Ask the Signaller to operate points, to check the correct points are being tested and thus eliminate confusion or doubt.

You should come to an understanding with the Signaller to apply a safe system of work and have a safe method of communicating with the Signaller.

To avoid injury whilst placing and removing gauges, it is strongly recommended that the 3.5mm Hands-Free FPL Gauge (PADS No. 094/007001) is used.

Self-Locking Nuts & Bolts

The majority of mechanical connections in the HPSS use self-locking nuts or bolts. If a self-locking fastener is removed it shall be replaced, as regular re-use reduces the locking effectiveness.

New self-locking fasteners shall therefore be used (where applicable) when replacing any mechanical component.

Also, tell-tale marks shall be applied so that future inspections are able to identify loosening. In the case of a nut and bolt both components shall be changed.

Motors and brake

Any drive keys associated with replaced equipment shall be renewed.

Gearbox

Inspect Gearbox to check that the clevis is pinned to the leadscrew as shown in the following line drawing, see Figure 1:

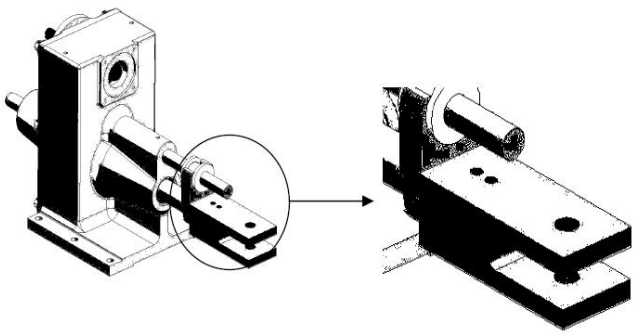


Figure 1 - Clevis is pinned to the leadscrew

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check the replacement item is not damaged and is correct type.

AFTER INSTALLATION WORK

3. Check the replacement item is correctly installed.

4. Check any replaced fasteners are correctly installed to the values detailed in NR/SMS/PartZ/Z02 (Points Reference Values).

5. Check that a visible gap exists between the white anti-rotation bush and the gearbox, with the HPSA in 'retract' (closed switch rails nearest to the ECU). If necessary, add packing shim(s) to the switch rail drive bracket to a minimum 2mm gap.

6. Check the switch rail packing shims and insulators are correctly installed.

7. Check any wires and cables are secure and clear of moving parts.

8. Check the replacement item operates correctly and without undue strain during manual operation.

9. Check O-rings, clips, packing shims, washers, spring washers, rubber gaiters, insulators, cable protection seals, and cable ties are correctly installed (where applicable).

10. Check that the switch openings are correct, see NR/SMS/PartZ/Z02 (Points Reference Values).

11. Test the brake torque holding capability if the gearbox has been changed, or if the brake or brake cables have been disconnected. See NR/SMS/PartB/Test/008 (HPSS Tests) - Brake Torque Test.

12. Check with the HPSS electrical component Test Plan NR/SMTH/Part04/PH01 (Replace a HPSS Electrical Component) for equipment that has been disconnected or disarranged and test as required.

13. Test (gauge) Facing Point Lock NR/SMS/PartB/Test/004 (Facing Point Lock Test HPSS).

14. Where PowerLink Supplementary Drive, Stretcher bar assembly, Bearing block, Torque tube, Shear pin module, and Drive pins have been changed, or if Supplementary detectors or cables have been disconnected), carry out NR/SMS/PartB/Test/008 (HPSS Tests) – Supplementary Sensor Integrity and Detection Test.

END

Includes:	HPSS; supplementary sensor mounting bracket (offset / standard)
Excludes:	Electronic Control Unit (ECU), motor, brake, toe and supplementary rail position sensor assembly, power isolation switch, internal HPSA cables, tail cables, gearbox, drive shaft, carriage, carriage shafts, drive arms, drive brackets, drive pins

Ask the Signaller to operate points, to check the correct points are being tested and thus eliminate confusion or doubt.

You should come to an understanding with the Signaller to apply a safe system of work and have a safe method of communicating with the Signaller

SUPPLEMENTARY SENSOR MOUNTING BRACKET

There are three types of bracket:

I. Non-handed, secured using 4 M12 screws to bearer wall, made from 5mm thick steel plate. All RT60 layouts and specific locations on UIC54B layouts. See **Figure 1.**

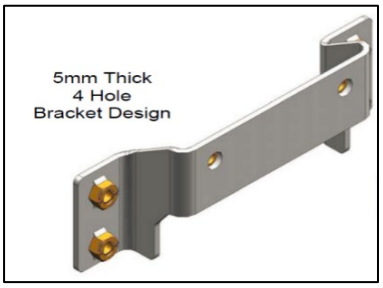


Figure 1 – Standard Mounting Bracket

2. Non-handed, secured using 2 M12 screws 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. See **Figure 2**.

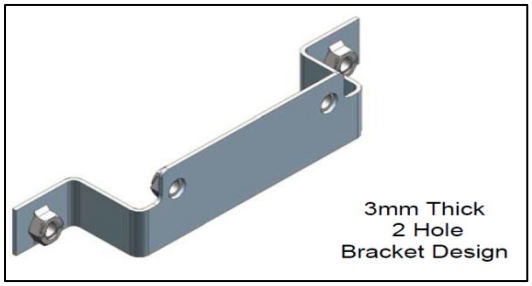


Figure 2 – Superseded Mounting Bracket

3. Offset Mounting Bracket (L/H or R/H), secured using 4 M12 screws to bearer wall, made from 5mm thick steel plate. Situated at specific locations on UIC54B layouts only, see **Figure 3.**

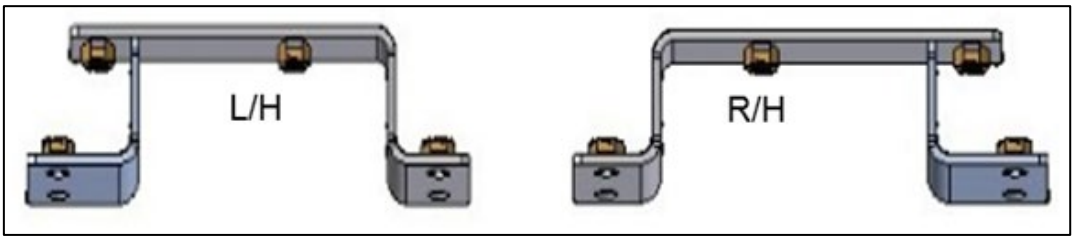


Figure 3 – Offset (Handed) Mounting Brackets

Table 1 shows the location of offset and standard supplementary sensor mounting bracket 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 1 - Bracket Type / Supplementary Bearer No. (UIC54B only)

BEFORE INSTALLATION WORK

1. Check the replacement unit is Not Damaged and is Correct Type.
2. Check the existing wiring has safe insulation.
3. Check the existing wiring is correctly labelled.
4. Check the existing unit is Isolated from the electrical supply.

AFTER INSTALLATION WORK

5. Check the replacement unit is correctly installed.

6. Check O-rings, clips, packing shims, washers, spring washers, rubber gaiters, insulators, cable protection seals, and cable ties are correctly installed (where applicable).

7. Check all bolts are correctly installed to the values stated in NR/SMS/PartZ/Z02 (Points Reference Values).

8. Check all plug couplers are correctly seated and secure.

9. Check that all cables are secure and clear of any moving parts and heaters.

10. Check the replacement item operates correctly and without undue strain during manual operation.

11. Check that the switch openings are correct, see NR/SMS/PartZ/Z02 (Points Reference Values).

12. Test (gauge) Facing Point Lock NR/SMS/PartB/Test/004 (Facing Point Lock Tests HPSS).

13. For each affected supplementary sensor mounting bracket, carry out the following test:

    a) With the point end in normal detection.

    b) Disconnect the affected sensor and observe that detection is lost via the handset and outgoing KR line.

    Supplementary sensors shall be disconnected at the sensor's plug coupler, not at the ECU.

    c) Reconnect the affected sensor and observe that detection is regained via the handset and outgoing KR line.

    NOTE: *It might be necessary to squeeze the Brake to restore detection in some cases.*

    d) Repeat the steps 'b' and 'c' for the reverse detection.

    e) Replace any supplementary cable clamps remove.

14. Point detection and correspondence test (NR/SMTH/Part03/Test/B08) affected ends.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PT01		
Replace a Hydro-Pneumatic Unit		
Issue No: 07	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Hydro-Pneumatic Unit
Excludes:	All other point operating equipment

GENERAL

BEFORE INSTALLATION WORK

1. Check replacement unit is not damaged and is correct type (pressure switch type, wiring configuration).
2. WIRE COUNT existing unit to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring is correctly labelled.
5. Check existing unit is isolated from the supply.

AFTER INSTALLATION WORK

6. Check replacement unit is correctly installed.
7. Check gauge is indicating the correct pressure level.
8. Check wiring is replaced as labelled.
9. Check terminations are secure and suitably protected.
10. WIRE COUNT replacement unit to the wiring diagram.
11. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
12. Check wires and cables are clear of moving parts.
13. Check points for freedom of movement throughout travel.
14. EARTH TEST (DC) or EARTH TEST (AC) circuits during normal and reverse operation where designed to be earth free.
15. Test any pressure switch correctly functions (pressure detection during and after point movement).
16. Check unit operates in the specified time:

    (Mk1 to 3:17–20 seconds or for Mark 4:15–30 seconds).

17. Carry out NR/SMS/PartB/Test/018 (Train Operated Points Detection Test) for the affected end and record the test measurements on the NR/SMS record card, together with the reason for the test.

18. Check or arrange for correct labelling of unit.

19. Observe a train trail through the train operated points and check that the points operate correctly before handing back into service (this is required even if there is a sparse train service over the points).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PW01		
Replace a Transformer-Rectifier or Battery Charger		
Issue No: 06	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Transformer-rectifiers and Battery Chargers
Excludes:	Any plug-in transformer-rectifier, transformer-rectifier or battery chargers used in track circuit feed sets

GENERAL

The correct battery charger shall be fitted for the battery size and type. Failure to do so will result in the failure of the battery and the standby supply.

BEFORE INSTALLATION WORK

1. Check replacement transformer-rectifier or battery charger is not damaged and is correct type.

2. WIRE COUNT existing transformer-rectifier/battery charger to the wiring diagram.

3. Check existing wiring has safe insulation.

4. Check existing wiring is correctly labelled.

5. Check existing transformer-rectifier or battery charger is isolated from the supply, any output circuits (transformer-rectifiers only) and battery (battery charger).

AFTER INSTALLATION WORK

6. Check replacement transformer-rectifier or battery charger is correctly installed.

7. Check wiring is replaced as labelled.

8. WIRE COUNT replacement transformer-rectifier or battery charger to the wiring diagram.

9. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.

10. Check output circuits are disconnected before supply is restored.

* 11. Test input and output voltages and ensure output polarity is correct. The output voltages and polarity shall be tested at the busbar as an additional check that the wiring has been correctly replaced.

* 12. Test battery charging rate with output circuitry restored and ensure battery is being charged with the correct polarity (BATTERY CHARGERS ONLY).

    It is advisable to return after a period of time, depending on the initial state of the cells, to retest the battery charger rate.

13. Test output voltage with output circuits restored.

14. Check any power off relay proving operates correctly (BATTERY CHARGERS ONLY).

15. EARTH TEST (DC) or EARTH TEST (AC) supply and outputs if designed to be earth free.

16. Carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Test) and record the test measurements on the appropriate record card, together with the reason for the test (SIGNAL FEED SETS ONLY).

17. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PW02		
Replace a Transformer		
Issue No: 06	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Transformers
Excludes:	All track circuit feed equipment

BEFORE INSTALLATION WORK

1. Check replacement transformer is not damaged and is correct type.
2. WIRE COUNT existing transformer to the wiring diagram.
3. Check existing wiring has safe insulation.
4. INSULATION TEST replacement transformer (use 1000V insulation tester) (minimum 2M ohms terminals to case).
5. Check existing wiring is correctly labelled.
6. Check existing transformer is Isolated from the supply.

AFTER INSTALLATION WORK

7. Check replacement transformer is correctly installed.
8. Check wiring is replaced as labelled.
9. WIRE COUNT replacement transformer to the wiring diagram.
10. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
11. EARTH TEST (DC) or EARTH TEST (AC) supply and outputs.
12. * Test correct operation of ALL AC phase sensitive equipment where local or control coils are fed from a supply via the cable under test (AC RELAY AREAS ONLY).
13. * Test voltage with input and output circuits restored.
14. * Test signal lamp, carry out, NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests), and record the test measurements on the NR/SMS record card, together with the reason for the test (SIGNAL FEED SETS ONLY).
15. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/PW03		
Replace a Non-Plug in Inverter or Converter		
Issue No: 06	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Devices which change a DC supply to an AC or DC supply
Excludes:	All other types of Inverter or Converter

BEFORE INSTALLATION WORK

1. Check replacement unit is not damaged and is correct type.
2. WIRE COUNT existing unit to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring is correctly labelled.
5. Check existing unit is isolated from the supply.

AFTER INSTALLATION WORK

6. Check replacement unit is correctly installed.
7. Check wiring is replaced as labelled.
8. WIRE COUNT replacement unit to the wiring diagram.
9. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
10. Check terminations are secure and suitably protected.
11. Test input and output voltages and polarity.
12. * Test voltage with input and output circuits restored.
13. * EARTH TEST (DC) or EARTH TEST (AC) supply and output if designed to be earth free.
14. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/RE11		
Replace a Solar Panel		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Solar Panel related to a Vamos Crossing
Excludes:	All other Solar Panel or Array.

Equipment Identification Image

Figure 1 – A Three Panel Solar Array

BEFORE INSTALLATION

1. Check that the replacement Solar Panel is of the correct type, version (modification level).
2. Check the replacement unit is not damaged.
3. WIRE COUNT the Solar Panel and check the wires have safe insulation and are correctly labelled.
4. Disconnect the Solar Panel output fuses.
5. Disconnect cables and insulate the cable connected to the panel being replaced.
6. Remove the failed Solar Panel from mounting rails and label it as faulty.

AFTER INSTALLATION

7. Check the replacement Solar Panel is correctly installed and is secure.
8. Check the panel is correctly angled and aligned
9. Reconnect all cables.
10. WIRE COUNT and check all connections are tight and secure.

11. Replace the Solar Panel output fuses.

12. Verify that the Solar panel is producing voltage by checking on the LED screen on the Solar Charge Controller and that there are no error messages shown.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/RE12		
Replace a Wind Turbine Nacelle		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	LE – 600 and the FM1803 Turbine
Excludes:	All other types of Turbine

Equipment Identification Image

Figure 2 - LE - 600

Figure 1 – FM1813

BEFORE INSTALLATION

1. Check that the replacement Turbine is of the correct type, version (modification level).

2. Check the replacement unit is not damaged.

3. Disconnect the turbine output fuses.

4. 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 will fail 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 to hard, this is to be recorded on the record card.

5. 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.

6. WIRE COUNT the turbine and check the wires have safe insulation and are correctly labelled.

7. Disconnect cables.

8. Remove the failed Turbine Nacelle and label it as faulty.

AFTER INSTALLATION

9. Check the replacement Turbine Nacelle is correctly installed and is secure.

10. Reconnect all cables.

11. WIRE COUNT and check all connections are tight and secure.

12. Raise the turbine using the approved method and secure it in place.

13. Release the turbine brake and confirm that the blades turn.

14. Replace the Turbine output fuses.

15. Verify that the Turbine is producing voltage by checking on the LED screen on the Solar Charge Controller and that there are no error messages shown.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/RE13		
Replace a Metron4		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Metron4 Monitor
Excludes:	All other types of Monitor unit

Equipment Identification Image

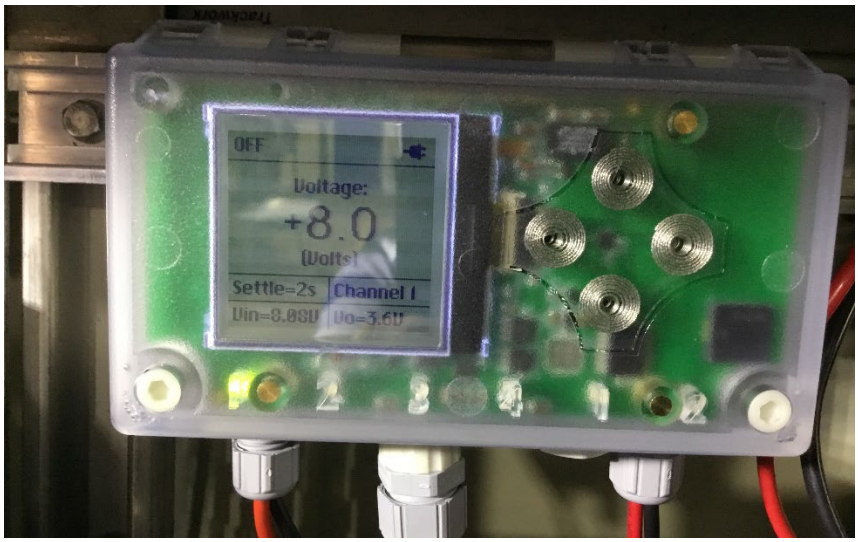


Figure 1 – Metron4 Monitor

BEFORE INSTALLATION

1. Check that the replacement Metron4 Monitor is of the correct type, version (modification level).
2. Check the replacement unit is not damaged.
3. WIRE COUNT the Metron4 Monitor and check the wires have safe insulation and are correctly labelled.
4. Disconnect power at the fuses.
5. Disconnect cables.
6. Remove the failed Metron4 Monitor from mounting rails and label it as faulty.

AFTER INSTALLATION

7. Check the replacement Metron4 Monitor is correctly installed and is secure.
8. Reconnect all cables.
9. WIRE COUNT and check all connections are tight and secure.

10. Replaces fuses and power up the unit.

11. Confirm that the PT10 is on (Green LED illuminated) and Metron4 is communicating over GSM.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/RE14		
Replace a TriStar Charge Controller		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	TriStar Charge Controller (Solar)
Excludes:	All other Charge Controller Units

Equipment Identification Image

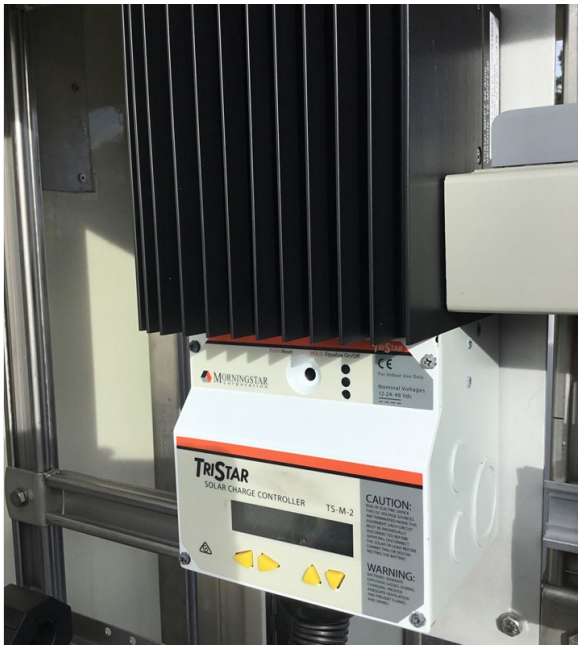


Figure 1 – Charge Controller

BEFORE INSTALLATION

1. Check that the replacement Charge Controller is of the correct type, version (modification level).
2. Check the replacement unit is not damaged.
3. WIRE COUNT the Charge Controller and check the wires have safe insulation and are correctly labelled.
4. Disconnect power at the fuses.
5. Disconnect cables.
6. Remove the failed Charge Controller from mounting rails and label it as faulty.
7. Note the configuration by recording the positions of the dip switches located under the removeable front panel. These shall be needed after installation of the new unit.

AFTER INSTALLATION

8. Check the replacement Charge Controller is correctly installed and is secure.
9. Reconnect all cables.

10. WIRE COUNT and check all connections are tight and secure.

11. Check the configuration dip switches are in the positions recorded during step 7.

12. Replaces fuses and power up the unit.

13. Verify that the LED screen is working and no error messages shown.

END

Includes:	EFOY Fuel Cell Unit Pro 2400 Duo
Excludes:	All other Fuel Cell Units

Do not smoke in the vicinity of methanol 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).

Equipment Identification Image

Figure 1 - EFOY Fuel Cell Unit

BEFORE INSTALLATION

1. Check that the replacement Fuel Cell Unit is of the correct type, version (modification level).

2. Check the replacement unit is not damaged.

3. WIRE COUNT the Fuel Cell Unit and check the wires have safe insulation and are correctly labelled.

4. Carry out the “Manual Off” process to power down the system.

5. Confirm the “Manual Off” process has finished, and the unit has stopped humming.

   Do Not disconnect the Fuel Cartridges or Batteries during the shutdown process.

6. Disconnect power at the fuses.

7. Disconnect the Fuel Cartridges using NR/SMTH/Part04/RE21 (Replace a Direct Methanol Fuel Cell Cartridge).

8. Disconnect the exhaust hose and protect it from the ingress of impurities, seal the exhaust outlet with the protective cap (swap the protection cap from new unit to old).

9. Remove the off-heat tube or the off-heat 90° elbow and remove the flange and fit it onto the new unit (if fitted).

Figure 2 – Off Heat Fittings

10. Disconnect cables.

11. Remove the failed Fuel Cell Unit from mounting plate and label it as faulty.

AFTER INSTALLATION

12. Check the replacement Fuel Cell Unit is correctly installed and is secure.

13. Reconnect all cables, pipes and fittings.

14. WIRE COUNT and check all connections are tight and secure.

15. Check the exhaust hose is secure and correctly fitted.

16. Check the off-heat tube or the off-heat bow is securely fitted.

17. Verify the Fuel Cartridges are correctly fitted.

18. Carry out a “Manual On” Power up of the system.

19. Verify that there are no error messages and the red LED is no longer illuminated.

20. The replaced unit should be returned to the depot for return to supplier.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/RE21		
Replace a Direct Methanol Fuel Cell Cartridge		
Issue No: 01	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	EFOY Fuel Cartridge M5, M10 or M28
Excludes:	All other types of Fuel Cartridge

Do not smoke in the vicinity of the methanol 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

The fuel cartridge can be changed while the device is in operation.

Equipment Identification Image

Figure 1 - EFOY Fuel Cartridges

BEFORE INSTALLATION

1. Check that the replacement Fuel Cartridge is of the correct type and not damaged.

2. <u>For Annual Replacement</u>

   Replace the empty Fuel Cartridge and the second cartridge.

3. <u>For a Fault Issue</u>

   Check the yellow warning light on the unit is flashing, the red LED on the operating panel is illuminated and the message “Fuel Cartridge Empty” is shown.

4. Verify the identity of the Fuel Cartridge to be exchanged.

5. Disconnect the cartridge connector.

   Only one Fuel Cartridge shall be replaced at a time.

6. Remove the cartridge.

AFTER INSTALLATION

7. Check the replacement cartridge is secure and the strap tightened (if fitted).

8. Check the cartridge connector is secure.

   Do not over tighten.

9. Verify that the fuel sensor yellow LED is extinguished.

10. For a Fault Issue

    Press the okay button on the control panel and verify that the error message and the red LED is no longer illuminated.

11. Re-set the fuel cartridge, using the Fuel Cartridge Sub-menu.

    For Details of this process see NR/SMS/Appendix/26 (General Information on the Direct Methanol Fuel Cell System).

12. Verify that a screw cap has been fitted to the empty cartridge before leaving site.

13. The empty cartridge should be returned to the depot for recycling.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/RE22		
Replace a Direct Methanol Fuel Cell Cartridge Sensor		
Issue No: 01	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	EFOY Fuel Cartridge Sensor FS
Excludes:	All other Fuel Cartridge Sensors

Do not smoke in the vicinity of the methanol 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.

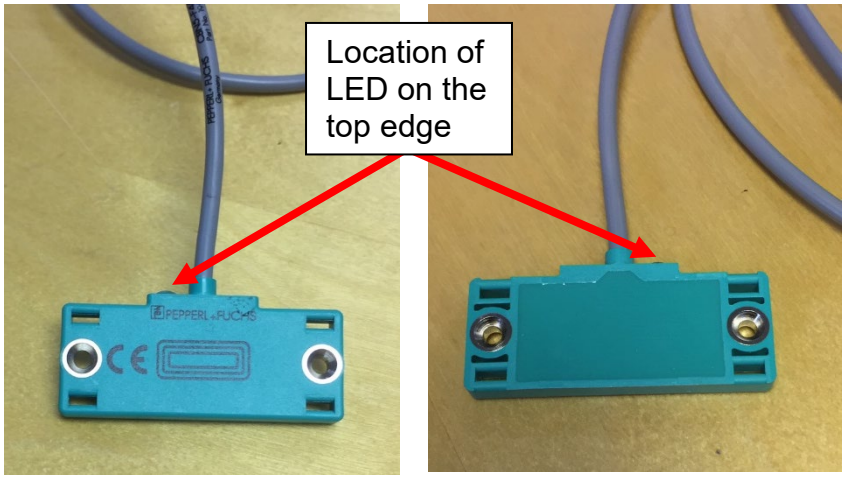
The EFOY Pro fuel cell shall not be opened.

Gloves and eye protection shall be worn during this task

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).

Equipment Identification Image



Sensor Front View Sensor Back View

Figure 1 - EFOY Fuel Cartridge Sensor

BEFORE INSTALLATION

1. Check that the replacement Fuel Cartridge Sensor is of the correct type, version (modification level).

2. Check the replacement unit is not damaged.

3. Check the Fuel Cartridge Sensor wire has safe insulation and are correctly labelled.

4. Remove Fuel Cartridge.

5. Unplug and remove the Fuel Cartridge Sensor and label it as faulty.

AFTER INSTALLATION

6. Reconnect the Fuel Cartridge Sensor cable and check the connections is tight and secure.

7. Check the yellow LED is illuminated before mounting the sensor. Place the sensor face down on the top of the Fuel Cell and verify the LED is extinguished.

8. Now install to final position.

9. Verify that the sensor is fitted with the correct sensing face facing outward.

10. Check the replacement Fuel Cartridge Sensor is correctly installed and is secure.

11. Re-install the Fuel Cartridge and check it is correctly fitted and secure.

12. The replaced unit should be returned to the depot for recycling.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/RE23		
Replace a Direct Methanol Fuel DuoCartSwitch		
Issue No: 01	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	EFOY DuoCartSwitch
Excludes:	All other types of DuoCartSwitch

Do not smoke in the vicinity of the methanol 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.

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).

Equipment Identification Image

Figure 1 - EFOY DuoCartSwitch

BEFORE INSTALLATION

1. Check that the replacement DuoCartSwitch is of the correct type, version (modification level).

2. Check the replacement DuoCartSwitch is not damaged.

3. Check the cable for safe insulation and correct labelling.

4. Disconnect the cable.

5. Remove the DuoCartSwitch and label it as faulty.

AFTER INSTALLATION

6. Check the replacement DuoCartSwitch is correctly installed and is secure.

7. Reconnect the cable and verify the cable is pushed home and secure.

8. The replaced unit should be returned to the depot for recycling.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SB01		
Replace a Back Projection Lamp Unit		
Issue No: 02	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	The GraphXMaster CX50-100U
Excludes:	All other back project lamp units

GENERAL

High voltages are present in the projector. The 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 the lamp to cool completely, before removal.

Wear eye protection (UV goggles with side protection) and clean cotton gloves when handling the lamp.

BEFORE INSTALLATION WORK

1. Check replacement unit is not damaged and is correct type.

2. Check the sapphire (glass) surface of the replacement unit for fingerprints or similar ‘oil or grease’ contamination.

3. If necessary, clean the sapphire (glass) surface, see NR/SMS/Appendix/02 (General Information on Ansaldo Signalling Equipment) - 6.2.

AFTER INSTALLATION WORK

4. Check replacement unit is correctly installed, see NR/SMS/Appendix/02 (General Information on Ansaldo Signalling Equipment) - 6.2.

5. Reset lamp timer (Service menu).

6. Check CSC. (GraphXMaster CX50-100U Installation and Maintenance Manual 54-017148-02P – Adjust CSC (section 2)).

7. Check replacement unit is correctly aligned. (GraphXMaster CX50-100U Installation and Maintenance Manual 54-017148-02P – 6-Axis Adjustment (section 2)).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SG01		
Replace an LED Buffer Stop Unit		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	LED Buffer Stop Units
Excludes:	All Other Buffer Stop lights

BEFORE INSTALLATION WORK

1. Check replacement component is not damaged, correct colour LED and is correct type.
2. WIRE COUNT the existing component terminals to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring is correctly labelled.
5. Disconnect the power supply

AFTER INSTALLATION WORK

6. Check replacement component is correctly installed.
7. Check wiring is replaced as labelled.
8. WIRE COUNT the replacement component terminals to the wiring diagram.
9. Check any links, and red dome nuts or equivalent, are secure and correctly replaced.
10. Test voltage with input and output circuits restored.
11. EARTH TEST (DC) or EARTH TEST (AC) the circuits and supplies where designed to be earth free.
12. Check that a red aspect is illuminated.
13. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SG02		
Replace a Lens		
Issue No: 06	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Chipped or cracked signal filter, chipped or cracked level crossing lights, chipped or cracked MARI (stencil) (with legend remaining). Outer dispersing lens for Ansaldo SD 321 Signal
Excludes:	Integral optical assembly, Signal optical unit

GENERAL

Ansaldo SD 321 Signals:

There are three different types of lenses on the Ansaldo SD 321 signal, these are type ‘A’ the ‘standard’ lens and types ‘Bd’ and ‘Bs’ which are used for signals located on curves.

Confirm that the correct type of lens is fitted.

Filament Lamp Signals:

Some signals may be fitted with a ‘Spreadlite’ lens.

When replacing a lens confirm that the correct type is used.

More details are in NR/SMS/PartC/SG00 (Signals: General).

All Signals:

Details of the lens type can be found on the NR/SMS signal lamp voltage record card or signal sighting form.

If you are unsure about the correct type of lens, ask your SM(S).

BEFORE INSTALLATION WORK

1. Check replacement item is not damaged and is correct type and colour.
2. Note position of hot strip (SIGNAL FILTERS ONLY).

AFTER INSTALLATION WORK

3. Check replacement item is correctly installed and aligned.
4. Signal sighting forms include specific details on signal alignment and configuration.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SG03		
Replace a Signal Wire (or part of)		
Issue No: 06	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

***** NO RECORD OF TEST REQUIRED WHEN ONLY ONE SIGNAL WIRE IS DISCONNECTED *****

Includes:	Mechanical signal wire, sling, replacement of a chain by a sling
Excludes:	All other types of wire, sling or chain connections

BEFORE INSTALLATION WORK

1. Check replacement signal wire is not damaged (rust) and is correct type (length, diameter).

2. Check wires are correctly labelled (WHEN MORE THAN ONE SIGNAL WIRE IS DISCONNECTED).

AFTER INSTALLATION WORK

3. Check replacement wire is correctly installed.

4. Check signal wires are replaced as labelled (WHEN MORE THAN ONE SIGNAL WIRE IS DISCONNECTED).

5. Check replacement wire is free moving and clear of obstruction.

6. Check wire strands are suitably cut back.

7. Check that there is adequate stroke and that the equipment operates correctly from the correct lever without undue strain on fittings.

NOTE: *There should ideally be 7.5" of stroke at the lever tail, but this can vary by 2" over every 100 yards of wire, depending on temperature. For long distance signals a draught wheel is used to double the stroke. See NR/SMS/PartC/SG00 (Signals: General) – 20. Wire Adjustment.*

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SG05		
Replace a Reflective Board, Sign or Support Structure		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Reflective Distant Signal Boards, Reflective Boards associated with RETB, Reflective Boards associated with ERTMS, Externally Lit Notice Boards, Reflective Trackside Boards associated with Level Crossings, Public Information Boards Attached to Light Units or Telephones at Level Crossings, Support Structures
Excludes:	TSR and PSR boards, Other trackside information boards

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check the replacement is of the correct type and not damaged.

3. Check the position of the board or sign is as described on the SSIFT App or on the local layout diagrams.

4. If the SSIFT App is not available stop work and inform you supervisor.

AFTER INSTALLATION WORK

5. Check the support structure is upright, secure in the ground and cannot be rotated.

6. Check the board is secure on the support structure and cannot rotate.

7. Check the board, sign or post is clear of the structure gauge.

8. Check the position of the board is correct to the SSIFT App (if available) or the local Layout diagrams and that it is facing in the correct direction.

9. Check where fitted that any external illumination is correctly positioned to illuminate the whole sign.

10. Measure the correct voltage is applied to the lamp or lamps.

11. For Reflective Distant Signal Boards, Reflective Boards associated with RETB, Reflective Boards associated with ERTMS: Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SG06		
Replace a Lamp Case		
Issue No: 06	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

BEFORE INSTALLATION WORK

1. Check replacement lamp case is not damaged and is correct type.
2. WIRE COUNT existing lamp case to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring is correctly labelled.
5. Check existing lamp case is isolated from the supply.

AFTER INSTALLATION WORK

6. Check replacement lamp case is correctly installed and aligned (backlight permanently obscured, or back blinder set to obscure backlight when signal arm is 5 degrees or more from the horizontal).
7. INSULATION TEST replacement lamp case (minimum 2M ohms terminals to lamp case).
8. Check wiring is replaced as labelled.
9. WIRE COUNT lamp case to the wiring diagram.
10. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
11. Check cable is secured.
12. EARTH TEST (DC) or EARTH TEST (AC) supply if designed to be earth free.
13. Check correct correspondence of the lamp proving indicator with lamp lit and lamp out.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SG07		
Replace a Signal Arm or Fittings		
Issue No: 06	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Signal arm, Spectacle casting, Disc, Back blinder, Spindle, Backstop, Lever plate, Down rod, Balance weight arm, Fixed signal
Excludes:	Down wire, Crank, Lamp case, Notice board, Circuit controller

BEFORE INSTALLATION WORK

1. Check replacement signal arm is not damaged and is correct type.

AFTER INSTALLATION WORK

2. Check replacement signal arm is correctly installed and within structure gauge.

3. Check the spectacle colours are correct.

4. Check new split pins are correctly installed.

5. Check for correct alignment of the spectacle casting.

For Moving Arms Only

6. Check signal operates correctly from the correct lever without undue strain on the fittings.

7. Test contact settings are correct according to the diagram, in any contact boxes connected to the arm or slot.

8. Check for correct correspondence between the signal arm or slot and any signal indicator or proving relay.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SG08		
Replace a Mechanical Searchlight Mechanism		
Issue No: 06	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Plug-coupled, free-wired, AC and AC electro-mechanical mechanisms
Excludes:	Fibre optic, Light emitting diode and Dichroic mirror types

BEFORE INSTALLATION WORK

1. Check replacement mechanism is not damaged and is correct type ('Home', 'distant').
2. Check mechanism is free of internal contamination.
3. Check replacement mechanism is correctly sealed.
4. WIRE COUNT existing mechanism to the wiring diagram (FREE-WIRED MECHANISMS ONLY).
5. Check existing wiring has safe insulation.
6. Check existing wiring is correctly labelled (FREE-WIRED MECHANISMS ONLY).
7. Check existing mechanism is isolated from the supply.

AFTER INSTALLATION WORK

Where any plug coupler is used check that no metallic dust or contamination exists between the two halves before reconnecting the plug couplers.

8. Check replacement mechanism is correctly installed (Level).
9. Check wiring is replaced as labelled (FREE-WIRED MECHANISMS ONLY).
10. WIRE COUNT replacement mechanism to the wiring diagram (FREE-WIRED MECHANISMS ONLY).
11. Check any retaining clips are in place.
12. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
13. Check terminations are secure and suitably protected.
14. Check correctly rated lamp is installed.
15. Check entry cable is secured and the signal head wiring is not susceptible to mechanical damage.
16. EARTH TEST (DC) or EARTH TEST (AC) circuits if designed to be earth free.

17. Test signal lamp, carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests) and record the test measurements on the NR/SMS record card, together with the reason for the test.

18. Check for correct beam alignment NR/SMS/PartC/SG00 (Signals: General) – Beam Alignment.

NOTE: *Signal sighting forms include specific details on signal alignment and configuration.*

19. ASPECT TEST signal.

20. Check or arrange for correct labelling of mechanism.

21. Check signal head door fits correctly (door seal intact, no case damage, no extraneous light enters).

NOTE: *Sighting forms, where provided, include specific details on signal alignment and configuration.*

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SG11		
Replace an Ansaldo SD 321 Signal Head Filter Unit		
Issue No: 02	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Ansaldo SD 321 signal head filter unit
Excludes:	Signal optical unit

BEFORE INSTALLATION WORK

1. Check replacement unit is not damaged and is correct type.
2. WIRE COUNT existing unit to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing unit is isolated from the supply.

AFTER INSTALLATION WORK

5. Check replacement unit is correctly installed.
6. Check plug coupler is correctly installed.

   Check that no metallic dust or contamination exists between the two halves of the plug coupler before reconnection.

7. WIRE COUNT replacement unit to the wiring diagram.
8. Check terminations are secure and suitably protected.
9. Test each signal lamp fed by the replacement unit NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SG12		
Replace an Ansaldo SD 321 Signal Head Optical Unit		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Ansaldo SD 321 signal head optical unit
Excludes:	Signal head filter unit

BEFORE INSTALLATION WORK

1. Check replacement unit is not damaged and is correct type.
2. Check replacement unit is free of internal contamination.
3. Check existing wiring has safe insulation.
4. Check existing unit is Isolated from the supply.

AFTER INSTALLATION WORK

5. Check replacement unit is correctly installed.
6. Check plug coupler is correctly installed.

   Check that no metallic dust or contamination exists between the two halves of the plug coupler before reconnection.

7. Check terminations are secure and suitably protected.
8. Check correct lamps are installed.
9. Check lamp holders are correctly installed (align red marks before inserting lamp holder).
10. Test each signal lamp NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests).
11. Arrange for a double yellow aspect to be displayed in a 4 aspect signal, (a red aspect in a 2 or 3 aspect head).
12. Check that when observed from the signal beam alignment point the signal is correctly aligned. In the case of a 4 aspect signal head the output of the unchanged optical unit and the replaced unit should appear the same colour and equally bright (See NR/SMS record card or signal sighting card for details of the signal beam alignment point).
13. ASPECT TEST the signal.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SG15		
Replace a Ground Position Light LED Signal		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Ground Position Light LED Signal
Excludes:	All other Position Light Signals

BEFORE INSTALLATION WORK

1. Note whether the existing 'on' aspect has two red lights or one red and one white.
2. Check replacement position light signal is not damaged and is correct type.
3. Check replacement position light internal wiring corresponds to the internal wiring of the existing position light or revised installation drawing.
4. WIRE COUNT existing position light signal to the wiring diagram.
5. Check existing wiring has safe insulation.
6. INSULATION TEST replacement signal head (minimum 2M ohms terminals to case).
7. Check existing wiring is correctly labelled.
8. Check existing signal head is Isolated from the supply.

AFTER INSTALLATION WORK

9. Check replacement position light signal is correctly installed and within structure gauge.
10. Check LED Signal Light Modules or equivalent, are correct type and colour, and are correctly orientated for their application.
11. Check that hoods are correctly installed and are correct type.
12. Check wiring is replaced as labelled.
13. WIRE COUNT replacement unit to the wiring diagram or revised installation drawing.
14. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
15. Check terminations are secure and suitably protected.
16. Check cable entry is secured and the signal head wiring is not susceptible to mechanical damage.
17. Carry out an EARTH TEST (DC) or EARTH TEST (AC) if the circuit is designed to be earth free.

18. Test the supply to each Signal Light Module and record the test measurements along with the other details required on the record card, together with the reason for the test.

19. Check for correct signal sighting.

20. Carry out an ASPECT TEST signal.

21. Check or arrange for correct labelling of the unit.

22. Check signal head door fits correctly (Door seal intact, no case damage).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SG51		
Replace a Filament Type Signal Head		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Filament lamp Colour light signals, Position light signals (PLS), Position light junction indicators (PLJI), Theatre type indicators (SARI), stencil type indicators (MARI)
Excludes:	Mechanical searchlight signal, Banner repeater signal, Electro-mechanical types, Fibre optic types, Dichroic mirror types, and Light emitting diode (LED) types

BEFORE INSTALLATION WORK

1. Check replacement signal head is not damaged and is correct type.

2. **If the Item is Missing** - Check for evidence on site and on the wiring diagrams that the missing equipment was previously fitted. If no evidence is present, consult your SM(S).

3. Check replacement signal head internal wiring corresponds to the internal wiring of the existing signal head.

4. WIRE COUNT existing signal head to the wiring diagram.

5. Check existing wiring has safe insulation.

6. INSULATION TEST replacement signal head (minimum 2M ohms terminals to case).

7. Check existing wiring is correctly labelled.

8. Check existing signal head is isolated from the supply.

AFTER INSTALLATION WORK

9. Check replacement signal head is correctly installed and within structure gauge.

10. Check filters are of correct type (colour) and are correctly installed.

11. Check wiring is replaced as labelled.

12. WIRE COUNT replacement signal head to the wiring diagram.

13. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.

14. Check terminations are secure and suitably protected.

15. Check that correctly rated lamps of the correct type are fitted in all aspects.

16. Check entry cable is secured, and the signal head wiring is not susceptible to mechanical damage.

17. Check correct hoods fitted.

18. EARTH TEST (DC) or EARTH TEST (AC) circuits if designed to be earth free.

19. Test each signal lamp, carry out NR/SMS/PartB/Test/021 Filament Signal Lamp Tests) and record the test measurements along with the other details required on the NR/SMS record card, together with the reason for the test.

20. Check for correct signal sighting NR/SMS/PartB/Test/302 (Signal Visibility Check) and beam alignment NR/SMS/PartC/SG00 (Signals: General).

    Signal sighting forms include specific details on signal alignment and configuration. Otherwise, see NR/GN/SIG/19032 for generic details.

21. ASPECT TEST signal.

22. Check or arrange for correct labelling of unit.

23. Check signal head door fits correctly (Door seal intact, no case damage, no extraneous light enters).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SG52		
Replace an Electro-Mechanical Signal		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Banner repeater signal, Solenoid shunt signal, Motor driven signal
Excludes:	Electro-mechanical searchlight mechanisms

BEFORE INSTALLATION WORK

1. Check replacement signal is not damaged and is correct type.
2. **If the Item is Missing** - Check for evidence on site and on the wiring diagrams that the missing equipment was previously fitted. If no evidence is present, consult your SM(S).
3. WIRE COUNT existing signal to wiring diagram.
4. Check existing wiring has safe insulation.
5. INSULATION TEST replacement signal (minimum 2M ohms terminals to case).
6. Check existing wiring is correctly labelled.
7. Check existing signal is isolated from the supply.

AFTER INSTALLATION WORK

8. Check replacement signal is correctly installed and within structure gauge.
9. Check wiring is replaced as labelled.
10. WIRE COUNT replacement signal to wiring diagram.
11. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
12. Check terminations are secure and suitably protected.
13. Check replacement signal lamps are correct type.
14. Check replacement signal wiring is not susceptible to mechanical damage.
15. Check replacement signal door fits correctly (door seal intact, no case damage).
16. Check for correct alignment of signal NR/SMS/PartC/SG00 (Signals: General).
17. Test signal mechanism operates freely.
18. EARTH TEST (DC) or EARTH TEST (AC) supply if designed to be earth free.

19. ASPECT TEST replacement signal.

NOTE: *Sighting forms include specific details on signal alignment and configuration.*

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SG53		
Replace an Electro-Mechanical Indicator		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Electro-mechanical indicators connected in series with relay coils
Excludes:	Any other type of indicator

GENERAL

BEFORE INSTALLATION WORK

1. Check replacement indicator is not damaged and is correct type.

2. **If the Item is Missing** - Check for evidence on site and on the wiring diagrams that the missing equipment was previously fitted. If no evidence is present, consult your SM(S).

3. WIRE COUNT existing indicator to the wiring diagram.

4. Check existing wiring has safe insulation.

5. Check existing wiring is correctly labelled.

AFTER INSTALLATION WORK

6. Check replacement indicator is correctly installed.

7. Check wiring is replaced as labelled.

8. WIRE COUNT replacement indicator to the wiring diagram.

9. EARTH TEST (DC) or EARTH TEST (AC) supply if designed to be earth free.

* 10. Test for correct operation and correspondence between the equipment and the indicator.

11. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SG54		
Replace a Fibre Optic Signal		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Alphanumeric indicators, Banner repeater signal, Position light signal, Preliminary route indicator, Points indicator, Fibre optic harness, Fibre optic light box
Excludes:	Filament types, Dichroic mirror types and Light emitting diode types

GENERAL

Replacement fibre optic harness and signal heads are supplied already connected together.

BEFORE INSTALLATION WORK

1. Note whether the existing 'on' aspect has two red lights or one red and one white (POSITION LIGHT SIGNAL ONLY).

2. **If the Item is Missing** - Check for evidence on site and on the wiring diagrams that the missing equipment was previously fitted. If no evidence is present, consult your SM(S).

3. Check replacement fibre optic unit is not damaged and is correct type.

4. Check replacement unit has the correct coloured filters (LIGHT BOX ONLY).

5. Check replacement signal head lens has the correct Hot Strip setting (SIGNAL HEAD ONLY).

   Signal light boxes contain specific information on Hot Strip setting.

6. Check replacement fibre optic harness is colour coded at the light box end.

7. WIRE COUNT existing unit to the wiring diagram.

8. Check existing wiring has safe insulation.

9. INSULATION TEST replacement signal head heater terminals (minimum 2M ohms terminals to case), (SIGNAL HEAD ONLY).

10. Check existing wiring is correctly labelled.

11. Check existing unit is isolated from the supply.

AFTER INSTALLATION WORK

12. Check replacement unit is correctly installed and within structure gauge.

13. Check wiring is replaced as labelled.

14. WIRE COUNT replacement unit to the wiring diagram.

15. Check terminations are secure and suitably protected.

16. Check replacement fibre optic harness is not kinked or damaged and colour codes match the light box, (HARNESS TYPE ONLY).

17. Check correctly rated lamps are correctly installed, (LIGHT BOX ONLY).

18. Check fibre optic cable is secured and not susceptible to mechanical damage.

19. Check correct hoods are fitted, (SIGNAL HEAD ONLY).

20. EARTH TEST (DC) or EARTH TEST (AC) electrical circuits.

* 21. Test each signal lamp, carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests) and record the test measurements along with the other details required on the NR/SMS record card together with the reason for the test.

* 22. Check correct beam alignment NR/SMS/PartC/SG00 (Signals: General), (SIGNAL HEAD ONLY).

23. Signal light boxes contain specific information on signal alignment.

24. ASPECT TEST signal.

25. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SG55		
Replace a Light Emitting Diode (LED) Signal Head		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	LED type main signal head, LED type position light junction indicator (PLJI), LED type position light signal (PLS), PLS fitted with LED Signal Lamp Modules (SLMs). LED Style MARI and SARI units
Excludes:	Filament types, Fibre optic types, Dichroic mirror types, replace a filament type signal head with a LED type, work that includes a data change, Individual LED SLMs

BEFORE INSTALLATION WORK

1. Note whether the existing 'on' aspect has two red lights or one red and one white. (PLS ONLY).

2. Check replacement signal head is not damaged and is correct type.

   Different alignments of the SLM front screen are provided for the signal configuration circumstances; see NR/SMS/PartC/SG00 (Signals: General) for more details.

3. Check replacement signal head internal wiring corresponds to the internal wiring of the existing signal head or revised installation drawing.

4. WIRE COUNT existing signal head to the wiring diagram.

5. Check existing wiring has safe insulation.

6. INSULATION TEST replacement signal head (minimum 2M ohms terminals to case).

7. Check existing wiring is correctly labelled.

8. Check existing signal head is isolated from the supply.

AFTER INSTALLATION WORK

9. Check replacement signal head is correctly installed and within structure gauge.

10. Check LED SLMs, or equivalent, are correct type and colour, and are correctly orientated for their application.

11. Check that hoods are correctly installed and are correct type.

12. Check wiring is replaced as labelled.

13. WIRE COUNT replacement head to the wiring diagram or revised installation drawing.

14. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.

15. Check terminations are secure and suitably protected.

16. Check cable entry is secured, and the signal head wiring is not susceptible to mechanical damage.

17. EARTH TEST (DC) or EARTH TEST (AC) circuits if designed to be earth free.

18. Test the supply to each SLM and record the test measurements along with the other details required on the NR/SMS record card, together with the reason for the test.

19. Check for correct signal sighting, carry out NR/SMS/PartB/Test/302 (Signal Visibility Check) and beam alignment NR/SMS/PartC/SG00 (Signals: General).

20. ASPECT TEST signal.

21. Check or arrange for correct labelling of the unit.

22. Check signal head door fits correctly (door seal intact, no case damage).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SL01		
Replace a SMARTLOCK CIXL I/O Subsystem Module		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	XAU, EAU and I/O PSU
Excludes:	All other types

GENERAL

Spare modules should be stored in the same ambient conditions as the operational interlocking to prevent any adverse effect to the performance of the modules, when unpacked and powered-up.

When removing or handling any CIXL modules, check that an ESD wrist strap is connected to the ESD Bonding Point on the left-hand side of the Cubicle; this wristband shall be worn on the wrist of personnel prior to the removal and handling of any CIXL modules.

Do not switch off both I/O groups as this removes power from the Computing Subsystem and cause the CIXL to shut down.

If the system is fully functional, but running in degraded mode, it is recommended that failure reports are completed before attempting repairs to allow correct recording of indicators.

BEFORE INSTALLATION WORK

1. Check the replacement module is not damaged and is the correct type.

2. Check for the correct working of the other I/O group. Use the I/O Group switch to power-off the I/O group in which a faulty module has been identified.

REMOVAL OF EXISTING SMARTLOCK I/O MODULE

3. Unplug the faulty Module from its backplane, by simultaneously applying thumb leverage in an upward and downward direction on the top and bottom card ejectors respectively, on the front panel of the Module.

4. Remove the faulty Module from the I/O Group and place it within an anti-static container.

INSTALLATION OF REPLACEMENT SMARTLOCK I/O MODULE

5. Withdraw a replacement LRU from its anti-static container, plug it into the empty slot and check that the LRU is seated correctly in its slot.

AFTER INSTALLATION WORK

6. Check that replaced modules and cards are correctly installed.

7. Use the front panel I/O Group switch to turn on the power of the I/O group into which the new board has been inserted.

8. On the related I/O Group PSU, check that the green LEDs called “In OK” and “Out OK” are steady on.

9. On each XAU, after approximately 20 to 30 seconds, check that the red LEDs called “OK1” and “OK2” flash as a rate of approximately once per second and check that the red LED called “RXHS” is steady on.

10. On each EAU, after approximately 5 to 10 seconds, check that both orange LEDs called “R” flash at a rate of approximately once per second.

11. On the SSys HMI, check that the previously reported alarms have become inactive (white) and clear them from the display. If the failure is still present or if one of the previous checks failed, refer to Second Line Maintenance.

Following replacement of an EAU due to address caching in the network equipment, communications between the CIXL and the Support System can take several minutes to start.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SL02		
Replace a SMARTLOCK CIXL Computing Subsystem Module		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	MPU, HSCU and Redman Modules, Computing Channel PSU, CIXL Computing Channel Identity Device and PCMCIA Card
Excludes:	All other types of Computing Subsystem Modules

GENERAL

Repair or replacement of the sealed safety fuse located on the circuit board of a Redman module in the CIXL shall not be carried out by first line maintenance under any circumstances, as this might mask an unsafe condition.

Spare modules should be stored in the same ambient conditions as the operational interlocking to prevent any adverse effect to the performance of the modules, when unpacked and powered-up.

When removing or handling any CIXL modules, check that an ESD wrist strap is connected to the ESD Bonding Point on the left-hand side of the Cubicle. This wristband shall be worn on the wrist of personnel prior to the removal and handling of any CIXL modules.

When running the CIXL in 2-out-of-2 mode, do not switch off either of the two operational Computing Channels as this causes the CIXL to shut down.

When there is a faulty board in a computing channel (MPU, HSCU or Redman board), all three boards shall all be replaced together.

Unless only the PCMCIA card has failed, once it is inserted into its MPU it shall be considered as captive to the MPU and shall remain inserted, even when the MPU is removed and returned for repair.

If the system is fully functional, but running in degraded mode, it is recommended that failure reports are completed before attempting repairs to allow correct recording of indicators.

BEFORE INSTALLATION WORK

1. Check the replacement module is not damaged and is correct type.

2. For PCMCIA cards and Identity Devices, check that the correct channel specific replacement is selected from the available spares.

3. Check for the correct working of the other two computing channels. Use the computing channel switch to power-off the computing channel in which a faulty module has been identified.

REMOVAL OF EXISTING SMARTLOCK COMPUTING CHANNEL MODULE

4. Unplug the MPU, HSCU and REDMAN boards from their backplane, by simultaneously applying thumb leverage in an upward and downward direction on the top and bottom cars ejectors respectively, on the front panels of the Modules.

5. Remove the MPU, HSCU and REDMAN boards from the Computing Channel and place each within an anti-static container.

REMOVAL OF EXISTING SMARTLOCK COMPUTING CHANNEL PCMCIA CARD

6. For failures of PCMCIA card only, press the button to eject the failed PCMCIA card and remove it from the MPU.

REMOVAL OF EXISTING CIXL COMPUTING CHANNEL IDENTITY DEVICE

7. Withdraw the device from the Maintenance Panel.

INSTALLATION OF REPLACEMENT COMPUTING CHANNEL IDENTITY DEVICE

8. Insert the spare Identity Device that has been pre-programmed for the computing channel (a specific Device labelled “A”, “B” and “C” is associated with each computing channel).

INSTALLATION OF REPLACEMENT SMARTLOCK COMPUTING CHANNEL MODULE OR PCMCIA CARD

9. Withdraw replacement MPU, HSCU and REDMAN boards from their anti-static containers, plug them into the empty slots and check that the cards are seated correctly in their slots.

10. Insert the spare PCMCIA card that has been pre-programmed for the computing channel.

NOTE: *A specific PCMCIA card labelled “A”, “B” and “C” is associated with each computing channel.*

AFTER INSTALLATION WORK

11. Check that replaced modules and cards are correctly installed.

12. Use the front panel switch to turn on the power of the computing channel into which the new modules have been inserted.

13. After 3 minutes, check the following LED indications (See Table 1):

Board name	LED	State in normal operation	Note
PSU	2 x In OK	Steady ON	
	2 x Out OK	Steady ON	
MPU	CPU	Steady ON	#
	PCI	Steady ON	#
	FUS	Steady ON	#
	SYS	Steady ON	#
	CHS	Steady OFF	
	BFL	Steady OFF	
HSCU	CHANNEL A OK	Flashing at about 1/sec	
	CHANNEL B OK	Flashing at about 1/sec	
REDMAN	FIE	Steady ON	
	FI	Steady ON	

Table 1 – LED Indications

14. Check the REDMAN display for correct details.

NOTE: *During normal operation, a text including the CIXL identity, the scheme name, each VIXL's data version and mode and the maximum used Time-Slot time since last display is shown in a loop on the REDMAN display. Any other behaviour indicates a faulty CIXL Channel.*

15. On the SSys HMI, check that the previously reported alarms have become inactive (white) and clear them from the display. If the failure is still present or if one of the previous checks failed, refer to Second Line Maintenance.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SL03		
Replace a SMARTLOCK CIXL Main PSU		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	CIXL Main PSU only
Excludes:	I/O PSU and Computing Channel PSU

GENERAL

Do not switch off the incorrect circuit breaker when operating on a single Main Power Supply as this causes the CIXL to shut down.

BEFORE INSTALLATION WORK

1. Check the replacement module is not damaged and is the correct type.

2. Use the circuit breaker at the rear of the CIXL cubicle to power-off the failed Main PSU.

REMOVAL OF EXISTING SMARTLOCK CIXL MAIN PSU

3. Using the two handles on the front panel of the Main PSU withdraw it from the PSU Sub-rack.

4. Remove the faulty Module from the main PSU sub-rack and place it within an anti-static container.

INSTALLATION OF REPLACEMENT SMARTLOCK CIXL MAIN PSU

5. Insert a spare Main PSU into the sub-rack and check that it is seated correctly in its slot.

AFTER INSTALLATION WORK

6. Check that replaced PSU is correctly installed.

7. Use the circuit breaker at the rear of the CIXL cubicle to turn on the power to the Main PSU which has been replaced.

8. Observe that the green “System” and “Uo” indicators on the new PSU are lit, and the red Error indicator is not lit.

9. On the SSys HMI, check that the previously reported alarms have become inactive (white) and clear them from the display. If the failure is still present or if one of the previous checks failed, refer to Second Line Maintenance.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SL04		
Replace a SMARTLOCK TICC Front End Module		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	FE Cassette, FE PSU
Excludes:	All Gateway Components, DLM and LDT

GENERAL

Do not shut down an operational FE Power Supply when the redundant FE cassette is not operating correctly, as this causes trackside signals controlled through the Front End to revert to their most restrictive conditions.

BEFORE INSTALLATION WORK

1. For replacement of a FE Cassette, obtain the correct, pre-programmed spare unit for this FE.

   NOTE: *A pre-configured spare for each FE has been supplied with the SMARTLOCK installation and is labelled 1A, 1B, 2A etc.*

2. Check the replacement module is not damaged and is the correct type.

3. Use the FE circuit breaker on the front of the TICC to power-off the failed FE. Wait at least 10 seconds to permit the discharge of the possible residual voltages.

REMOVAL OF EXISTING FE MODULE

4. Extract the FE module by pulling on its handles.

INSTALLATION OF REPLACEMENT FE MODULE

5. Insert the spare Front End Module, pushing it until its rear connectors are engaged correctly and completely with the related connectors of the backplane, and it is flush with the front of the rack.

6. Secure the FE Module into the rack, using the four front panel screws.

AFTER INSTALLATION WORK

7. Check that replaced Module is correctly installed.

8. Use the circuit breaker for the FE to turn on the power.

9. Check that the LED “Vout” of the FE PSU is ON.

10. For replacement of the FE PSU, measure the output voltage supplied by the PSU, connecting a multimeter to the test points. Check that the voltage is 24V DC +/- 10%, adjusting it, if needed.

11. Check that the related FE cassette is working properly by observing the LEDs.

12. On the SSys HMI, check that the previously reported alarms have become inactive (white) and clear them from the display. If the failure is still present or if one of the previous checks failed, refer to Second Line Maintenance.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SL05		
Replace a SMARTLOCK TICC GW Module		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Gateway Module, Gateway Configuration Device and Gateway PSU
Excludes:	All Front-End Components, DLM and LDT

GENERAL

Do not switch off the wrong (working) gateway of a pair, as this results in loss of output to the trackside datalink and reversion of signals to red retained.

The Gateway PSUs are each protected by a fuse in the power tray, and an internal fuse. These should be checked before replacing the PSU.

BEFORE INSTALLATION WORK

1. For replacement of a GW Configuration Device, obtain the correct, pre-programmed spare unit for this GW.

2. Check the replacement module is not damaged and is the correct type.

3. Use the circuit breaker at the base of the TICC to power-off the failed module or PSU.

REMOVAL OF EXISTING GW MODULE

4. Disconnect the two cables from the “MODEM” and “TDL” connectors on the front panel of the GW Module.

5. Extract the GW Module from the sub-rack.

REMOVAL OF EXISTING GW CONFIGURATION DEVICE

6. Power-off and remove the corresponding DLM or LDT to gain access to the configuration device from the rear of the cubicle.

7. Remove the GW module following clauses 4 and 5.

8. Disconnect the power and earth wiring from the Configuration Device, noting the positions.

9. Unscrew the Configuration Device from the sub-rack and remove, noting the position.

REMOVAL OF EXISTING GW PSU

10. Extract the GW PSU from the sub-rack.

INSTALLATION OF REPLACEMENT GW MODULE OR GW PSU

11. Insert the replacement GW Module/PSU and check that it is seated correctly in its slot.

12. Secure the GW module/PSU into the sub-rack using the four screws.

13. For GW Module replacement, re-connect the two cables to the “MODEM” and “TDL” connectors on the front panel of the GW Module.

INSTALLATION OF REPLACEMENT GW CONFIGURATION DEVICE

14. Screw the replacement GW Configuration Device into the sub-rack into the position noted in clause 9.

15. Re-connect the power and earth wiring into the positions noted in Step 9.

16. Re-fit the GW Module following clause’s 11 - 13.

17. Re-fit and switch on the power to the corresponding DLM or LDT removed at clause 8.

AFTER INSTALLATION WORK

18. Check that replaced GW components are correctly installed.

19. Use the Switch or circuit breaker at the base of the TICC cubicle to turn on the power to GW.

20. Observe that the LED “Vout” on the PSU is lit.

21. On the SSys HMI, check that the previously reported alarms have become inactive (white) and clear them from the display. If the failure is still present or if one of the previous checks failed, refer to Second Line Maintenance.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SL06		
Replace a SMARTLOCK SSys Component		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Support Server and Network Devices (includes Remote Client Router)
Excludes:	SSys Local and Remote Client PCs

GENERAL

Endeavour to clear Support Server faults by rebooting the device before resorting to replacement.

BEFORE INSTALLATION WORK

1. Check the replacement unit is not damaged and is the correct type.

2. For replacement of the SSer, Shut down the SSer through the windows menu. If this is not possible, then force a power-down using the power switch.

3. For Network Device replacement, power-off the Network Device by removing its power connector.

REMOVAL OF EXISTING SUPPORT SERVER

4. Disconnect all cables from the rear of the SSer to be replaced, noting connector positions.

5. Remove the SSer from the SSys rack.

REMOVAL OF EXISTING NETWORK DEVICE

6. Disconnect all cables from the front and rear of the Network Device, noting the positions.

7. Remove the Network Device from the SSys rack.

INSTALLATION OF REPLACEMENT NETWORK DEVICE

8. Insert a spare Ethernet network device (from the approved Smartlock 400 spare list) in the SSys rack (if the device is a router or IDNet Switch, it needs to be a pre-configured unit. IMNet switches are left on factory default settings).

9. Reconnect all cables at the front and rear of the Ethernet network device in the positions noted in Step 4.

INSTALLATION OF REPLACEMENT SUPPORT SERVER

10. Install a configured spare SSer into the SSys rack.

    The replacement unit shall be pre-configured for the same role as the removed SSer. The hardware shall be of a compatible type, and the installed software and configuration shall be the same as for the removed unit. The labelling of the two machines shall match:

    a) The machine shall be for the same scheme, and have the same name within that scheme, e.g. Horsham SSer1A.

    b) The S2K version is the same, e.g. 6.6.1.

    c) The Support System software baseline is the same, e.g. 1.4.9.

    d) The specific application data release shall be the same, e.g. Horsham 1.7.

11. Reconnect all cables at the rear of the new SSer in the positions.

AFTER INSTALLATION WORK

12. Check that replaced SSys components are correctly installed.

13. Where necessary, power-on the replacement component.

14. For SSer replacement, observe the start-up screen for error messages.

15. After booting has completed, check that the new Support Server is working by observing the status of the server on the HMI.

16. For Network device replacement, On the Client HMI, check that the previously reported alarms have become inactive (white) and clear them from the display.

17. As required, arrange for the Addition/Removal of machines from the Windows Domain.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SL07		
Replace a SMARTLOCK SSys Client PC		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	SSys rack mounted Local client / client gateway PCs, desk-top Client PCs and Remote Client PCs
Excludes:	All other SSys rack mounted equipment

GENERAL

Replacement of a Client PC hardware requires configuration in the Windows Server domain to allow the SSer to be recognised and function.

The removed hardware shall also be removed from the SSer domain configuration.

BEFORE INSTALLATION WORK

1. Check the replacement module is not damaged and is the correct type.

2. Shut down the SSys Client through the windows menu. If this is not possible, then force a power-down using the power switch.

REMOVAL OF EXISTING CLIENT PC

3. Disconnect all cables from the rear of the SSys Client noting the positions.

4. Remove the SSys Client.

INSTALLATION OF REPLACEMENT CLIENT PC

5. Install a configured spare SSys Client PC.

6. Reconnect all cables to the SSys Client in the positions noted at Step 3.

AFTER INSTALLATION WORK

7. Check that replaced Client PC is correctly installed.

8. Where necessary, power-on the replacement components.

9. After booting has completed, check that the new Client PC is working correctly by exercising the Support System HMI.

10. As required, arrange for the addition/Removal of machines from the Windows Domain.

11. Check that the previously reported alarms have become inactive (white) and clear them from the display.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SS01		
Replace an SSI MPM or PPM		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Mk2A, Mk2B and Mk3 MPMs
Excludes:	Mk1A and Mk1B MPMs

***** INDEPENDENCE EXEMPT *****
PROVIDED THAT THERE IS NO SYSTEM SHUTDOWN AND NO RE-ENTRY OR MODIFICATION OF TECHNICIANS CONTROLS IS REQUIRED

The Installed SSI Software Record (ISSR) sheet details software version, hardware mod state, hardware compatibility and Memory Module (MM) serial number.

BEFORE INSTALLATION WORK

1. Print a current list of all controls from the Technician's Terminal (TT), in case a power down is necessary.

2. Check the printout against the Technician's Controls Logbook.

3. Check replacement MM is not damaged and is correct type, ensuring that the front panel of the replacement MM is identically labelled to that of the existing MM (Control Centre name/number, Interlocking name/number, Module name, program label, data label), **(IF MM IS TO BE REPLACED).**

   The existing MM may be reused, unless it is suspected that it was causing a problem, in which case it shall be returned with the MPM/PPM.

4. Check replacement MPM or PPM is not damaged and is correct type. Check for the correct mod state (label on the rear of the unit). This shall be the same as the mod state of the existing MPM or PPM.

5. Check compatibility between the replacement MM and the existing MPM or PPM is correct (mod state compatibility as defined in SSI 8150), **(IF MM IS TO BE REPLACED).**

6. Check replacement MPM or PPM and MM are sealed.

7. Enter details of the MM on the next available line of the ISSR and strike out the line relating to the existing MM **(IF MM IS TO BE REPLACED).**

   Once the replacement MM has been checked in service, a copy of the amended ISSR shall be returned to the National Records Group.

8. Insert the replacement MM into the replacement MPM or PPM **(IF MM IS TO BE REPLACED).**

9. Check a SSI Equipment Status Report is completed for the existing MPM or PPM (serial number, mod state, manufacturer, lamps/indicators, MPM or PPM, Interlocking).
10. Check existing MPM is disabled from the interlocking via the Technician's Terminal **(MPM ONLY).**

    This allows the interlocking to continue to operate by reconfiguring the two remaining MPMs from a triplicate to a duplicate system. When only two MPMs are working and one is to be replaced the interlocking shall be stopped.

    The successful disabling of an MPM is reported via MPM1. Hence, if MPM 1 is the MPM being disabled, “CONTROL NOT ACKNOWLEDGED” is displayed on the TT Screen instead of “CONTROL EXECUTED”, although the MPM is in fact disabled.

11. Check existing MPM or PPM is switched off. This is achieved by pulling the ON/OFF switch toggle, to release the lock and set the switch to the OFF position.

REMOVAL OF EXISTING MPM OR PPM

12. Identify and remove the module fuse from the cubicle base.

13. Disconnect the power cable and data cables from the rear of the existing MPM/PPM.

14. Remove the existing MPM/PPM (4 securing screws) from the interlocking cubicle.

INSTALLATION OF REPLACEMENT MPM OR PPM

15. Install the MM out of the existing MPM or PPM into the replacement MPM/PPM **(IF MM IS TO BE REUSED).**

16. Install the replacement MPM or PPM with MM into the Interlocking Cubicle (4 securing screws).

17. Reconnect the data cables and power cable and replace the module fuse.

18. Pull the ON/OFF switch toggle to release the lock and set the switch to the ON position.

    It is not necessary to re-enable the MPM from the Technician's Terminal. The unit starts automatically when power is applied

AFTER INSTALLATION WORK

19. Check replacement MPM/PPM and memory module are correctly installed.

20. Check that the replacement MPM or PPM is operating correctly by observing the indicator LEDs (all alight, front and rear of unit). Observe the operation of the Interlocking for about five minutes.

21. Check that all controls are entered from the Technician's Terminal before starting interlocking **(MPMs AFTER TOTAL SYSTEM SHUTDOWN ONLY).**

    A new list of controls shall be obtained from the Technician's Terminal as a check.

22. Check or arrange for correct labelling of unit.

23. Return the SSI Equipment Status Report to your SM(S). A copy of the Equipment Status Report and ISSR shall accompany the faulty module on its return for repair.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/SS02		
Replace an SSI TFM, DLM, or LDT		
Issue No. 06	Issue Date: 01/09/18	Compliance Date: 01/12/18

Includes:	Point TFM, signal TFM.
Excludes:	MPM, PPM.

***** INDEPENDENCE EXEMPT *****

The "Installed SSI Software Record" (ISSR) sheet at the interlocking details allowable mod states and any local restrictions.

BEFORE INSTALLATION WORK

1. Check replacement TFM or DLM or LDT is Not Damaged and is Correct Type.

2. Check replacement TFM or DLM or LDT mark and mod state is correct (local restrictions).

3. Check replacement TFM or DLM or LDT is sealed.

4. Isolate existing TFM or DLM or LDT power supplies in the correct order (110V then any 140V supply).

AFTER INSTALLATION WORK

5. Check replacement TFM or DLM or LDT is Correctly Installed.

6. Check TFM or DLM or LDT power supplies are restored in the correct order (any 140V then 110V supply).

7. Check replacement TFM operates correctly. **(TFM ONLY)**

"Operates correctly means", observing the correct indications on the TFM itself and confirming the correct operation of one function operated by the TFM.

For example, a signal's aspect can be changed, points operated normal and reverse, etc.

8. Check or arrange for Correct Labelling of unit.

9. Check that the TFM current proving function is in use, by carrying out a Lamp Proving Test [Remove lamp test (NR/SMS/Test/022)] for each current-proved output. **(ALSTOM Mk3, MOD STATE 4, SIGNAL MODULE ONLY)**

It is not necessary to carry out the first filament failure test, but only to confirm with the signaller that the lamp-out condition has been detected.

If the module fails to detect lamp out, the signal shall be immediately treated as defective and steps shall be taken to investigate and correct the failure.

Current proving links in the 75-way plug coupler shall be verified by visually checking for correct position of the pins and measurement of electrical continuity. If the links and plug coupler are in place, the module itself should be sent for investigation.

The details of the failure discovered shall be reported promptly to your Section Manager (Signals).

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SS03		
Replace an Ansaldo Interlocking Plug in Module		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	The Area Controller (AC), Field Device Controller (FDC), Field Isolation Unit (FIU), Field Adaption Unit (FAU), Interlocking Unit, CIU Interlocking Module
Excludes:	Any other type or make of plug in module

General

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

Before changing any module(s) that form part of a replicated system check that the other components in that system are functioning correctly.

Before disconnecting or reconnecting the red or green fibre optic data transfer cables confirm that the Fibre Interface module is not fully inserted to allow the capacitors to discharge.

The Area Controller (AC), Field Device Controller (FDC), Field Isolation Unit (FIU) and Field Adaption Unit (FAU) modules can be removed and replaced without powering down but once removed allow 10 seconds (minimum) to elapse before replacement.

The CIU Interlocking module shall be powered down before removal.

BEFORE INSTALLATION WORK

1. Check replacement module is not damaged and is correct type.

2. Check cover of replacement module is correctly fitted and secure.

AFTER INSTALLATION WORK

3. Check replacement module is correctly installed.

4. Check replacement module operates correctly.

   Check correct operation means observing the correct indications on the module itself.

5. Check or arrange for correct labelling of module.

6. Advise box Technician of serial number of failed module and replacement module.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/SS04		
Replace a VHLC Card		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	VHLC Card
Excludes:	All other equipment card types

BEFORE RE-INSTALLATION WORK

1. Check replacement card is not damaged.
2. Check replacement card is correct type.

AFTER RE-INSTALLATION WORK

3. Check card is installed correctly.
4. Complete VHLC voltage SMS/PartB/152.
5. Check green status LEDs.
6. Check on known input to corresponding input LED.
7. Check one known output to corresponding output LED.
8. Observe the interloclking for five minutes.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SS05		
Replace an SSI TFM Plug Coupler		
Issue No: 02	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	SSI TFM Plug Coupler where its internal wiring harness or plug coupler has been damaged
Excludes:	All Other Plug Couplers

GENERAL

Failure to isolate the SSI TFM plug coupler wires and plug coupler to the TFM can result in unwanted point movements, aspect clearances or damage to the SSI Datalink.

You shall come to a clear understanding with the Signaller on:

a) The extent of the work to be carried out.

b) The equipment that shall be affected by the work.

c) The timescales involved in installation and testing

As each TFM address is unique to the SSI, this test is only applicable if:

d) The replacement SSI TFM plug coupler has been specifically manufactured for the specific site/module.

e) The new SSI TFM plug coupler wiring is of correct length to be installed

Verify that all routes are normalized, points are keyed to the required position and clamped and scotched.

BEFORE INSTALLATION WORK

1. Obtain the agreement of the S&TME to use the replacement SSI TFM Plug coupler harness.

2. Check replacement SSI TFM plug coupler is not damaged.

3. Check replacement SSI TFM plug coupler has safe insulation.

4. Check replacement SSI TFM plug coupler wiring is correct to the SSI TFM plug coupler pin number. Refer to the site copies of the diagrams.

NOTE: *The diagrams refer the SSI TFM plug coupler analysis from the wire side.*

5. Check replacement SSI TFM plug coupler address pins to the site copies of the diagrams.

6. Check the anti-rotation collars are present on the specified address pins. Refer to the SSI TFM plug coupler analysis.

7. Check guide Pins and Jack Screws are correct to the SSI TFM plug coupler analysis.

8. Check Datalink wiring has been completed as a twisted pair.

9. CONTINUITY TEST all cores in the replacement SSI TFM plug coupler.

10. Check existing SSI TFM plug coupler is isolated from the supplies at all terminals and the TFM Module power supply is isolated.

11. WIRE COUNT existing SSI TFM plug coupler terminals to the wiring diagram.

12. Check existing SSI TFM plug coupler terminals are correctly labelled.

13. Physically trace the existing SSI TFM plug coupler wiring.

DURING INSTALLATION WORK

14. Remove the existing SSI TFM plug coupler from the TFM Module.

15. Insert and secure the new SSI TFM plug coupler to the TFM Module checking the plug coupler is the correct orientation.

16. Working in a logical order, carry out a "wire by wire" replacement of the existing SSI TFM plug coupler wiring harness. Remove and insulate each wire as soon as it is detached.

AFTER INSTALLATION WORK

17. Check replacement SSI TFM plug coupler is correctly installed on the correct TFM module and check the plug coupler retaining screws for security.

18. Check replacement wires are correctly terminated.

19. Check terminated twisted pair wires are twisted up to 25mm (1 inch) from the terminals.

20. WIRE COUNT affected wires to the site diagrams.

21. Arrange for the SSI Module to be powered up and observe the module status indications.

NOTE: *Come to a clear understanding with the Signaller that the 551 TFM Module is to be powered up and that all Signal Routes and points are normalized to minimalize unwanted aspects clearing to proceed or point movements when Module is powered up*

22. Check the Maintenance Test Plan for the item of equipment fed by the affected SSI TFM Plug Coupler and carry out steps marked with an asterisk '*'.

23. If the affected SSI TFM plug coupler goes to point detection circuits, carry out steps marked with an asterisk '*' on the Maintenance Test Plan for the point detection circuits.

24. EARTH TEST (DC) or EARTH TEST (AC) circuits where designed to be earth free.

25. Check at the SSI Interlocking for any error messages on the Technicians Terminal and arrange for them to be removed.

26. Check or arrange for correct labelling of the SSI plug coupler.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/SW10		
Replace a Siemens Train Staff Lockout Device		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Siemens Train Staff Lockout Device (TSLD)
Excludes:	All other types of lockout device

BEFORE INSTALLATION WORK

1. Check the replacement instrument is the correct type and not damaged.
2. WIRE COUNT the existing instrument to the wiring diagram.
3. Check the wiring for safe insulation and that it is correctly labelled.
4. Remove the existing key from the instrument.

   NOTE: The key has to be removed before the instrument is powered down.

5. Disconnect the power supply.
6. Remove and label the failed instrument as defective.

AFTER INSTALATION WORK

7. Check the instrument is securely installed.
8. WIRE COUNT the new instrument to the wiring diagram.
9. Check the wire and cables are clear of moving parts.
10. Reconnect the power supply.
11. Replace the key into the instrument.
12. Check the key can only be removed when a release is given.
13. Check that once removed, the key, can be replaced back into the system and that any function released by the withdrawal of the key is cancelled.
14. Check, or arrange for the correct labelling of the new instrument.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/TC00		
Partial Testing of EBI Track 200 (TI21), 50Hz AC, Reed, FS2600, HVI, EBI Track 400 Track Circuits for Defined Tasks		
Issue No: 07	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	EBI Track 200 (TI21), 50Hz AC, Reed, FS2600, HVI Track, EBI Track 400 Circuits only
Excludes:	Any other type of Track Circuit

GENERAL

A full NR/SMS test shall be completed unless the following tests are completed satisfactorily within the stated limits.

EBI TRACK 200 (TI21)TRACK CIRCUITS

Defined Tasks:	a) Remove/Replace track circuit connections b) Renew or remove and refit Track circuit bonding not located within the tuned zone (all types, including traction bonding) c) Track replacement of a short length of plain rail (for defect) but not re-railing, S&C, rail located within the tuned zone, IRJs (except when referred here by TC03 (Testing Track circuits After IRJ Renewal)

If both track tuning units are removed from the same track circuit (TC‘2’), it is possible for TC‘3’ to be energised by TC‘1’ feed with a train on TC‘3’. If it is required to remove both track tuning units disconnect both adjacent track circuits (TC‘1’ and TC‘3’) and inform your SM(S).

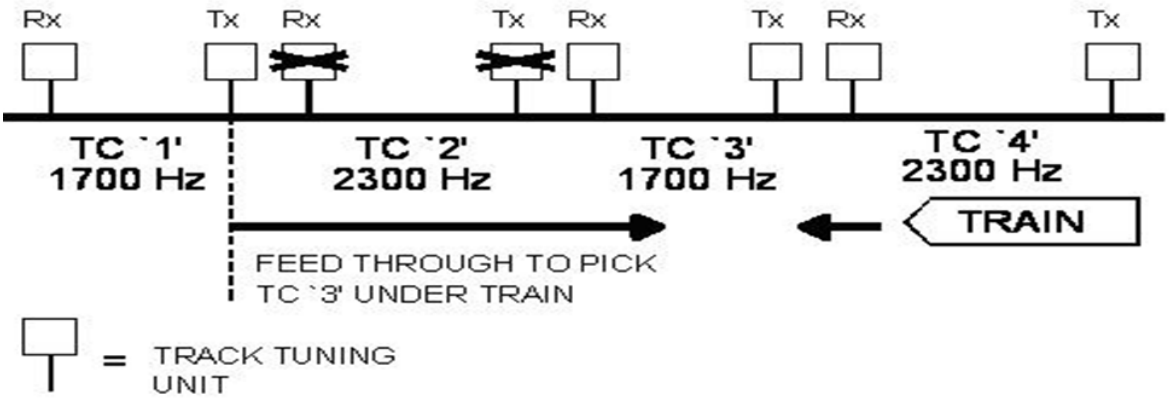


Figure 1

1. Carry out a drop shunt and pick-up shunt test, see NR/SMS/PartB/Test/253 (EBI Track 200 (Audio Frequency) Track Circuit Test)).

The values obtained shall not deviate from the previously recorded reading by more than +0.1 ohm and be greater than or equal to the minimum value listed in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

2. For Analogue receivers measure the voltage across the 1Ω resistor; compare this reading against the record card. The reading obtained shall not deviate by more than +10 % from the previously recorded reading.

3. For Digital receivers, record the *Inow* AV current using the display on the receiver and compare this reading against the record card. The reading obtained shall not deviate by more than +10 % from the previously recorded reading.

4. Check for correct stagger of track with respect to all adjacent track circuits affected. (**SINGLE RAIL ONLY**).

5. Confirm track circuit drops with 0.5 ohm at all extremities and visually check all bonding. (**SINGLE RAIL ONLY**)

6. Check correspondence of the track circuit indication with the Signaller.

7. If available, check RCM traces have returned to their normal operating level as before the work.

AC TRACK CIRCUITS: SINGLE RAIL, DOUBLE RAIL, VT1 (SP)

Defined Tasks:	a) Remove/Replace track circuit connections b) Renewal of like-for-like track tail cables (excluding doubling), c) Track circuit components listed in TC01, TC02, d) Track circuit bonding (all types, including traction bonding), e) Track replacement of a short length of plain rail (for defect) but not re-railing, S&C, or IRJ (except when referred here by TC03)

1. Carry out a drop shunt and pick-up shunt test, see NR/SMS/PartB/Test/260 (50Hz AC Track Circuit Test).

   The values obtained shall not deviate from the previously recorded reading by more than +0.1 ohm and be greater than or equal to the minimum value listed in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

2. Check the relay control coil voltage, see NR/SMS/PartB/Test/260. The values obtained shall not deviate by more than +10 % from the previously recorded reading.

3. Check for correct stagger of track with respect to all adjacent track circuits affected, see NR/SMS/PartB/Test/260.

4. Confirm track circuit drops with 0.5 ohm at all extremities and visually check all bonding (**SINGLE RAIL TRACK CIRCUITS ONLY**).

5. Perform a stability test, see NR/SMS/PartB/Test/260 (**DOUBLE RAIL TRACK CIRCUITS ONLY).**

6. Check correspondence of the track circuit indication with the Signaller.

7. If available, check RCM traces have returned to their normal operating level as before the work.

REED TRACK CIRCUITS

Defined Tasks:	a) Remove/Replace track circuit connections b) Renewal of like-for-like track tail cables (excluding doubling), c) Track circuit components listed in TC01, TC02, d) Track circuit bonding (all types, including traction bonding), e) Track replacement of a short length of plain rail (for defect) but not re-railing, S&C, or IRJs (except when referred here by TC03)

1. Carry out a drop shunt and pick-up shunt test, see NR/SMS/PartB/Test/257 (Reed Type RT Track Circuit Test).

   The values obtained must not deviate from the previously recorded reading by more than +0.1 ohm and be greater than or equal to the minimum value listed in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

2. Check the track receiver filter output voltage t11/t12 is 150 to 300 mV [Receiver track filter voltage, see NR/SMS/PartB/Test/257.

3. The values obtained shall not deviate by more than +10 % from the previously recorded reading.

4. Confirm track circuit drops with 0.5 ohm at all extremities and visually check all bonding (**SINGLE RAIL ONLY**).

5. Check correspondence of the track circuit indication with the Signaller.

6. If available, check RCM traces have returned to their normal operating level as before the work.

FS2600 TRACK CIRCUITS

Defined Tasks:	a) Remove/Replace track circuit connections b) Renewal of like-for-like track tail cables (excluding doubling) c) Track circuit components listed in TC01, TC02 d) Track circuit bonding (all types, including traction bonding) e) Track replacement of a short length of plain rail (for defect) but not re- railing, S&C, or IRJs (except when referred here by TC03)

1. Carry out a drop shunt and pick-up shunt test, see NR/SMS/PartB/Test/259 (FS 2600 Track Circuit Test).

   The values obtained shall not deviate from the previously recorded reading by more than +0.1 ohm and be greater than or equal to the minimum value listed in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

2. Check the Monitor Point Voltage (MPV), see NR/SMS/PartB/Test/259.

   The values obtained shall not deviate by more than +10 % from the previously recorded reading.

3. Check correspondence of the track circuit indication with the Signaller.

4. If available, check RCM traces have returned to their normal operating level as before the work.

HVI TRACK CIRCUITS

Defined Tasks:	a) Remove/Replace track circuit connections b) Renewal of like-for-like track tail cables (excluding doubling), c) Track circuit components listed in TC01, TC02, d) Track circuit bonding (all types, including traction bonding), e) Track replacement of a short length of plain rail (for defect) but not re- railing, S&C, or IRJs (except when referred here by TC03)

1. Carry out a drop shunt and pick-up shunt test, see NR/SMS/PartB/Test/255 (HVI (High Voltage Impulse) Track Circuit Test.

   The values obtained shall not deviate from the previously recorded reading by more than +0.1 ohm and be greater than or equal to the minimum value listed in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

2. Check the relay coil voltage, see NR/SMS/PartB/Test/255.

   The values obtained shall not deviate by more than +10 % from the previously recorded reading.

3. Check for correct stagger of track with respect to all adjacent track circuits affected.

4. Confirm track circuit drops with 0.5 ohm at all extremities and visually check all bonding.

5. Check correspondence of the track circuit indication with the Signaller.

6. If available, check RCM traces have returned to their normal operating level as before the work.

EBI TRACK 400 TRACK CIRCUITS

Defined Tasks:	a) Remove/Replace track circuit connections b) Renew or Remove and Refit Track Circuit bonding not located within the tuned zone (all types, including traction bonding) c) Track replacement of a short length of plain rail (for defect) but not re-railing, S&C, rail located within the tuned zone, or IRJ (except when referred here by TC03)

1. Carry out a drop shunt and pick-up shunt test, NR/SMS/PartB/Test/263 (EBI Track 400 Audio Frequency Track Circuit Test).

   The values obtained shall not deviate from the previously recorded reading by more than +0.1Ω and be greater than or equal to the minimum value listed in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

   On the pick-up shunt, allow 2 seconds between each value to allow the slow-to-pick relay drive from the Rx to operate.

   Station Area Frequency circuits should operate within 1 second.

   The pick-up value should be 0.1Ω higher than the drop-shunt value.

2. Check the *ITH* (Threshold) using the display on the receiver and compare this with the record card. The obtained reading shall not deviate from the previously recorded reading.

3. Check the *INOW AV* using the display on the receiver and compare this with the record card. The obtained reading shall not deviate by more than +/-10% of the previously recorded reading.

4. Check the *INOW QUAL* value using the display on the receiver. The obtained reading shall not be less than 100%.

5. Check the display of the Receiver for a steady “PICK” or “drop” indication.

   If one of these indications cycles with “ERR” then refer to NR/SMS/Appendix/10 (General information on EBI Track 400 Audio Frequency Track Circuit Equipment) to investigate and rectify the reason.

6. Confirm track circuit drops with minimum shunt value as per NR/SMS/PartZ/Z03 (Train Detection – Reference Values) at all extremities and visually check all bonding (**SINGLE RAIL ONLY**).

7. Confirm track circuit drops with 0.2Ω shunt at the following positions within the track circuit (**STATION AREA FREQUENCY CIRCUITS ONLY**):

   - Transmitter Pole
   - Mid-Point
   - Receiver Pole

8. Check correspondence of the track circuit indication with the Signaller.

9. If available, check RCM traces have returned to their normal operating level as before the work.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/TC01		
Replace Plug in Track Circuit Equipment		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	All plug-in track circuit equipment, Track relays with detachable tops
Excludes:	All other types of Plug in equipment

GENERAL

During relay replacement, record the information required in accordance with NR/L2/SIG/11129, to enable the SM(S) to update the relay database.

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check replacement track circuit relay is not damaged (contact spring alignment, internal contamination, relay comb alignment, loose object) and is correct type.

3. Check track circuit receiver is isolated from the supply (ASTER, SF15 AND TI21 TRACK CIRCUITS ONLY).

4. Check any wiring between the bottom half of the detachable top and the relay terminals has safe insulation (DETACHABLE TOP RELAYS ONLY).

5. Test any wiring between the bottom half of the detachable top and the relay terminals are correct (DETACHABLE TOP RELAYS ONLY).

6. Check replacement unit is correctly sealed (RELAYS ONLY).

7. Check plugboard is free of contamination.

AFTER INSTALLATION WORK

8. Check spades are locked in plugboard.

9. Check replacement unit is correctly installed, and the retaining clip is in place.

10. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.

* 11. Carry out track circuit NR/SMS/Test/251 to 263 (full test) and record the test measurements on the record card, together with the reason for the test.

12. Check, or arrange for, correct labelling of unit.

Where wiring between relay coil and rails is removed

* 13. Test relay coil polarity is correct (DC TRACK CIRCUITS IN AC ELECTRIFIED AREAS ONLY).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/TC02		
Replace Track Circuit Equipment		
Issue No: 09	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Track Circuit Equipment
Excludes:	All plug-in track circuit equipment, trackside track circuit units

GENERAL

During relay replacement, record the information required in accordance with NR/L2/SIG/11129, to enable the SM(S) to update the relay database.

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Check replacement unit is not damaged and is correct type and free of internal contamination.
3. WIRE COUNT existing unit to the wiring diagram.
4. Check existing wiring has safe insulation.
5. Carry out INSULATION TEST replacement transformer (use 1000V insulation tester) (minimum 2M ohms terminals to case). (TRACK ISOLATING TRANSFORMER ONLY).
6. Check existing wiring is correctly labelled.
7. Check replacement unit is correctly sealed (RELAYS ONLY)
8. Check existing unit is isolated from the supply.

AFTER INSTALLATION WORK

9. Check replacement unit is correctly installed (level).
10. Check wiring is replaced as labelled.
11. WIRE COUNT replacement unit to the wiring diagram.
12. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
13. Check terminations are secure and suitably protected.
14. Check output circuits are disconnected before supply is restored. (TRANSFORMER-RECTIFIER / BATTERY CHARGER ONLY).

15. Test input and output voltages and output polarity. (TRANSFORMER-RECTIFIER / BATTERY CHARGER ONLY).

16. Carry out EARTH TEST (DC) or EARTH TEST (AC) primary supply. (TRANSFORMER-RECTIFIER / BATTERY CHARGER ONLY).

17. Test battery charging rate with output circuitry restored. (BATTERY CHARGERS ONLY).

    It is advisable to return after a period of time, depending on the initial state of the cells, to retest the battery charger rate.

18. Test output voltage with output circuits restored. (TRANSFORMER-RECTIFIER / BATTERY CHARGER ONLY).

19. Check polarity/phase (stagger) on the rails and check this conforms to the bonding plan. (TRACK CIRCUITS EXCEPT REED AND JOINTLESS TYPES).

20. Test the track circuit and record the test measurements on the record card, together with the reason for the test.

21. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/TC03		
Testing Track Circuits After IRJ Renewal		
Issue No: 03	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Renewal of insulating rail joint installed in the same track bed. EBI Track 200 (TI21), EBI Track 400, 50Hz AC, FS2600, Reed, HVI, DC Track Circuits only
Excludes:	Renewal of IRJ in other track circuit types

BEFORE INSTALLATION

1. When an IRJ is renewed, it shall be cleaned of any swarf and the effectiveness of the insulations tested at the time of installation.

AFTER INSTALLATION

2. Refer to NR/SMTH/Part04/TC00 (Partial Testing of EBI Track 200 (T121), 50Hz AC, Reed, FS2600, HVI, EBI Track 400 Track Circuits for Defined Tasks) and complete relevant test **(EXCLUDING DC TRACKS).**

3. Complete NR/SMS/PartB/Test/251 (DC Track Circuit Test) – Full Test and Residual Voltage Test **(DC TRACKS ONLY).**

4. Check that IRJ clearances conform to any shown on the Bonding Plan and NR/SMS/PartZ/Z03 (Train Detection - Reference Values) – Section 3 (IRJ CLEARANCES).

   There shall not be a worsening of any existing clearances; existing non-conforming clearances shall be reported to your SM(S).

5. Check fittings and fixings for security (side leads, track circuit connections). Check that side leads and tail cables are clear of tamping zone.

6. Check cable side lead/tail cable is not susceptible to mechanical damage.

7. Check that rail clips are not shorting on the IRJ plate.

8. If available, check RCM current traces have returned to their normal level as before the renewal.

END

Includes:	All Aster, SF15, EBI Track 200 (TI21) and EBI Track 400 trackside units external to apparatus case
Excludes:	All other types of trackside unit

GENERAL

CAUTION: Disconnection of TX and RX tuning units of the same track circuit from the rails at the same time can result in Wrong Side Failure. Confirm adequate means of protecting safety of the line are in place while completing this work.

If both track tuning units are removed from the same track circuit (TC‘2’), it is possible for TC‘3’ to be energised by TC‘1’ feed with a train on TC‘3’.

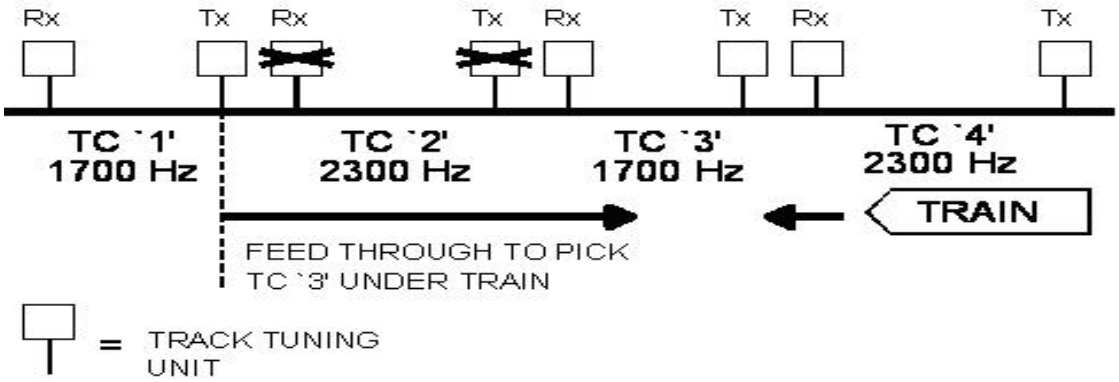


Figure 1 – Track Layout

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).
2. Check replacement unit is not damaged and is correct type.
3. WIRE COUNT existing unit to the wiring diagram.
4. Check existing wiring has safe insulation.
5. Check existing wiring is correctly labelled.
6. Check existing unit is isolated from the supply.

AFTER INSTALLATION WORK

7. Check replacement unit is correctly installed.

8. Check wiring is replaced as labelled.

9. WIRE COUNT replacement unit to the wiring diagram.

10. Check T1 & T2 terminals are arranged as Figure 2 **(EBI TRACK 200 (TI21) TRACK CIRCUITS ONLY).**

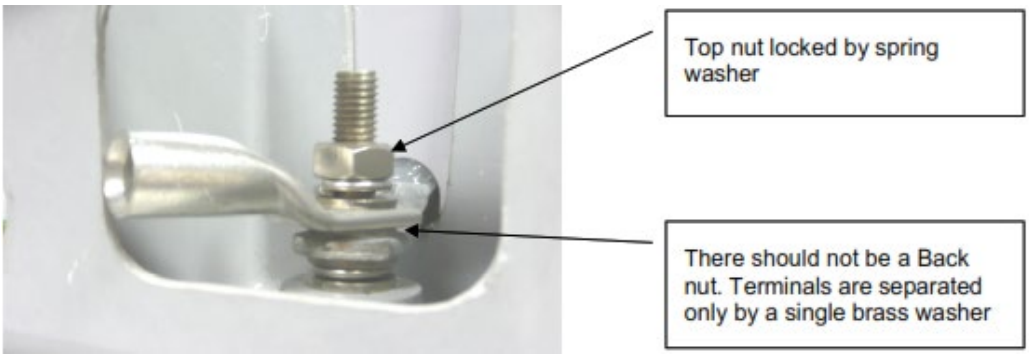


Figure 2 – T1 & T2 Correct Terminal Arrangement

11. Check that any sound reducing jacket previously fitted has been replaced **(EBI TRACK 200 (TI21) TRACK CIRCUITS ONLY).**

* 12. Refer to NR/SMS/PartB/Test/253 (EBI200) or NR/SMS/PartB/Test/254 (SF15 / Aster U) or NR/SMS/PartB/Test/263 (EBI400) and carry out Maintenance Test of the track and record the test measurements on the record card, together with the reason for the test.

    Both associated track circuits (receivers) shall be tested if a centre feeding transmitter unit has been replaced.

13. If the replaced track circuit tuning unit is part of a Tuned Zone, refer to NR/SMS/PartB/Test/253 (EBI200) or NR/SMS/PartB/Test/254 (SF15 / Aster U) or NR/SMS/PartB/Test/263 (EBI400) and carry out Maintenance Test for the companion tuning unit track circuit, record the test measurements on the record card, together with the reason for the test.

14. Where available, check RCM traces have returned to normal levels.

END

BEFORE INSTALLATION WORK

1. Check replacement track circuit interrupter is not damaged and is correct type.
2. Wire count existing track circuit interrupter to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring is correctly labelled.
5. Check existing track circuit interrupter is isolated.

AFTER INSTALLATION WORK

6. Check replacement track circuit interrupter is correctly installed.
7. Check wiring is replaced as labelled.
8. Wire count replacement track circuit interrupter to the wiring diagram.
9. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.
10. Where duplicated leads are connected to the track interrupter, all connections should be checked against the bonding diagram before they are connected together.
11. Check only the correct track circuit energises when the cable is reconnected to the track circuit interrupter.
12. Test track circuit. Refer to track circuit full test NRSMS/PartB/Index (Index – Specific Tests -Tests 250 to 261) and record the test measurements on the record card, together with the reason for the test. (WHERE NO TRACK CIRCUIT INTERRUPTER RELAY PROVIDED).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/TC06		
Replace an Impedance Bond		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check replacement unit is not damaged and is correct type.

3. INSULATION TEST replacement impedance bond (minimum 1M ohm at 1000V) auxiliary coil to case and auxiliary coil to traction coil. This shall be performed with no cables or tuning capacitors attached to the terminals. A short circuit shall also be applied across the running rails if the side leads have been installed.

4. WIRE COUNT existing unit to the wiring diagram.

5. Check existing wiring has safe insulation.

6. Check existing conductors are correctly labelled.

7. Check existing unit is isolated.

AFTER INSTALLATION WORK

8. Check replacement unit is correctly installed.

9. Check replacement unit, fittings and fixings for security (Side leads, busbars). Check that side leads are clear of tamping zone.

10. Check conductors are replaced as labelled.

11. WIRE COUNT replacement unit to the wiring diagram.

* 12. Test all IRJs in the affected track circuit that are required to be electrically staggered with respect to adjacent track circuits.

* 13. Test track circuit voltage and phase are correct.

14. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.

15. Check terminations are secure and suitably protected.

16. Check cable is secured.

* 17. Check for correct phase (stagger) of the track circuit.

18. Test all affected track circuits, see NR/SMS/PartB/Tests/251 to 263 and record the test measurements on the appropriate NR/SMS record card, together with the reason for the test.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/TC07		
Replace a Track Loop		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Reed track loops
Excludes:	ATP track loops

BEFORE INSTALLATION WORK

1. Check replacement loop is not damaged and is correct type.
2. WIRE COUNT existing loop to the wiring diagrams.
3. Check replacement loop has safe insulation.
4. Check replacement loop is correctly labelled.
5. Check resistance of replacement loop is correct (14 to 19 ohms).
6. Check loop fuses are removed.

AFTER INSTALLATION WORK

7. Check loop is correctly installed.
8. Check security of replacement loop to the rails.
9. INSULATION TEST replacement loop (minimum 1M ohm).
10. Test track circuit Track circuit full test (NR/SMS/Test/250 to 261) and record the test measurements on the record card, together with the reason for the test.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/TC08		
Replace a Track Circuit Aid (TCAID) Unit		
Issue No: 07	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	TCAID(N), TCAID(D)
Excludes:	All other types of Track Circuit Aid

GENERAL

Accuracy of connection is absolutely vital if a TCAID(D) is to function correctly and not suffer from false detections or failures to detect trains.

The TCAID (MC) is a non-direction selective TCAID mounted in a metal case. This type is no longer used. Any found shall be reported to your SM(S).

BEFORE INSTALLATION WORK

1. Check replacement unit is not damaged and is correct type. MOD Level 0-2 (of the unit) are not for use in high voltage track circuit areas, MOD Level 3 can be used in all track circuit areas up to 160V.

2. Carry out a WIRE COUNT on the existing unit to wiring diagram (see track circuit equipment standards).

3. Check that existing wiring has safe insulation.

4. Check that existing wiring is correctly labelled.

5. Check existing unit is isolated from the supply by slipping links in the disconnection box.

AFTER INSTALLATION WORK

6. Check replacement unit is correctly installed.

7. Check wiring is replaced as labelled.

8. WIRE COUNT the replacement unit to the wiring diagram (see track circuit equipment standards).

9. Check any links, and red dome nuts or equivalent, are correctly replaced and secure.

10. Check terminations are secure and suitably protected.

* 11. Test TCAID unit NR/SMS/PartB/Test/043 (TCAID Test) and record the test measurements on the NR/SMS record card, together with the reason for the test.

* 12. Test the track circuit Track circuit full test (NR/SMS/Test/251 to 263) and record the test measurements on the NR/SMS record card, together with the reason for the test.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/TC09		
Replace ZKL3000-RC		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Dual Inventive ZKL3000-RC T-COD
Excludes:	RS 3000 or any other remotely operated device or switch

GENERAL

The installation siting form and access to the 'MTinfo 3000' Application is required for this test.

BEFORE INSTALLATION WORK

1. Check replacement ZKL3000-RC is not damaged, is the correct type and is calibrated.

2. Confirm the device is positioned correctly by corresponding it to the siting form.

3. **For Missing Equipment Only**: Check for evidence on site, the siting form, and records that the equipment was previously installed. If no evidence found stop and consult your SM(S).

AFTER INSTALLATION WORK

4. Check replacement ZKL3000-RC is correctly installed.

5. Check the power cable is routed correctly, clear of the tamping zone, and suitably protected where it passes under the running rail (installations with external/solar power supply only).

6. Switch the ZKL3000-RC to 'Operational' (Override Key horizontal in relation to the device).

7. Using the MTinfo 3000 App, find the correct ZKL3000-RC device by using its unique ID and check that 'Detection Quality' is at least 80%.

   If detection quality is below 80% the test has failed, and the device shall be returned and quarantined.

8. Using the MTinfo 3000 App, correspond the displayed status of the device to each Override Key switch position in turn: 'Operational' → 'ON' → 'Operational' → 'OFF' → 'Operational'.

NOTE: It is advised to pause for a few seconds at each key position to allow time for the status to be updated in the application.

9. With the ZKL3000-RC keyed to 'Operational' but not activated, test the affected Track Circuit.

For DC Tracks complete NR/SMS/PartB/Test/251 (DC Track Circuit Tests) – Full Test and NR/SMS/PartB/Test/251 (DC Track Circuit Tests) – Residual Voltage Test **(DC TRACKS ONLY).**

For all other Track Circuit types, refer to NR/SMTH/Part04/TC00 (Partial Testing of EBI Track 200 (T121), 50Hz AC, Reed, FS2600, HVI, EBI Track 400 Track Circuits for Defined Tasks) and complete relevant test **(EXCLUDING DC TRACKS).**

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/TQ01		
Replace a Mechanical Treadle		
Issue No: 07	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Type 69 one and two arm mechanical treadles
Excludes:	Electronic treadles

GENERAL

Treadle arm guards shall not be fitted to mechanical treadles. If any are found on an existing installation inform your SM(S).

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check replacement treadle is not damaged, the arm is free to move, and the correct gland is available.

3. Check the replacement treadle is the correct type either bi-directional or uni-directional (A-B or B-A) refer to NR/SMS/PartC/TQ00 (Treadles – General) for more information.

4. Check the correct timing rod is fitted with the letter V or A stamped on the top. Note timing rods with the letter X stamped on them shall not be installed (refer to RIA 66 Section 6).

5. Check existing wiring has safe insulation.

6. INSULATION TEST replacement treadle (minimum 2M ohms terminals to case).

7. WIRE COUNT existing treadle to the wiring diagram (Non-Plug coupled version only).

8. Check existing wiring is correctly labelled.

9. Check existing treadle is isolated from the supply.

10. Check and examine the treadle bracket for damage and replace if required.

11. Remove and replace with new rubber washers.

AFTER INSTALLATION WORK

12. Check replacement treadle is correctly installed (no arm guard).

13. Check the Signalling diagrams for the correct configuration of the treadle.

14. Check wiring is replaced as labelled.

15. WIRE COUNT replacement treadle to the wiring diagram. (Non-Plug coupled version only).

16. Check cable links, and red dome nuts or equivalent, are correctly replaced and secure.

17. Check terminations are secure and suitably protected.

18. Check wires and cables are clear of moving parts and are secured.

19. EARTH TEST (DC) or EARTH TEST (AC) circuits where designed to be earth free.

20. Check replacement treadle for the correct level of oil (refer to NR/SMS/PartC/TQ00 (Treadles – General) for more information.

21. Carry out NR/SMS/PartB/Test/177 (Treadle Gauging Test).

22. Carry out NR/SMS/PartB/Test/044 (Treadle Timing and Adjustment Test).

23. Record the test measurements on the appropriate NR/SMS record card

24. Check with the Maintenance Test Plan for the item of equipment fed via this treadle and carry out steps marked with an asterisk "*".

25. Arrange for follow up visit after 48 hours to retime the treadle arm function.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/TQ03		
Replace a GETS or Siemens Electronic Wheel Sensor		
Issue No: 03	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	GETS WDD Wheel Sensor, Siemens WSR wheel sensor
Excludes:	Any other type or make of electronic wheel sensor

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only**: Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check replacement unit is not damaged and is correct type.

3. WIRE COUNT existing unit to the wiring diagram.

4. Check existing wiring has safe insulation.

5. Check existing wiring and connectors are correctly labelled.

6. Check existing unit is Isolated from the supply.

AFTER INSTALLATION WORK

7. Check replacement unit is correctly installed.

   The pre moulded cable from the wheel sensor(s) shall NOT be shortened.

   Check any restrictions that apply to the positioning of the wheel sensor equipment relative to other equipment (e.g. TPWS), rail joints and clearance points.

8. Check wiring and connectors are replaced as labelled.

9. WIRE COUNT replacement sensor to the wiring diagrams.

10. Remove any litter and metallic objects near to the replacement wheel sensor.

11. Carry out the full NR/SMS/PartC/TQ13 (Siemens Wheel Sensor), starting with Service B to set the height correctly; Calibrate in accordance with Appendix A in the SMS (SIEMENS UNITS ONLY).

12. Carry out the full NR/SMS/PartC/TQ14 (GET's Treadle Replacement Unit). Calibrate the WDD to BJ and ETU units in accordance with Appendix A in the SMS (units only).

13. If the sensor forms part of a track feed circuit, carry out steps marked with an "*" on the Maintenance Test Plan for the track feed equipment.

14. Observe that the wheel sensor is successfully restored to normal operation.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 4/TQ04		
Replace a GETs Electronic Treadle Unit (ETU)		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	GETs ETU
Excludes:	Any other Electronic Treadle Relay Unit

BEFORE INSTALLATION WORK

1. Check replacement unit is not damaged and is correct type.
2. WIRE COUNT existing unit to the wiring diagram.
3. Check existing wiring has safe insulation.
4. Check existing wiring and connectors are correctly labelled.
5. Check existing unit is isolated from the supply.

AFTER INSTALLATION WORK

6. Check replacement unit is correctly installed.
7. Check wiring and connectors are replaced as labelled.
8. WIRE COUNT replacement ETU to the wiring diagrams.
9. Calibrate and set up in accordance with SMS TQ14 Appendix A
10. Check treadle time delay is correct for site specific application.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/TQ11		
Replace a Treadle Timing Screw		
Issue No: 02	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	Type 59 ,69 and Sagem Euro Treadle Timing Screws Arm
Excludes:	All other types of treadle

Liaison with the signaller is required and an appropriate possession may be required.

***** INDEPENDENCE EXEMPT *****

BEFORE INSTALLATION WORK

1. Check existing treadle is not damaged.
2. Check replacement timing screw is Not Damaged and is Correct Type.
3. Check existing timing screw, which is being replaced, is Not Damaged.

If the existing timing screw is broken and one part still remains in the treadle fluid reservoir, arrange for the treadle to be changed at the earliest opportunity.

AFTER INSTALLATION WORK

4. Check replacement timing screw is Correctly Installed.
5. Carry out NR/SMS/PartB/Test/177 (Treadle Gauging Test).
6. Carry out NR/SMS/PartB/Test/044 (Treadle Timing and Adjustment Test).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/TS10		
Style JE Trainstop (Complete) and or Trip Arm		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	JE Style Trainstop (Complete) and or Trip Arm
Excludes:	The Motor Assembly and any other type or make of Trainstop or sub-component.

Trainstops contain moving parts which can cause severe personal injury.

Further information can be found in SMS Appendix 18 – General Information on the JE Style Trainstop.

BEFORE INSTALLATION WORK

1 Check the replacement Trainstop and or Trip Arm is Not Damaged and is the Correct Type.

2 Check cable core numbers to the wiring diagram.

3 Check existing wiring has Safe Insulation.

4 Check existing wiring is Correctly Labelled.

5 Isolate the Trainstop from the supply.

AFTER RE-INSTALLATION WORK

6 Reinstate power supply to the Trainstop.

7 Carry out SMS/Test 028 –JE Style TrainStop Positioning Check.

8 Carry out SMS/Test 027 –JE Style Trainstop Detection Test.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 04/TS11		
Style JE Trainstop - Motor Assembly		
Issue No: 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Style JE Trainstop Motor Assembly
Excludes:	Any other type or make of Trainstop or sub-component.

Trainstops contain moving parts which can cause severe personal injury.

Further information can be found in SMS Appendix 18 – General Information on the Style JE Trainstop.

BEFORE INSTALLATION WORK

1. Check the replacement Trainstop motor assembly is Not Damaged and is the Correct Type.
2. Check cable core numbers to the wiring diagram.
3. Check existing wiring has Safe Insulation.
4. Check existing wiring is Correctly Labelled.
5. Isolate the Trainstop from the supply.

AFTER RE-INSTALLATION WORK

6. Reinstate power supply to the Trainstop.
7. Carry out SMS/Test 027 – Style JE TrainStop Detection Test.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WC01		
Replace WESTCAD-E MCR Modules (except CPU-4)		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Siemens WESTCAD-E MCR Housing Modules, CPU-2N, CPU-3, NET- 4 TM, EAM-TM1, SA-2, SA-2TM, SA-2TF, SCO-4MT, SCO-4ST, KCO-2F, MCO-2F, VID-4, SER-8, VID-2TF
Excludes:	CPU-4 modules, CPU Compact Flash Memory Module, MCR Housing & Signalling Network Components

***** NOT INDEPENDENCE EXEMPT IF CONFIGURATION IS REQUIRED *****

Modules can be replaced while the Modular Control Rack housing is powered up.

- Where the MCR is fitted with two PSUs, either PSU is capable of powering the housing and the other PSU or RFM can be replaced with the remaining PSU powered up and the housing operational.
- Where two CPUs are fitted, never remove one unless the other is fitted and fully operational, unless both have failed.

BEFORE INSTALLATION WORK

1. Check the replacement module is not damaged, is the correct type, and has the correct Module Coding Pegs.
2. Record the serial number of the replacement unit.
3. On dual CPU systems check that the System Arbiter Module changeover switch is set to the system that does not contain the module being replaced.
4. Check that cables attached to the module to be replaced are correctly labelled.
5. If replacing a Power Supply module, turn off the power at the Rear Filter Module.
6. If replacing an RFM, switch off and disconnect the power cable.

AFTER INSTALLATION WORK

7. Check the replacement item is correctly installed and secure.
8. Check cables are securely terminated in the correct location.
9. If a PSU or RFM module has been replaced, restore the power to the RFM.
10. If a VID-4 has been replaced, re-boot the associated CPU-4 module.
11. If the replaced module requires configuration this shall be carried out in accordance with the instructions found in the latest version of the System Maintenance Manual.

12. On a dual CPU system, set the System Arbiter Module Changeover switch to ‘Auto’.

13. Apply the system checks in NR/SMS/PartC/IC16 (WESTCAD - MCR) to confirm the correct operation of the new module.

14. Place the old module into an anti-static bag.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WC02		
Replace WESTCAD-E MCR CPU-4 Modules		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Siemens WESTCAD-E MCR Housing CPU-4 Modules, Compact Flash Memory Modules
Excludes:	All other WESTCAD-E Modules, MCR Housing and all Signalling Network Components

***** INDEPENDENCE EXEMPT *****

Modules can be replaced while the Modular Control Rack housing is powered up.

- Where two CPUs are fitted, never remove one unless the other is fitted and fully operational, unless both have failed.
- To replace only the Compact Flash Memory Module, it is first necessary to remove the CPU-4.

BEFORE INSTALLATION WORK

1. If replacing a CPU-4, check the replacement module is not damaged, is the correct type, and has the correct Module Coding Pegs.
2. If replacing the Compact Flash Memory Module, check it is labelled with the correct and Data Version and is for the correct SYS1 or SYS2.
3. Check the date on the label on the front of the CPU-4 module. If more than four years has elapsed since the date on the label, do not use that module.
4. Record the serial number of the replacement unit, except for Compact Flash Memory Modules.
5. On dual CPU systems check that the System Arbiter Module changeover switch is set to the system that does NOT contain the module being replaced.
6. Check that cables attached to the module to be replaced are correctly labelled.

DURING WORK

7. Eject the Compact Flash Memory Module from the module being replaced and insert it into the slot on the new CPU-4 module, checking it is correctly oriented before pressing fully into position.

AFTER INSTALLATION WORK

8. Check the replacement item is correctly installed and secure.
9. Check cables are securely terminated in the correct location.

10. Place the System Arbiter Module Changeover control switch to ‘Auto’.

11. Apply the required system checks in NR/SMS/PartC/IC16 (WESTCAD – MCR) to confirm correct working of the new module.

12. Place the old CPU-4 module into an anti-static bag, or protective case for Compact Flash Memory Module.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WC03		
Replace WESTCAD-E MCR Housing		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Siemens WESTCAD-E MCR Housing
Excludes:	All other WESTCAD-E Modules and all Signalling Network Components

***** NOT INDEPENDENCE EXEMPT IF CONFIGURATION IS REQUIRED *****

This test plan requires the housing to be powered down.

BEFORE INSTALLATION WORK

1. Check the replacement housing is not damaged and is the correct type.
2. Check the replacement housing has the correct Housing Coding Pegs for each module slot at the front and rear.
3. Record the serial number of the replacement housing.
4. Check that cables attached to the housing modules are correctly labelled.
5. On dual CPU housings attach temporary labels identifying the SYS1 and SYS2 CPUs.
6. Turn off the power at the Rear Filter Modules.

AFTER INSTALLATION WORK

7. Check the replacement housing is correctly installed and secure.
8. Check all housing modules are correctly installed and secure.
9. On dual CPU housings verify the SYS1 and SYS2 CPUs are in the correct slots and remove temporary labelling.
10. Check cables are securely terminated in the correct location.
11. Restore the power to the housing PSUs.
12. If the replaced housing requires configuration this shall be carried out in accordance with the instructions found in the latest version of the System Maintenance Manual.
13. On a dual CPU system, check the System Arbiter Module Changeover switch is set to ‘Auto’.
14. Apply the required system checks in NR/SMS/PartC/IC16 (WESTCAD - MCR) to confirm the correct operation of the new housing.
15. Place the removed housing into protective packaging.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 4/ WC04		
Replace WESTCAD Level Crossing Touch Screen Device (Integral Processor)		
Issue No: 01	Issue Date: 01/09/18	Compliance Date: 01/12/18

Includes:	WESTCAD-LC-TSD (Level Crossing Touch Screen Device) with integral Processor.
Excludes:	WESTCAD-LC-TSD (Level Crossing Touch Screen Device) with external Processor, WESTRONIC 1024 TDM System and WESTRONIC Eight Bit TDM

***** INDEPENDENCE EXEMPT *****

The unit and associated power supply should be unplugged from its power source before replacement.

BEFORE INSTALLATION WORK

1. Check that the unit has not been accidently switched off or the contrast and brightness controls altered.

   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. 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 before replacing the LC-TSD.

3. Record any reminders that have been applied to the LC-TSD.

4. Switch off power to the LC-TSD using its rear mounted ON/OFF rocker switch.

5. Record the part number, serial number and Mod state of the current and replacement unit. Investigate further any part number or Mod state differences.

6. Check all cables attached to the existing LC-TSD are correctly labelled related to their current connected position i.e. Mains Power, Network 1 and 2.

DURING INSTALLATION WORK

7. Eject the LC-TSD CompactFlash Memory Module from the existing unit (accessible after removal of a top mounted protective cover).

8. Check the CompactFlash Memory Module Data version matches that detailed in site drawings. Investigate further any version number differences.

9. Install this Compact Flash Memory Module into the replacement LC-TSD.

10. Replace the top access cover plate on both the existing and replacement units.

11. Disconnect all cables from the existing unit and remover it from the VESA Mounting bracket. Attach the replacement unit to the VESA Mounting bracket.

12. Reconnect all cables referring to cable labels and connector identification as necessary.

    Refer to site drawings as required.

AFTER INSTALLATION WORK

13. Check the replacement item is correctly installed and secure.

14. Check cables are securely terminated in the correct location.

15. Switch on power to the LC-TSD using its rear mounted ON/OFF rocker switch.

16. Adjust screen brightness and contrast 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).

17. Follow the user manual related to screen calibration and cleaning mode selection.

18. Liaise with the Signaller to safely test LC-TSD functionality, check the new unit is working correctly.

19. Verify that any applied reminders have been restored correctly or re-apply as necessary.

20. Identify the suspect unit with a suitable label and pack in a protective container.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 4/WC05		
Replace WESTCAD Level Crossing Touch Screen Device (External Processor)		
Issue No: 01	Issue Date: 01/09/18	Compliance Date: 01/12/18

Includes:	Siemens WESTCAD-LC-TSD (Level Crossing Touch Screen Device) with an external processor
Excludes:	Siemens WESTCAD-LC-TSD (Level Crossing Touch Screen Device) with an integral processor, WESTRONIC 1024 TDM System and the WESTRONIC Eight Bit TDM

***** INDEPENDENCE EXEMPT *****

The unit and associated power supply should be unplugged from its power source before replacement.

BEFORE INSTALLATION WORK

1. Check that the unit has not been accidently switched off or the contrast and brightness controls altered.

   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. The supporting CPU-2N processor card is installed in a 3U housing located in the workstation desk section. Investigate further any CPU-2N processor card related faults before replacing the LC-TSD.

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 before replacing the LC-TSD.

4. The supporting CPU-2N processor card is installed in a 3U housing located in the workstation desk section. Investigate further any CPU-2N processor card faults before replacing the LC-TSD (refer to the Westronic 1024 technical manual for additional information if required).

5. Record any reminders that have been applied to the LC-TSD.

6. Switch off power to the LC-TSD by unplugging the 12VDC power plug. Measure output voltage from the power adapter.

   Change the power adapter if its output voltage is not within the range 12VDC ±5%.

7. Record the part number, serial number and Mod state of the current and replacement unit. Investigate further any part number or Mod state differences.

8. Check all cables attached to the existing LC-TSD are correctly labelled related to their current connected position i.e. DC Power, VGA, USB, serial.

DURING INSTALLATION WORK

9. Disconnect all cables from the existing unit and remover it from the VESA Mounting bracket. Attach the replacement unit to the VESA Mounting bracket .

10. Reconnect all cables (excluding the power cable) referring to cable labels and connector identification as necessary.

    Refer to site drawings as required.

AFTER INSTALLATION WORK

11. Check the replacement item is correctly installed and secure.

12. Check cables are securely terminated in the correct location.

13. Switch on power to the LC-TSD by connecting the 12VDC power plug.

14. Adjust screen brightness and contrast 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).

15. Follow the user manual related to screen calibration and cleaning mode selection.

16. Liaise with the Signaller to safely test LC-TSD functionality, check the new unit is working correctly.

17. Verify that any applied reminders have been restored correctly or re-apply as necessary.

18. Identify the suspect unit with a suitable label and pack in a protective container.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WC06		
Replace a WESTCAD – WESTLOCK Ancillary Components		
Issue No: 01	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	12v 300W PSU, 5V EMC PSU, 230V Power Filter Module, 2U 10 Way IEC Distribution Panel, Fan Tray and Mains Switch Box Panel.
Excludes:	Any ancillary equipment that requires configuration

***** INDEPENDENCE EXEMPT *****

Before handling any electronic equipment observe ESD precautions.

BEFORE INSTALLATION WORK

1. Check the replacement unit is of the correct type and not damaged.
2. Isolate the power supply.

AFTER INSTALLATION WORK

3. Check the unit is secure and correctly labelled.
4. Restore the power supply.
5. Verify using the Technicians Terminal or equivalate system that the replaced unit is working correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL01		
Replace a WESTLOCK Interlocking Module		
Issue No: 04	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	MP, CM, SCM, DI and PM
Excludes:	Any other type or make of interlocking module

***** INDEPENDENCE EXEMPT *****

GENERAL

WESTLOCK MPs receive configuration data from the associated MPs. This requires two MP modules to be operational.

NEVER UNLOCK MORE THAN ONE MP MODULE AT A TIME. Never unlock a healthy MP when another is indicating a fault. Do not remove both DIs, CMs or SCMs at the same time. Do not remove both PMs from a FEP at the same time.

Each SCM is connected to a single data link, therefore a faulty but still operational SCM shall not be replaced if the other data link has failed - repair the faulty data link first.

If a DI module has a field (input) fault and a module fault, resolve the field fault first.

If the standby PM in a FEP has an Ethernet fault, resolve the Ethernet fault before removing the active module or swapping between active and standby modules.

WESTLOCK interlocking modules can be removed and replaced with the equipment powered up.

Provided the other WESTLOCK interlocking modules are serviceable, replacing a single MP module or one of a pair of duplicated CM, SCM or PM modules, will not affect the operational capability of the equipment.

If the equipment has two faults, one in an MP and one in another type of WESTLOCK interlocking module, replace the MP first. Wait until the Active indicator of the replaced module illuminates, then replace the remaining faulty module.

BEFORE INSTALLATION WORK

1. Check the replacement module is not damaged and is correct type.

2. Check connectors for damaged pins. If damaged pins are present, do not insert the module.

3. Check that all CIP & TIF interlocking modules are locked (lock lever in three o’clock position and lock indicator off).

4. Check that all FEP PMs are fully inserted (captive screws are tight) and powered (PMs are switched off if the module is not fully inserted and the lower handle locked in the up position by the red switch).

AFTER INSTALLATION WORK

5. Check that the replacement module is correctly installed.

   If the replaced module is an MP or a CM, wait for the module to be programmed by the associated MP modules. This can take up to 10 minutes for an MP and two minutes for a CM.

   If the replaced module is a PM, the new module will load its configuration from the PM backplane and start automatically. This will take approximately 35 seconds.

6. Check that for a replaced MP, the active indicator then starts flashing at the same rate as the associated MPs. This can take a further one to two minutes.

7. Check that for other replaced CIP & TIF module types, the active indicator is lit. This can take one to two minutes.

8. On the FEP, press the red Change Over button on the active PM to make the new module active. Check that the new module is error free.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL03		
Replace a WestLock Power Supply Unit (PSU)		
Issue No: 03	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Traco TSL 120-124P
Excludes:	Any other type or make of PSU

GENERAL

WestLock PSUs may be removed and replaced with the cubicle powered up.

Two identical PSUs are fitted in each CIP, TIF and SIF cubicle.

A failed PSU may be replaced with the equipment still being powered by the second PSU.

Store unused WestLock PSUs in their original packing

BEFORE INSTALLATION WORK

1. Check the replacement power supply unit (PSU) is not damaged and is correct type.

REMOVAL OF EXISTING POWER SUPPLY UNIT

2. 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 will remove the DC supply from the cubicle equipment.*

3. Positively identify the input and output power fuses for the PSU to be removed.

   Remove the fuses and check on the PSU input terminals that the 110V AC is absent.

4. Note the positions of the input and output wires on the PSU terminals. Check the cables and wires are correctly labelled.

5. Remove the wires from the PSU terminals, insulating them using insulating tape.

6. Remove the PSU from the DIN rail and label it.

INSTALLATION OF REPLACEMENT POWER SUPPLY UNIT

7. Fit the serviceable replacement PSU onto the DIN rail, in the same position as the original PSU.

8. Connect the input and output wires in the positions noted at step 04. If in doubt, refer to the site records.

9. Re-fit the fuses removed at step 03.

10. On the front panel of the PSU, check the DC On status indicator is lit.

11. At the TW(L), check the fault list to confirm correct operation of the PSU.

AFTER INSTALLATION WORK

12. Check the replacement PSU is correctly installed.

13. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL04		
Replace a WestLock CSG or TW(L) Module		
Issue No: 03	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	CSG/TW(L) housing cards, housing power supplies and KVM unit
Excludes:	Any other type or make of module

GENERAL

Only a WRSL supplied replacement module that has the correct part number shall be used.

Follow precautions and local instructions for the handling of electrostatic sensitive devices when replacing these modules.

A failed PSU may be replaced with the remaining PSU powered up and the TW(L)/CSG operational.

The housing is fitted with two PSUs. Either PSU is capable of powering the equipment.

Store unused modules in their original packing

BEFORE INSTALLATION WORK

1. Check the replacement module is not damaged and is correct type.
2. Check the data cables connected to the card to be replaced, are correctly labelled.

REMOVAL OF EXISTING HOUSING CARDS

3. At the rear of the housing, set the input power switches for both PSUs to the off (O) position.
4. Disconnect any data cables from the card.
5. Undo the single securing screw at the left and right of the card.
6. Release the card from the backplane connector by pressing the left and right card handles apart.
7. Carefully slide the card from the housing and place it in an anti-static bag.

REMOVAL OF EXISTING HOUSING PSUS

8. At the rear of the housing, set the power input switch supplying the failed PSU to the off (O) position.
9. At the front of the housing, undo the screws securing the PSU to the housing and remove the PSU.

REMOVAL OF EXISTING KVM UNIT

10. Isolate power to the KVM by disconnecting the mains cable feeding the KVM power supply. Check cables are correctly labelled.

11. Disconnect the connectors from the rear of the KVM unit.

12. Unscrew the four screws securing the KVM to the rack and withdraw the complete KVM.

INSTALLATION OF REPLACEMENT HOUSING CARDS

13. 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).

14. Insert the card into its correct position and secure using the two front panel screws.

15. Reconnect the data cables as necessary. Check each cable is fitted into the correct connector. If in doubt, refer to the site records.

16. Set the input power switches to on (I). Wait for the processor to boot up.

17. If the replaced card was a Rear Transition Module (which contains the hard disk drive) load the operating program from the USB memory stick.

    Insert a USB memory stick containing the correct version and application, then select the application (TW(L), CSG ‘A’ or CSG ‘B’) using the keyboard/VDU.

18. Check all indications are correct and the equipment works correctly.

INSTALLATION OF REPLACEMENT HOUSING PSU

19. Check the replacement PSU is correct type (the same type as that removed).

20. Check the PSU is the correct way up, then carefully align the PSU with the guides within the housing and slide the PSU fully into the housing.

21. Apply firm pressure on the PSU front panel to fully insert the PSU into the housing.

22. Secure the PSU with the front panel screws.

23. Restore the mains input supply and check the status indicator on the front panel illuminates.

INSTALLATION OF REPLACEMENT KVM UNIT

24. Check that the replacement KVM unit is correct type (the same type as the one removed).

25. Slide the KVM housing into the rack and secure with the four screws.

26. Reconnect the cables at the rear of the KVM housing.

27. Restore power to the KVM.

28. Test for correct operation.

AFTER INSTALLATION WORK

29. Check the replacement item is correctly installed.

30. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL05		
Replace a WESTLOCK CIP or TIF Baseplate		
Issue No: 04	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	MP, CM, DI and SCM Baseplates
Excludes:	Any other type or make of Baseplate

GENERAL

Obtain permission from SFI Level 2 before undertaking this task.

The affected CIP or TIF sub-system shall be powered down during this procedure. In Dual Cubicles, power shall only be removed from the required sub-system.

Baseplates are inherently very reliable. Before deciding to replace a baseplate, eliminate all other possible causes of the fault e.g., fuses and faulty cables.

BEFORE INSTALLATION WORK

1. Check the replacement baseplate is not damaged and is correct type.
2. WIRE COUNT any cables and wires connected to the baseplate.
3. Check any cables and wires are correctly labelled.
4. Make a hard copy of the applied Technician's controls and verify this against the locally recorded list.
5. For older WESTLOCK cubicles containing one WESTLOCK sub-system (CIP or TF), power down the WESTLOCK cubicle by setting the input power switch on the two power distribution panels in the lower part of the cubicle to the off (O) position.

   For Dual WESTLOCK Cubicles, power down the affected sub-system by opening the relevant fuse carriers on the power distribution rail.

AFTER INSTALLATION WORK

6. Check the replacement Baseplate is correctly installed.
7. Check wiring is replaced as labelled.
8. WIRE COUNT each cable fitted.
9. Set the input power switches to on (I) or close the fuse carriers as required.
10. If the replaced baseplate was other than an MP baseplate, wait for the interlocking to boot up. Check that on the MP modules the Active indicator is flashing and that on the other module types the Active indicator is lit.
11. If the replaced baseplate was an MP baseplate, arrange for the interlocking to be reprogrammed by a competent person.

12. If the replaced baseplate was a CIP MP baseplate, at the TW/TF re-apply any previously applied Technician's Controls; issue a Technician's Request 'Enable CIP', using the method described in the WESTLOCK Technician's Workstation manual or WESTLOCK Technician's Facility Manual.

13. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL06		
Replace a WESTLOCK FEP Housing Backplane		
Issue No: 03	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	FEP Housing Backplane and PM Backplane / 40HP Housing Backplane B47000/353AA / 40HP Housing Backplane Shield B53454/1
Excludes:	Any other type or make of Housing, Backplane or Shield

GENERAL

The affected FEP sub-system shall be powered down during this procedure.

Only one FEP Housing Backplane shall be replaced at a time within the locality to the need to remove the Addressing Plug from the Housing.

Backplanes are inherently very reliable. Before deciding to replace a backplane, eliminate all other possible causes of the fault e.g., fuses and faulty cables.

The Housing Backplane fits to the top half of the FEP housing and does not contain any configuration data. It is therefore not necessary to re-programme the FEP after this procedure, provided the PM backplanes fitted to the lower half of the housing are not disturbed.

BEFORE INSTALLATION WORK

1. Check the replacement backplane is not damaged and is correct type.
2. Check the cables connected to the FEP Housing to be replaced are correctly labelled.
3. WIRE COUNT all connections to be removed.
4. Power down the FEP Housing by opening the relevant fuse carriers on the power distribution rail. Note that there are two power supplies to each Housing.

AFTER INSTALLATION WORK

5. Check replacement unit is correctly installed.
6. Check wiring / cables are installed as labelled.
7. WIRE COUNT each cable fitted to the correct connector.
8. Power up the FEP Housing by closing the fuse carriers on the power distribution rail. Note that there are two power supplies to each switch.
9. Wait for the PMs to boot up. If both PMs are available, the Primary PM in Slot 1 becomes active. Check that the active PM has a green flashing Active indication and that both PMs indicate no fault, Standby OK and Ethernet activity.
10. Check or arrange for correct labelling of unit.

11. Check new red seals covering the retaining screws on the Addressing Plug are installed.

12. Replace any front panel removed.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL07		
Replace a Siemens Zone Controller Module		
Issue No: 05	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Westrace IO Modules, PM, RSA, MAU and IO Module Surge Cassettes. (including PIM50, ROM50, SOM24, SOM110, CIM and LOM110)
Excludes:	All any other type or make of Trackside module

INDEPENDENCE EXEMPT

GENERAL

Do not remove both RSAs from a Zone Controller at the same time.

Each RSA is connected to a single Ethernet and SMB data link.

A faulty but still operational RSA shall not be replaced if the other Ethernet or SMB link has failed - repair the faulty link first.

Do not remove both MAUs from a Zone Controller at the same time.

Each MAU is connected to a single SMB data link. Therefore, a faulty but still operational MAU shall not be replaced if the other SMB link has failed - repair the faulty link first.

If an I/O Module has a field (input) fault and a module fault, resolve the field fault first.

WESTLOCK Trackside modules may be removed without impacting other modules in the system. They should be removed and inserted with the signalling supply isolated. The logic supply can remain powered up.

Provided the other RSA/PM is serviceable, replacing a single RSA/PM module does not affect the operational capability of the equipment

Provided the other MAU is serviceable, replacing a single MAU module does not affect the operational capability of the equipment.

Changing a Surge Cassette does not affect the operational capability of the equipment.

MAUs, RSAs and PMs are not necessarily all provided.

BEFORE INSTALLATION WORK

1. Check the replacement module is not damaged and is correct type.

2. Check connectors for damaged pins. If damaged pins are present, do not insert the module.

3. If the module to be replaced is a MAU, check the Optical Fibre cables are correctly labelled.

4. Check that all modules are fully inserted, and all RSA, PM, MAU and IO Modules are powered.

NOTE: *Zone Controller modules are switched off if the module is not fully inserted with the lower handle locked and the red switch has popped up).*

AFTER INSTALLATION WORK

5. Check that the replacement module is correctly installed.

If the replaced module is an RSA, the new module loads its configuration from the backplane and starts automatically.

This takes approximately 35 seconds.

If the replaced module is a SOM110 and LOM110 module, after the module starts, the FEP downloads the configuration data to the new module.

This takes approximately 5 seconds.

6. If the module being replaced is a SOM110 or LOM110, check the module operates correctly.

Operates correctly means:

a) Observing the correct indications on the module itself.

b) Confirming correct operation of one function operated by the module.

For example, a signal's aspect can be changed, points operated normal and reverse, etc.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL08		
Replace a Siemens Zone Controller Housing Backplane		
Issue No: 04	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Siemens Zone Controller Housing Backplane WESTRACE Mk2 80HP Backplane B47000/351AA WESTRACE Mk2 80HP shield backplane B53433/1
Excludes:	Any other type or make of Housing, Backplane or Shield

GENERAL

The affected Housing shall be powered down during this procedure.

Only one Housing Backplane shall be replaced at a time.

The Housing Backplane fits to the top 3U section of the housing and connects 24V DC power and SMB to the modules.

The Housing Backplane does not contain any configuration data. It is therefore not necessary to re-programme the RSA after this procedure provided the PM backplane is not disturbed.

Backplanes are inherently very reliable. Before deciding to replace a backplane, eliminate all other possible causes of the fault e.g., fuses and faulty cables.

BEFORE INSTALLATION WORK

1. Check the replacement backplane is not damaged and is correct type.
2. Check the cables connected to the Zone Controller equipment to be replaced are correctly labelled.
3. WIRE COUNT all cables and connectors.
4. Power down the housing using the circuit breakers on the front of the 24V DC Power Supply Module.

AFTER INSTALLATION WORK

5. Check replacement unit is correctly installed.
6. Check any wiring is replaced as labelled.
7. WIRE COUNT all cables and connectors.
8. Power up the housing using the circuit breakers on the front of the 24V DC Power Supply Module.
9. Check that each module in the housing has a green flashing active indication and an RSA indicates Ethernet activity. Check that the power indication on the modules is green (both supplies are operating.)

10. Check new red seals covering the retaining screws on the Addressing Plug are installed.

11. Replace the front panel in front of the Addressing Plug.

12. Check or arrange for correct labelling of the unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL09		
Replace a Siemens Zone Controller PM Backplane		
Issue No: 03	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Siemens Zone Controller PM Backplane WESTRACE Mk2 PM Backplane B47000/299AA WESTRACE Mk2 PM Backplane Shield B52217/1
Excludes:	Any other type or make of Backplane or Shield

GENERAL

Before undertaking this task, permission shall be sought from SFI level 2.

The Housing Backplane fits to the middle section of the housing behind an RSA and connects the Ethernet to the RSA.

The PM backplane used by the RSA contains the site-specific data for the RSA. It is therefore necessary to re-programme the RSA module after changing a PM backplane.

The RSA plugged into the backplane shall be powered down during this procedure, it is not necessary to power down the housing.

Backplanes are inherently very reliable. Before deciding to replace a backplane, eliminate all other possible causes of the fault e.g., fuses and faulty cables.

BEFORE INSTALLATION WORK

1. Check the replacement backplane is not damaged and is correct type.

2. Check the cables connected to the Zone Controller equipment to be replaced are correctly labelled.

3. WIRE COUNT all cables and connectors.

AFTER INSTALLATION WORK

4. Check replacement unit is correctly installed.

5. Check wiring is replaced as labelled.

6. WIRE COUNT all cables and connectors.

7. Arrange for the RSA to be reprogrammed. Refer to the WESTLOCK FLM for details of the procedure to programme an RSA.

8. Wait for the RSA to boot up. Check that each module in the housing has a green flashing active indication and that the RSA indicates Ethernet activity.

9. Check or arrange for correct labelling of the unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL10		
Replace a Siemens Zone Controller Surge Interface Board		
Issue No: 03	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Siemens Zone Controller Surge Interface Backplane, SOM110 Surge Interface board B47000/346AA and SOM110 Interface Board Cover B53401/1
Excludes:	Any other type or make of Interface Board or Cover

GENERAL

The Surge Interface Board connects the bottom half of the IOM to the Surge Cassette and fits to the lower 6U section of the housing.

Interface Boards are inherently very reliable. Before deciding to replace an Interface Board, eliminate all other possible causes of the fault e.g., fuses and faulty cables.

BEFORE INSTALLATION WORK

1. Check the replacement interface board is not damaged and is correct type.

2. Check the cables connected to the Zone Controller Surge Interface Board to be replaced are correctly labelled.

AFTER INSTALLATION WORK

3. Check replacement unit is correctly installed.

4. Check cables removed are replaced as labelled.

5. Power up the SOM110 by raising the lower handle until the red button clicks into place. Wait for the module to boot up. Check that the module is operating normally.

6. Check or arrange for correct labelling of the unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL11		
Replace a Siemens Zone Controller MAU Backplane		
Issue No: 02	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Siemens Zone Controller Housing Backplane, WESTRACE Mk2 Dual MAU Backplane B47000/354AA and WESTRACE Mk2 Dual MAU Backplane Shield B53461/1
Excludes:	Any other type or make of Housing, Backplane or Shield

GENERAL

The MAU Backplane fits to the bottom 3U section of the housing and connects 24V DC power and SMB to two MAU modules. The MAU Backplane does not contain any configuration data.

Backplanes are inherently very reliable. Before deciding to replace a backplane, eliminate all other possible causes of the fault e.g., fuses and faulty cables.

BEFORE INSTALLATION WORK

1. Check the replacement backplane is not damaged and is correct type.

2. Check the cables connected to the Zone Controller equipment to be replaced are correctly labelled.

AFTER INSTALLATION WORK

3. Check that each module in the housing has two green flashing SMB indications. Check that the power indication on the MAU is green (both supplies are operating).

4. Check or arrange for correct labelling of the unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL12		
Replace a WESTLOCK FEP PM Backplane		
Issue No: 03	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	FEP Housing Backplane and PM Backplane WESTRACE Mk2 PM Backplane B47000/299AA WESTRACE Mk2 PM Backplane Shield B52217/1
Excludes:	Any other type or make of Housing, Backplane or Shield

GENERAL

Before undertaking this task, permission shall be sought from SFI level 2.

The affected FEP sub-system shall be powered down during this procedure.

Backplanes are inherently very reliable. Before deciding to replace a backplane, eliminate all other possible causes of the fault e.g., fuses and faulty cables.

The PM backplane fits to the lower half of the FEP Housing behind each Processor Module and contains the site-specific data for the FEP. It is therefore necessary to re-programme the PM after changing a PM backplane.

BEFORE INSTALLATION WORK

1. Check the replacement backplane is not damaged and is correct type.
2. Check the cables connected to the FEP Housing to be replaced are correctly labelled.
3. WIRE COUNT all cables and connectors.

AFTER INSTALLATION WORK

4. Check replacement unit is correctly installed.
5. Check wiring and cables are replaced as labelled.
6. WIRE COUNT all cables and connectors.
7. Arrange for the PM to be reprogrammed by a competent person. Follow the Site PC User Instructions for downloading the FEP data in the WESTLOCK First Line Maintenance manual.
8. Wait for the PMs to boot up. If both PMs are available, the Primary PM in Slot 1 will become active. Check that the active PM has a green flashing active indication and that both PMs indicate no fault, Standby OK and Ethernet activity.
9. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL13		
Replace a Siemens FEP/ZC Addressing Plug		
Issue No: 04	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Siemens FEP/ZC Addressing Plug C52928/1
Excludes:	Any other type or make of Housing or Addressing Plug

GENERAL

Before undertaking this task, permission shall be sought from SFI level 2.

Only one Addressing Plug shall be removed at any one time.

The affected housing shall be powered down during this procedure.

The Addressing Plug identifies the housing to the interlocking. Check the housing and installation addresses are set in accordance with the site-specific documentation. An incorrect address might lead to a wrong side failure.

The Addressing Plug is fitted inside the ZC housing behind the blanking panel.

Addressing Plugs are inherently very reliable. Before deciding to replace an Addressing Plug, eliminate all other possible causes of the fault.

BEFORE INSTALLATION WORK

1. Check the replacement Addressing Plug is not damaged and is correct type.

2. Check the site-specific documentation is available and defines the correct setting for the Addressing Plug.

AFTER INSTALLATION WORK

3. Check that each LOM110 or SOM110 in the housing has a green flashing active indication. Check that both SMB activity indications are flashing on all LOM110 or SOM110 in all housings in the Zone Controller.

4. Perform a correspondence check on each IOM in housing.

5. Check or arrange for correct labelling of the unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL14		
Replace a Siemens Zone Controller Housing		
Issue No: 02	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Siemens Zone Controller Equipment Housing C52927/1
Excludes:	Any other type or make of Housing

GENERAL

The Zone Controller Equipment Housing is supplied without backplanes or Surge Interface boards fitted. If spare backplanes and Surge Interface Boards are fitted to the housing before going on site, use a spare module of the correct type into the appropriate slot in the housing when fitting each backplane to check the backplane aligns with the module support rails.

The Addressing Plug from the existing housing should be used in the new housing unless it is known to be damaged or faulty.

BEFORE INSTALLATION WORK

1. Check the replacement Zone Controller Equipment Housing is not damaged and is the correct type.

2. Check the cables connected to the Zone Controller equipment to be replaced are correctly labelled.

AFTER INSTALLATION WORK

3. Power up each RSA, MAU and LOM110 or SOM110 module by raising the lower handle until the red button clicks into place. Wait for the module to boot up. Check that the module is operating normally.

4. Check that each module in the housing has a green flashing active indication. Check that both SMB activity indications are flashing on all I/O modules in all housings in the Zone Controller.

5. Check or arrange for correct labelling of the unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL15		
Replace a Siemens Zone Controller Power Distribution Housing		
Issue No: 03	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Siemens Zone Controller Power Distribution Housings, Power Distribution Housing with one EMI filter E26440/1, Power Distribution Housing with two EMI filters E26440/2 and Power Distribution Housing with three EMI filters E26440/3
Excludes:	Any other type or make of Housing

The Power Distribution Housing contains two 24VDC Power Cassettes (C52986/1) and between one and three 110VAC Power Cassettes (C52986/2). See NR/SMTH/Part04/WL14 (Replace a Siemens Zone Controller Housing).

BEFORE INSTALLATION WORK

1. Check the replacement Power Distribution Housing is not damaged and is the correct type.

2. Turn off ALL circuit breakers on the front of the Power Cassettes.

3. Turn off the upstream circuit breakers appropriate to the Power Cassettes (lockout procedures apply).

AFTER INSTALLATION WORK

4. Verify each down-stream circuit is functioning correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL16		
Replace a Siemens FEP/ZC Power Supply Modules		
Issue No: 03	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Siemens FEP/ZC Power Supply Modules, 24VDC Power Supply Module C52986/1 and 110VAC Signalling Supply Module C52986/2
Excludes:	All other type or make of Power Supply

GENERAL

The affected Housing and Units shall be powered down during this procedure otherwise lethal voltages could be present.

During normal operation, the Power Supply Modules should not get hot, however, they may be warm to the touch.

BEFORE INSTALLATION WORK

1. Check the replacement Power Supply Module is not damaged and is the correct type.
2. Check the cables connected to the Zone Controller equipment to be replaced are correctly labelled.
3. Turn off all circuit breakers on the front of the Power Supply Module.
4. Turn off the upstream circuit breaker relevant to the Power Supply Module (lockout procedures apply).

AFTER INSTALLATION WORK

5. Check replacement unit is correctly installed.
6. Check cables are replaced as labelled.
7. Turn on the upstream circuit breaker.
8. Turn on each circuit breaker on the front panel of the Power Supply Module.
9. If fitting a 24VDC Power Supply Module part number C52986/1, verify the green “DC Ok” status indicator is illuminated.
10. Check the corresponding effected equipment is operating correctly by observing the indication LED’s.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL17		
Replace a Siemens Zone Controller Power Buffer Unit		
Issue No: 03	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Siemens Zone Controller Power Buffer Units, 12kWs Power Buffer Unit C52986/3 and 6kWs Power Buffer Unit C52986/4
Excludes:	All other type or make of Power Buffer Unit

GENERAL

The Power Buffer Units contain large super-capacitors to provide the buffer function. These units can retain charge, even when disconnected (like a battery). The connections in the plug coupler are shielded to prevent accidental contact. However, direct insertion of probes/tools could result in injury.

These units connect to the 24VDC Power Supply module (part number C52986/1). They are provided to back up the logic supply to the Zone Controller modules, so equipment is not affected by short power interruptions of up to 30 seconds.

BEFORE INSTALLATION WORK

1. Check the replacement Power Buffer Unit is not damaged and is the correct type.
2. Check the cables connected to the Power Buffer Unit to be replaced are correctly labelled.
3. Turn off all circuit breakers on the front of the associated power supply module.
4. Turn off the upstream circuit breaker relevant to the power supply module (lockout procedures apply).

AFTER INSTALLATION WORK

5. Check replacement unit is correctly installed.
6. Check cables are replaced as labelled.
7. Turn on the upstream circuit breaker.
8. Turn on the circuit breakers on the front of the power supply module.
9. Check the status indicator on the front of the buffer unit. The indicator shows“charging” or “ready”.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL18		
Replace a Siemens Zone Controller TPWS Circuit Breaker		
Issue No: 04	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Siemens Zone Controller TPWS Circuit Breakers MCB Single Pole Mounting Plate C53013/1 MCB Double Pole Mounting Plate C53013/2
Excludes:	Any other type or make of Circuit Breaker or Mounting Plate

The connections to the circuit breakers are shrouded. Test these circuits to check they are not live before commencing maintenance activities. Lethal voltages are present.

Single pole versions have two wires and two retaining fixings and are attached to mounting plate P/N C53013/1.

Double pole versions have four wires and four retaining fixings and are attached to mounting plate P/N C53013/2.

BEFORE INSTALLATION WORK

1. Check the replacement TPWS Circuit breaker is not damaged and is the correct type/rating.
2. WIRE COUNT existing MCB to the wiring diagram.
3. Check the cables connected to the equipment to be replaced are correctly labelled.
4. Turn off the upstream circuit breaker associated with the faulty TPWS circuit breaker. If other circuit breakers are present on the plate, isolate these circuit breakers as well (lockout procedures apply).

AFTER INSTALLATION WORK

5. Check replacement MCB is correctly installed.
6. Check wiring has been replaced as labelled.
7. WIRE COUNT the new MCB to the wiring diagram.
8. Turn on the upstream circuit breakers associated with circuit breaker plate.
9. Turn on the circuit breakers on the plate.
10. Carry out NR/SMS/PartB/Test/230 (Train Protection and Warning System (TPWS) Tests.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL19		
Replace a Siemens Zone Controller I/O Cable		
Issue No: 02	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Siemens Zone Controller I/O Connection Cable and SOM110 I/O Connection Cable C53038/1
Excludes:	Any other type or make of Connection Cable

GENERAL

Zone Controller I/O Connection Cables are supplied as a single Line Replaceable Unit. The Connector is factory tested after assembly and should not be dismantled.

If the cable is faulty the whole cable assembly should be replaced.

BEFORE INSTALLATION WORK

1. Check the replacement I/O Connection Cable not damaged and is correct type.

2. Check the cables connected to the Zone Controller equipment to be replaced are correctly labelled.

AFTER INSTALLATION WORK

3. Power up the IOM by raising the lower handle until the red button clicks into place. Wait for the module to boot up. Check that the module is operating normally.

4. Correspond the connections from the affected IOM to the Signaller.

5. Check or arrange for correct labelling of the unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL20		
Replace a Siemens Ethernet Switch Power Supply		
Issue No: 03	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Siemens Ethernet Switch Power Supply Unit P/N 615990339
Excludes:	Any other type or make of Power Supply

GENERAL

The Power Supply is free wired to the Buffer Unit. The Buffer Unit is provided to back up the power supply to the Ethernet Switch, so it is not affected by a short power interruption of up to 30 seconds.

BEFORE INSTALLATION WORK

1. Check the replacement Power Supply Unit is not damaged and is the correct type.
2. Check the cables connected to the Power Supply Unit to be replaced are correctly labelled.
3. WIRE COUNT the wires connecting the Power Supply Unit to the 110V AC supply and to the Buffer unit.
4. Turn off the upstream circuit breaker relevant to the power supply (lockout procedures apply).

AFTER INSTALLATION WORK

5. Check the replacement Power Supply Unit is secure and correctly fitted.
6. Check wiring is replaced as labelled.
7. WIRE COUNT the wires connecting the Power Supply Unit to the 110V AC supply and to the Buffer unit.
8. Turn on the upstream circuit breaker.
9. Check the status indicator on the front of the buffer unit. The indicator shows “charging” or “ready”.
10. Verify power supply to the Ethernet Switch is functioning correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL21		
Replace a Siemens Ethernet Switch Power Buffer Unit		
Issue No: 03	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Siemens Ethernet Switch Power Buffer Unit P/N 6153806161
Excludes:	Any other type of Power Buffer Unit

GENERAL

The Power Buffer Units contain large super-capacitors to provide the buffer function. These units can retain charge, even when disconnected (like a battery). The connections are shielded to prevent accidental contact. However, direct insertion of probes/tools could result in injury. Take care when disconnecting the output wires so not to short the wires.

The Buffer Unit is free wired to the 24VDC Ethernet Switch Power Supply Unit P/N 615990339. It is provided to back up the power supply to the Ethernet Switch, so it is not affected by a short power interruption of up to 30 seconds.

BEFORE INSTALLATION WORK

1. Check the replacement Power Buffer Unit is not damaged and is the correct type.
2. Check the cable connecting the Power Buffer Unit to be replaced to the Power Supply is correctly labelled.
3. WIRE COUNT the wires connecting the Buffer Unit to the Power Supply Unit and to the Ethernet Switch.
4. Turn off the upstream circuit breaker relevant to the power supply (lockout procedures apply).

AFTER INSTALLATION WORK

5. Check the Buffer Unit is secure and correctly fitted.
6. Check wiring is replaced as labelled.
7. WIRE COUNT the wires connecting the Buffer Unit to the Power Supply Unit and to the Ethernet Switch.
8. Turn on the upstream circuit breaker.
9. Check the status indicator on the front of the buffer unit. The indicator shows “charging” or “ready”.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL22		
Replace a Siemens AMI-SRA Modular Technicians Facility PC		
Issue No: 03	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Siemens: AMI-SRA Modular Technicians Facility PC (LOCAL)
Excludes:	All other types of Technician Facility / Technicians Terminal

GENERAL

Liaise with the Signaller before carrying out this work.

Relevant electrostatic precautions shall be taken when handling the evaluation board and / or the board rack.

IDENTIFICATION

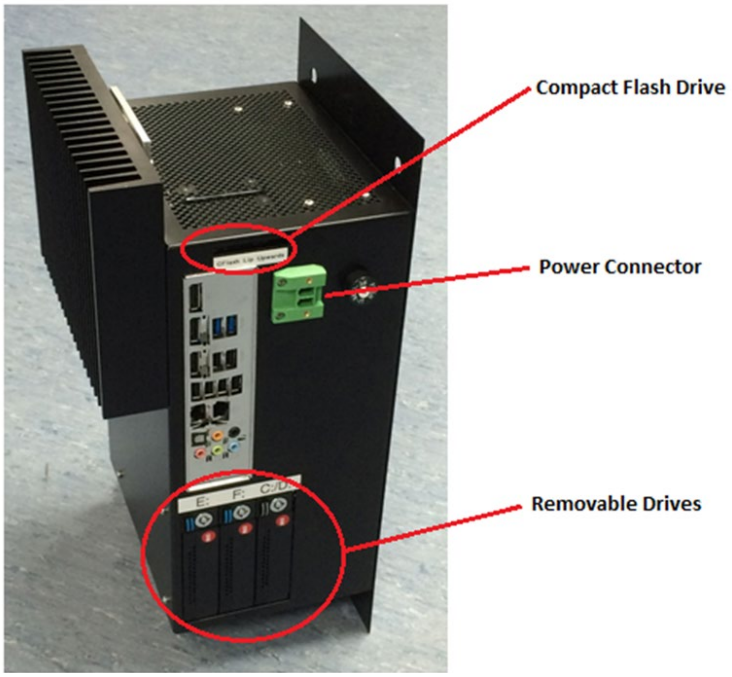


Figure 1 - Siemens AMI-SRA Modular Technicians Facility PC

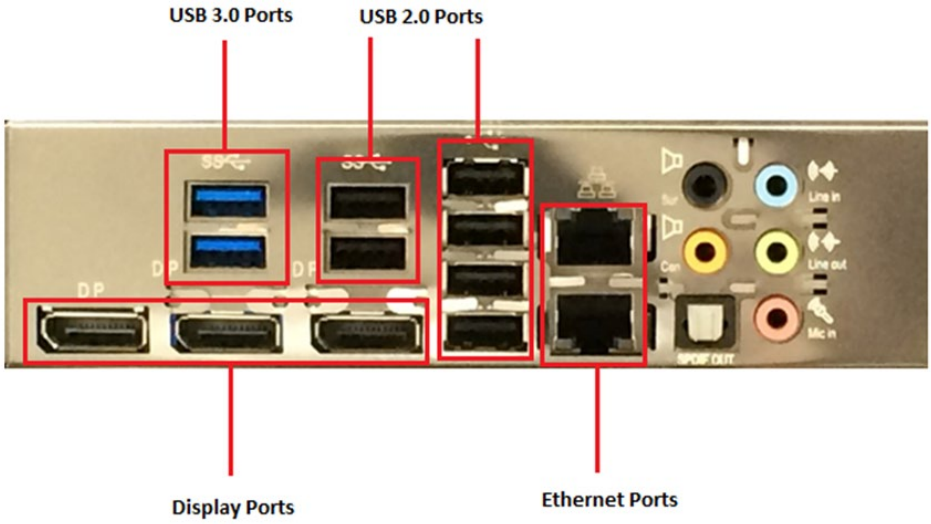


Figure 2 - Ports

BEFORE INSTALLATION WORK

1. Check that the replaced PC is of the correct type and not damaged. Include a check of the Mod state to confirm it is the same or later.

2. Record the serial number of the replacement unit.

3. Note the positions of all cables and which ports they are connected to.

4. Check the cables and wires are correctly labelled.

AFTER INSTALLATION WORK

5. Check the replacement PC is correctly installed.

6. Check wiring is replaced as labelled.

7. Perform the required test to confirm that the system is operational.

8. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WL23		
Replace a Siemens BlueChip C110 Technicians Facility PC		
Issue No: 03	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Siemens: BlueChip C110 Technicians Facility PC
Excludes:	All other types of Technician Facility / Technicians Terminal

GENERAL

Liaise with the Signaller before carrying out this work.

Relevant electrostatic precautions shall be taken when handling the evaluation board and / or the board rack.

Lithium batteries shall be disposed of in line with company policy. If you are unsure, ask your SM(S).

IDENTIFICATION

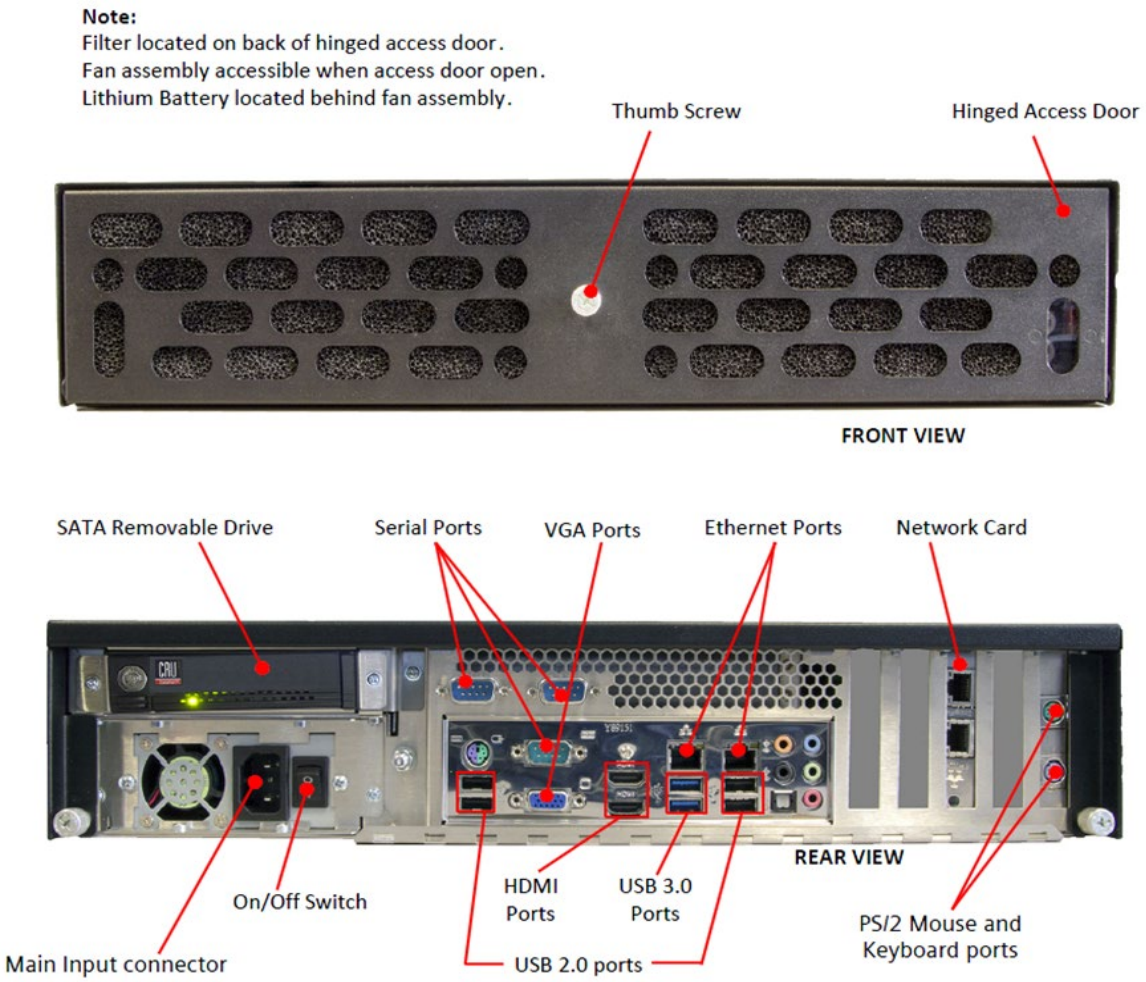


Figure 1 – Front View and Rear View

BEFORE INSTALLATION WORK

1. Check that the replaced PC is of the correct type and not damaged.
2. Check that the Mod state is the same or later version.
3. Record the serial number of the replacement unit.
4. Note the positions of all cables and which ports they are connected to.
5. Check the cables and wires are correctly labelled.

AFTER INSTALLATION WORK

6. Check the replacement PC is correctly installed.
7. Check cables and wiring is replaced as labelled.
8. Perform the required test to confirm that the system is operational.
9. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WP01		
Replace a WESTPLEX Module		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	WESTPLEX HD/LINK and HD COMMUNICATOR modules
Excludes:	WESTPLEX end of line unit, interface unit, PSU assembly, WAGO connector and its integral external configuration device

For replacement of a PSU Assembly, or a WAGO Connector and/or its integral External Configuration Device (ECD), refer to the Maintenance and Repair Manual.

***** INDEPENDENCE EXEMPT *****

BEFORE INSTALLATION WORK

1. Check replacement module is not damaged and is correct type.

2. Retrieve the event log and check for cause of failure.

3. Check existing module is isolated from its power supply.

AFTER INSTALLATION WORK

4. Check replacement module is correctly installed and WAGO Connector retaining screw is tightened.

5. Power up module.

6. Check that module LEDs are showing the correct status for details see NR/SMS/PartC/RC05 (Remote Control System – Westplex) Appendix A.

7. Check new module for correct operation.

   Check correct operation means observing for an HD/LINK module, the change of state of one controlled function's operated by it,

   or for an HD COMMUNICATOR module, the change of state of one controlled function operated by any HD/LINK module attached to the same Echelon LAN.

   For example, a signal's aspect can be changed, points operated normal and reverse, etc.

8. For a replaced HD COMMUNICATOR module, access the Line 1 and Line 2 web pages and check that the values for Signal to Noise and Loop Attenuation are the same/similar to those prior to changeover.

   If there is deterioration, investigate and correct defects.

9. Check or arrange for, setting of the date and time in the replaced module. For a HD/LINK module also check or arrange for the resetting of the communicating

statistics for all modules in the system that the replaced HD/LINK module was communicating with.

10. Check or arrange for correct labelling of unit.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WP02		
Divert a Faulty WESTPLEX Cable Core		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	WESTPLEX system
Excludes:	The diversion of a cable core on any other system of circumstances

General

This test plan shall be used in conjunction with NR/SMTH/Part04/CA05 (Divert a Faulty Cable Core).

BEFORE INSTALLATION WORK

1. Carryout steps 01 to 07 of test plan NR/SMTH/Part04/CA05 (Divert a Faulty Cable Core).

2. Using Laptop connected to the LAN port of the HD COMMUNICATOR and Microsoft Explorer Note the Signal/Noise value and Loop attenuation value.

AFTER INSTALLATION WORK

3. Carryout steps 08 to 15 of test plan NR/SMTH/Part04/CA05 (Divert a Faulty Cable Core).

NOTE: *Steps 16 and 17 of test plan NR/SMTH/Part04/CA05 (Divert a Faulty Cable Core) are not relevant to WESTPLEX*

4. Check Line 1 and Line 2 LEDs on HD COMMUNICATOR are ON and steady (approximately 15 seconds after restoring the connection of diverted core).

5. Using Laptop running Microsoft Explorer connected to the LAN port of the HD COMMUNICATOR. Check that the Signal/Noise value is better (HIGHER) than previous value and Loop Attenuation value is better (LOWER) than previous value.

6. Check WESTPLEX System Monitor is indicating ‘OK’.

7. Carryout steps 18 and 19 of test plan NR/SMTH/Part04/CA05 (Divert a Faulty Cable Core).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part04/WP03		
Replace a WESTPLEX LAN End of Line (EOL) Unit		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	WESTPLEX LAN end of line unit
Excludes:	Any make or type of LAN unit

BEFORE INSTALLATION WORK

1. Connect Laptop running HD Linker to the DIAGNOSTIC port of the HD/LINK module that is wired closest to HD COMMUNICATOR and obtain Communications Statistics (using the Configures utility [C53201.exe]).

2. Check replacement EOL unit is not damaged and is correct type and free of contamination.

3. WIRE COUNT existing EOL unit to the wiring diagram.

4. Check existing wiring has safe insulation.

5. Check existing wiring is correctly labelled.

AFTER INSTALLATION WORK

6. Check replacement EOL unit is correctly installed.

7. WIRE COUNT Replacement EOL unit to the wiring diagram.

8. Reset Communications Statistics and wait for approximately 10 to 15 minutes.

9. Collect Communications Statistics and check there are no missed messages.

10. Check or arrange for correct labelling of unit.

END

Ref:	**NR/SMTH/Part/05**
Issue:	19
Date:	02 December 2023
Compliance date:	02 March 2024

NR/L3/SIG/11231

NR/SMTH/Part/05

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INDEX

END

1. Principles

1.1 All reported wrong side failures shall be investigated and be treated as being genuine until proven otherwise.

1.2 Reports of wrong side failures often occur during unusual operating conditions.

1.3 After the Test Guide(s) have been selected, it is usually necessary to define the suspect circuit or circuits. The suspect circuit is not always obvious.

1.4 Following a Test Guide might find a wrong side failure that is still present but, if the fault is not present at the time of testing, only by carrying out the full range of steps on the correct circuit can a hidden wrong side failure be found.

1.5 It is then necessary to determine which circuit or circuits should have prevented the wrong side failure from happening, (where Solid State Interlockings are in use it is not normally necessary to select a suspect circuit).

1.6 In the event of a serious incident or accident, the arrangements for investigation might need to be changed, particularly if the Police are involved.

1.7 The procedure for the investigation process is summarised as a flow chart in NR/SMTH/Part05/Module/S21 (Failure and Incident Testing Flowchart).

END

1. Competence

1.1 This module details the additional competency requirements to undertake WSF investigations.

Level 1 Staff (L1)

1.2 Authority to undertake SFI investigations shall typically be granted by the S&TME on the recommendation of the SM(S) and after successful completion of the approved training course.

1.3 Where response teams are provided, these teams shall include SFI Level 1 competent staff member for the duration of each shift.

1.4 SFI level 1 staff can be used to assist with management of Wrong Side Failures.

Level 2 Staff (L2)

1.5 As per Level 1 plus additional experience either:

a) As a leader of a team investigating failures on site at first instance and preparing reports for consideration by others, or

b) As a SM(S) or member of a technical support team who has regularly attended failures, provided advice or endorsement of other people's actions, or

c) With detailed relevant technical knowledge of the equipment in the locality gained by such activities as signal works testing, design or installation.

1.6 The Level 2 staff shall be certified as SMTH testers.

1.7 Level 2 staff are typically a SM(S) or manager of Level 1 staff, or member of a technical support group.

Level 3 Staff (L3)

1.8 A Level 3 shall have knowledge of Signalling Maintenance Testing and Failure and Incident Testing procedures.

1.9 They shall be certified SMTH Testers or be approved by the Route Engineer (Signalling), Principal Route Engineer [Signalling) or equivalent.

1.10 Level 3 staff are typically Signal Engineers with a higher level of technical expertise, such as the S&TME or members of the teams supporting the Route Engineer (Signalling), Principal Route Engineer (Signalling) or equivalent.

1.11 Access to a competent SFI Level 3 is not normally needed at the onset of SFI testing, but staff should have access to SFI Level 3 competent staff when required.

END

1. Exempted (Level 1) Failures

1.1 When a single, obvious cause of failure is found and confirmed, the following failures types require only a Level 1 sign back:

a) Failure of any filament/LED signal lamp.

b) Failure of level crossing filament/LED lamp.

c) Signallers panel lamps/LEDs.

d) Failure of a lamp holder (life expired, wear and tear).

e) SPT or level crossing telephones, unless there is any doubt as to the cause of the failure or the failure.

f) AWS permanent magnet missing or faulty.

g) Failure of a transformer, transformer/rectifier or rectifier.

h) Failure of a fuse/MCB.

i) Failure of a timing device.

j) Failure of an audible warning device (except level crossings).

k) Failure of a primary cell.

l) Failure of an electronic or mechanical flashing device.

m) Failure of a filament changeover relay.

n) Failure of barrier / gate mechanisms / hydraulics (where the failure can be restored by simple adjustment or ‘like-for-like’ replacement).

o) Failure of any equipment caused by vandalism (providing destructive testing is not required to resolve the failure).

p) Failure of a mechanical signal to return to the ‘ON’ position due to an obstruction, extreme weather conditions or simple adjustment of other mechanical equipment.

q) Failure caused by loss of electrical supply from an Electricity Supply Company and no standby facility has been provided.

END

1. Scope

This module provides guidance on the categorisation, investigation and sign back of track circuits following potential Wrong Side Failure or Remote Conditioning Monitoring (RCM) Alarm/Alert.

2. Categorisation of Track Circuit Failures

2.1 Track Circuit Showing Clear When Occupied (SCWO)

A track circuit is considered to have failed wrong-side if the interlocking fails to correctly detect a train or the Signallers indication does not show the passage of a train. Typically, this is reported by the Signaller, but in certain circumstances this might not be immediately evident.

Examples of evidence where the interlocking might have failed to detect a train include:

a) Reports from Signallers.

b) Reports from Drivers.

c) Out of sequence alarms on a workstation or train describer.

d) Occurrences logged on event recorders.

e) Evidence from Technicians' terminal downloads.

f) Interrogation of digital EBI track receivers.

In each case above, these shall be treated as Wrong Side Failures and investigated.

2.2 Track Circuit RCM Alert or Alarm

RCM alarms and alerts of short duration are not definitive evidence that a track circuit Wrong Side Failure has occurred.

Track circuit systems (which include the first repeat relay or equivalent electronic control) have features which prevent incorrect and intermittent operation of the TR being detected by the interlocking.

RCM events lasting less than 300ms where:

a) the track circuit current has risen above the track clear level whilst a train is traversing the track circuit (occupied-clear-occupied or slow to clear event), or

b) where the track circuit current has failed to fall below the track occupied current (slow to occupy event),

shall not be treated as a wrong side failure as it can be assumed that the interlocking has not reacted.

These events shall be classified as a Negligible Risk Failure as defined in NR/L3/SIG/20047 and actioned as an RCM alarm in line with route processes.

NOTE: *These alarms are a precursor that a Wrong Side failure of the track circuit might be imminent and should be actioned (e.g. Arrange for Rail Head Treatment).*

Where the duration of the events in a) and b) above has exceeded 300ms, these shall be assumed to be a Wrong Side Failure unless there is evidence that the interlocking has not responded.

NOTE: *Evidence whether the interlocking has responded includes event recorder downloads, downloads from control systems or Technicians' terminals.*

Where RCM systems have identified rail head contamination effects of any duration and it can be proved that the interlocking did not respond, these are not be classified as a wrong side failure.

NOTE: *For track circuit RCM to provide a robust control in the management of Track Circuit Wrong Side Failures, it is essential that it is working, calibrated correctly and monitored by competent staff.*

2.3 Interlocking Controls

In some locations, interlocking controls are in place to prevent the interlocking responding to intermittent or false operation of a track relay (e.g. SSI Sequence Proving or Red Proving).

Where these controls are in place, the SFI investigation shall consider if these controls were breached and if a Wrong Side Failure has occurred.

NOTE: *These controls are specific to location and shall be confirmed by the local SFI Level 3.*

NOTE: *Special consideration should be given to absolute block controls which might differ between Signal boxes.*

2.4 Special Working

Where the Signaller is protecting the line and not relying on the track circuit as described in TS11 clause 15.2, track circuit SCWO events shall not to be classified as Wrong Side Failures and do not require investigation.

These incidents shall continue to be recorded in FMS and Operations Controllers shall confirm with the Signaller the use of TS11 and record in the FMS record notes. No SINCS record is required.

If there is any doubt as to whether the Signaller has been protecting the line, these incidents shall be classified as Wrong Side Failures and investigated in line with SFI procedures.

3. Management of a Potential Track Circuit Wrong Side Failure

The flowchart (Figure 1) and the corresponding guidance describes the process to be followed when classifying, investigating and signing back track circuit wrong side failure events.

3.1 Report of a Potential Wrong Side Failure

Potential track circuit WSF reported by the Signaller, a Driver, by interlocking event recorders / Technician terminals, or by Remote Condition Monitoring systems shall be investigated.

3.2 Evidence of a Potential Wrong Side Failure

Track circuit Wrong Side Failures occurring where the interlocking has responded or where the Signallers indication does not show the passage of a train shall be treated as a WSF and investigated.

Evidence of whether the interlocking has responded includes event logging of interlocking functions, downloads from Technicians' terminal; out of sequence alarms on a workstation or train describer; interrogation of digital EBI track receivers.

Where no RCM is fitted, this shall be treated as a Wrong Side Failure unless positive interlocking evidence is provided and / or interlocking controls are confirmed to be in place and working.

3.3 Authorisation to Treat the Rail Prior to Confirming Contamination

The principle of SFI is to preserve evidence of a wrong side failure and investigate thoroughly to establish the root cause. This can lead to restrictive methods of working being applied for long periods of time coupled with additional risk with sending staff to site.

Track circuit RCM provides comprehensive real-time asset status information and can be used to improve failure investigation and rectification of rail head contamination events.

Rail head contamination can be seen on RCM traces and can be seen to improve following treatment of the rail.

The SFI Level 3 can authorise the rail head to be treated without sending staff to site. This authorisation is subject to the following conditions:

a) Track circuit RCM is fitted and working.

b) The SFI Level 3 has assessed the traces and confirmed that these are indicative of rail head contamination.

c) There is evidence to support a likely rail head contamination event.

Typical evidence which support likely rail head contamination event has occurred include:

a) The time of year (i.e. Autumn).

b) The geographic location is susceptible to railhead contamination events (e.g. history of leaf fall issues, lightly used line etc).

c) Weather conditions (e.g. recent high winds).

d) The type of train (e.g. light engines, class 158's).

e) Rerailing.

Where the track circuit has Failed Wrong Side or assumed to have failed Wrong Side the Signaller shall be instructed not to rely on the track circuit until they are informed otherwise.

The SFI Level 2 shall arrange for information to be collected to support the investigation, sign back and closure of the fault report and SINCs file. As a minimum this shall include steps N1 to N12 from Wrong Side Failure Test Guide NR/SMTH/Part08/T002.

3.4 Arrange for Rail Head Treatment

Rail head treatment processes differ across Routes and Regions. Treatment can consist of use of rail head treatment trains (RHTT) or manual rail head treatment.

Prior to and following treatment, RCM traces and interlocking monitoring shall be continually monitored to check for improvement or deterioration.

It is possible for isolated TC WSF events to occur (e.g. the first train of the day or specific train formations). This could be due to the contamination being on the wheel sets rather than the track circuit.

Where this is the case, RCM traces can improve to a point where they could be signed back into use without treatment.

This shall only be permitted with the authority of the SFI Level 3 and following review of RCM traces for subsequent trains.

3.5 SFI Level 2 to Review Testing Requirements

The SFI Level 2 shall determine any further testing necessary from:

- NR/SMTH/Part08/T025 (Wrong Side Failure Test Guide: Track Circuit Rail Head Contamination – Remote Condition Monitoring (Not Fitted)) or
- NR/SMTH/Part08/T026 (Wrong Side Failure Test Guide: Track Circuit Rail Head Contamination – Remote Condition Monitoring (Fitted)), for rail head contamination or
- NR/SMTH/Part08/T002 (Wrong Side Failure Test Guide: Track Circuits), for other TC WSF scenarios.

NOTE: *The SFI Level 2 should collate evidence to determine if the fault has been found and the treatment has been effective prior to sign back. In the absence of RCM, the remaining steps in NR/SMTH/Part08/T025 support this decision.*

3.6 SFI Level 2 Review

The SFI Level 2 shall review evidence collected to determine if the fault has been found.

Where RCM is fitted, the SFI Level 2 shall assess the RCM trace to confirm that it shows an improvement following rail head treatment and/or passage of similar train stock and size.

Where the trace returns to normal, this is evidence that the fault has been found and the track circuit can be relied upon.

Where track circuits are handed back in the leaf fall season, RCM traces and interlocking monitoring shall be continually monitored to check for deterioration and to determine if further rail head treatment is required.

Where rail head treatment does not result in improvement to the RCM trace, this is an indication that there is another problem with the track circuit which shall be investigated.

Where there is no RCM coverage, the SFI Level 2 shall determine if the evidence presented from the SFI testing in NR/SMTH/Part08/T025 (for rail head contamination scenarios) or NR/SMTH/Part08/T002 (other TC WSF scenarios) has demonstrated that the fault has been found.

3.7 Positive Evidence the Interlocking responded as intended

Where the RCM alarm/alert shows an event, which is longer than 300ms in duration, the SFI Level 1 shall check to see if the interlocking responded.

Evidence of whether the interlocking has responded includes event logging of interlocking functions, downloads from Technicians' terminal; out of sequence alarms on a workstation or train describer; interrogation of digital EBI track receivers.

3.8 Interlocking Controls in Place

Interlocking controls are specific to location and shall be confirmed by the SFI Level 2.

Where implemented, SSI sequence proving as described in SSI8003-82 hold the TPR function down in the interlocking for a set time prior to clearing unless the track circuits are shown to operate in sequence.

NOTE: *These controls are documented on scheme plans and in control tables.*

3.9 SFI Level 2 Sign Back

The SFI Level 2 shall confirm that the investigation evidence supports the conclusion after testing and rectification (e.g. rail head contamination and that the treatment has been effective).

Where RCM is fitted the SFI Level 2 should confirm that the trace has returned to normal prior to sign back. Where the trace shows no improvement and has not returned to normal, further treatment / investigation shall be undertaken and the track circuit shall not be signed back for use.

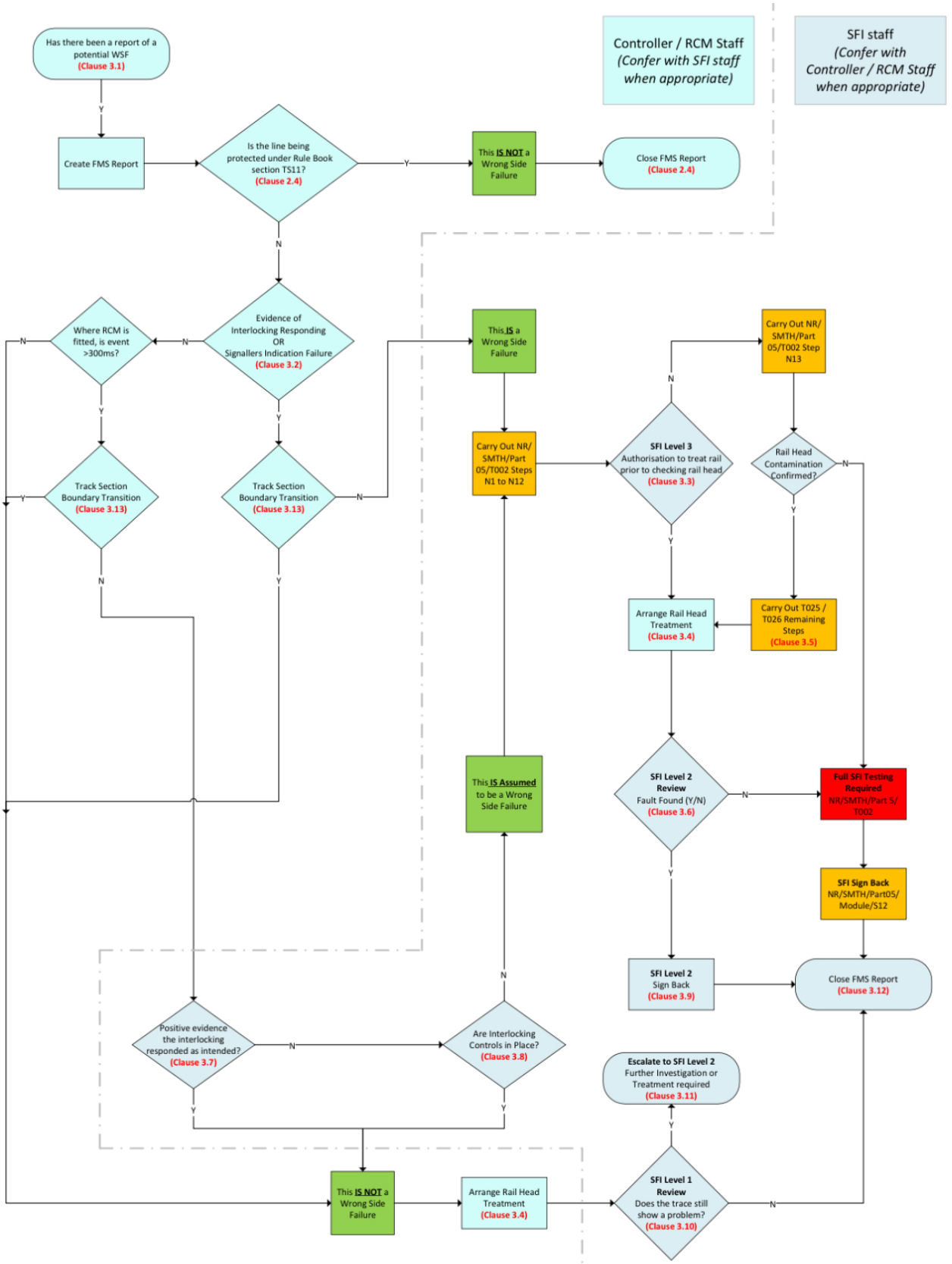

Figure 1 – Track Circuit Management Flowchart

3.10 SFI Level 1 Review

The SFI Level 1 shall confirm the RCM trace shows an improvement following rail head treatment and/or passage of similar train stock and size. Where the trace returns to normal the track circuit can be relied upon however close monitoring shall be undertaken to watch for degradation.

NOTE: *There is a competency requirement in the hand back of signalling faults. SFI Level 1 might need to consult with others while reviewing RCM traces (e.g. CCT's, Flight Engineers, SFI Level 2).*

3.11 Further Investigation Required

Where no improvement in RCM trace following Rail Head Treatment this is either an indication that there is another problem with the track circuit which shall be investigated, or the treatment has not been effective.

The SFI Level 1 in discussion with the SFI Level 2 shall determine any further investigation or treatment required.

3.12 Closure of Failure Report

Where SFI Level 2 or Level 3 sign back is required, the following evidence shall be supplied and appended to the FMS report to support closure of the failure and associated SINCs file:

a) SFI Level 2 or 3 report / statement.

b) II RCM traces.

c) Extract of evidence from interlocking loggers or Technician's terminal.

Where an event is considered to be NOT a wrong side failure, RCM traces shall be to be appended to the relevant FMS record as evidence.

3.13 Track Section Boundary Transition

Track Section Boundary Transitional Track Circuit Showing Clear While Occupied events where;

a) The abutting Track Section remains occupied, and

b) The event is less than 1s duration.

shall not be treated as a wrong side failure as it can be assumed that the interlocking has not reacted.

These events shall be classified as a Negligible Risk Failure as defined in NR/L3/SIG/20047 and actioned as an RCM alarm in line with Route processes.

NOTE: *These events are a precursor that a Wrong Side Failure of the track circuit might be imminent and should be actioned (e.g. Arrange for Rail Head Treatment)*

END

1. Protecting the Line

1.1 It is the Signaller's duty to protect the line. It is **NOT** the duty of Signal Technicians to provide protection by disconnecting signals or track circuits.

1.2 Signalling Technicians shall inform the Signaller of the protection required to minimise the risks associated with the wrong side failure.

1.3 Disconnections or adjustments to equipment to assist traffic flow can be requested by operations staff. This is only permitted with the authority of the S&TME, only when any investigation testing affected by such disconnections has been completed.

1.4 Any disconnections shall be recorded, and arrangements made to restore them as soon as the reported failure has been rectified and other circumstances allow.

1.5 Where an incident does not involve any failure of the signalling system, or allegation of failure, Signalling Technicians shall co-operate fully with the operations staff, providing advice on the benefits and risks of the protection proposed.

1.6 Further information on the giving of releases is contained in NR/GI/B003 (Releases and Restoration).

END

1. Testing Procedure

1.1 Testing shall only be carried out once line protection arrangements have been agreed with the Signaller.

1.2 Before testing commences, all the available facts and evidence shall be assessed and together with additional reports and information such as from the:

a) Driver.

b) Signaller.

c) Intelligent infrastructure.

d) Technicians terminal.

e) Train describer stepping records.

f) Other witnesses.

g) Facing train cameras.

h) Station cameras.

From this information, the possible causes should be identified, and the relevant Test Guide(s) selected and applied to any suspect circuit(s). The Test Guides detail the tests required for investigating each possible cause.

1.3 The testing shall also include the identification of requirements for recreating the circumstances of the incident.

1.4 The Test Guides are comprehensive but are not necessarily in the correct test sequence for every investigation.

1.5 Tests considered most relevant to the reported problem or observed symptoms shall be carried out first.

1.6 Testing shall include associated equipment and circuits which could have led to the failure.

1.7 Always consider other possibilities beyond the ’obvious’ cause.

1.8 It is important that those exercising L2 and L3 sign-off of investigations, confirm that the way a failure is reported to the Technicians carrying out the investigation, has not influenced their thinking about what needs to be disproved.

1.9 Testing shall be carried out in two distinct stages Non-destructive tests followed by Destructive tests.

Non-destructive tests

1.10 Carried out or directly supervised by the Tester and can involve:

a) Visual examination of equipment.

b) Taking measurements or readings without disturbing or disconnecting the equipment or its wiring, or without affecting the electrical characteristics of the system.

1.11 Independent confirmation of fault diagnosis is required.

1.12 All conditions that existed at the time of failure shall be recorded by questioning and observation.

1.13 Where it is not possible to perform a test, which is designated as 'non-destructive' without risk of disturbing equipment/wiring, then this shall be recorded, and the test conducted during the 'destructive testing' phase instead.

1.14 Doors can be opened, but equipment covers can only be removed by persons competent to do so, and then only if no disturbance to the equipment/wiring or disarrangement of locking would occur.

Destructive tests

1.15 Carried out by the Tester these tests can sometimes alter the electrical, mechanical or physical state of the equipment.

1.16 This disturbance might make a repeat of the fault impossible.

1.17 Destructive tests shall be authorised by an SFI level 2 or 3 and independent confirmation of fault diagnosis is required.

2. Deferred Testing

2.1 Testing shall only be deferred if:

a) Requested by a Network Rail Operations Manager and endorsed by the Route Engineer (Signalling), Principal Route Engineer (Signalling) or equivalent, and

b) For the Railway to operate safely, it shall always be assumed that the wrong side failure report is genuine, and

c) The S&TME records the names of those involved in this decision.

3. Testing Methods

3.1 If the circumstances allow, try to repeat the equipment operations that led to the reported failure. This can include dropping track circuits to recreate the effect of a passing train or actually observing a train through a section.

3.2 This allows equipment to be operated but can cause the destruction of evidence about its state, such as relay positions, and therefore shall be undertaken at an early stage of destructive testing.

3.3 Any such tests shall be done with the Signaller's authority and after consideration of any risks involved.

3.4 Equipment shall be signed out of use before test straps are used.

3.5 Test straps shall be removed and accounted for before equipment is made available for use.

3.6 Seals shall not be broken during testing.

3.7 Connecting test instruments to vital signalling systems has the potential to create wrong side failures. Unwanted connections can arise via internal instrument circuits and these might be far from obvious.

3.8 Specialist test equipment shall only be connected to vital signalling equipment by competent staff.

4. Defined Tests

4.1 Particular care is required when carrying out a WIRE COUNT especially at some older installations.

4.2 Wire counting is therefore specified as a destructive test within the Test Guides.

4.3 Wiring with poor terminations and/or insulation degradation or wiring trapped against metallic or moving equipment can cause faults and is easily disturbed.

4.4 In some cases, the removal of covers to allow inspection of wiring within trunking might also disturb faults. It might be necessary to consider this activity as a destructive test carried out after an INSULATION TEST of the wiring.

END

1. Data Loggers and Condition Monitoring Systems

1.1 Where equipment has built-in and/or portable event recording or condition monitoring, arrangements shall be made to recover and protect any data.

1.2 This requirement is identified in the Test Guides as; ‘Check any relevant system terminal printout and remove any recording media for checking’.

1.3 Many styles of data recording are used to monitor signalling equipment, such as, but not limited to:

a) SSI Technician's Terminal.

b) IECC.

c) ARS.

d) Computer Based Interlockings.

e) VHLC.

f) Trackwatch.

g) Intelligent Infrastructure systems.

h) HABD.

i) Axle counter systems.

j) SPT recordings.

k) Event recorders.

l) Other types of event or condition monitoring equipment.

1.4 The recording time on the logging/monitoring system shall be verified or calibrated against a known base time.

NOTE: *If the time system is controlled by the Anthorn transmitter, alterations to the time are not possible.*

1.5 The Tester shall verify that the relevant functions are recorded correctly by the system, e.g., when track circuits become occupied or clear, or signals change aspect.

This need not entail additional testing of the functions as these will be tested as part of the investigation, but should establish that the monitor was capable of accurately recording the events associated with the reported failure or incident.

1.6 Confidence in the equipment can be conferred by checking that events both before and after the incident are recorded in a logical order.

1.7 Removable storage media shall be withdrawn in a timely manner post incident and analysed to provide a focus for testing activities or in some cases provide data which indicates the cause of the failure / incident.

1.8 The data shall be recovered in accordance with the instructions for the respective equipment.

1.9 Data shall be collected from all relevant sources even if the equipment is not implicated in the failure as it might provide additional information.

1.10 Consideration shall be given to removal of voice recording media.

1.11 Following a serious incident, it is important to impress on the Investigating Officer that a copy of the SSI and IECC files shall be taken before the recording media itself is removed into police custody.

END

1. Escalation Procedure

1.1 The Route Engineer (Signalling), Principal Route Engineer (Signalling) or equivalent shall confirm that the correct levels of authority have been applied and documented at the various stages of the investigation.

These are to be based on the three levels of competence defined in NR/SMTH/Part05/Module/S02 (Wrong Side Failure Testing Competence).

1.2 All other reportable wrong side failures shall be escalated to the Level 2 Tester as soon as possible.

This would normally be done before testing starts so that a second independent mind considers the symptoms and agrees the required degree of testing.

1.3 The Level 2 Tester shall be independent of the actual testing and not physically involved.

1.4 If a fault is found during non-destructive testing, independent confirmation shall be required from a Level 2 Tester that the fault found, accounts for the reported failure, and that all the relevant testing has been carried out.

1.5 If the Level 2 Tester agrees the failure has been identified, carry out repairs as soon as possible.

1.6 The equipment is to be signed back into use in accordance with the matrix in NR/SMTH/Part05/Module/S12 (Sign Back Matrix).

1.7 If no fault has been found, permission shall be sort from the Level 2 Tester to move to the destructive testing phase.

1.8 If a fault is found during destructive testing, independent confirmation shall be required from the Level 2 Tester that the fault found accounts for the reported failure and that relevant testing has been carried out.

1.9 If the Level 2 Tester agrees the failure has been identified, carry out repairs as soon as possible.

1.10 At each of the above stages, the Level 2 Tester shall confirm that the items listed under ‘Other Considerations’ have been tested.

1.11 If no fault is found after testing, a Level 3 Engineer, independent of the actual testing to date, shall decide what further action is to be taken.

1.12 The Level 2 Tester and Level 3 Engineer shall always confirm if any steps have been omitted and verify that the reason for not carrying out the steps were valid and have not reduced the effectiveness of the testing.

1.13 If any doubt exists with the failure investigation or findings, the wrong side failure shall be escalated to a required level of expertise or authority at any time.

1.14 Additional testing resources might be considered necessary to complete the testing and reduce timescales.

1.15 Following an investigation, the Level 3 Engineer shall pass any necessary details to the Route Infrastructure Control if more than one stakeholder or engineering discipline is involved in the incident.

1.16 It is the responsibility of the Route Infrastructure Control to share details of no fault found after testing, in accordance with RIS-0707-CCS (Clause 2.2.3.3).

END

1. Keeping Records

1.1 It is important to record all relevant information. Notes shall be made at the time of observation. Even if these notes are rewritten later, it is important to retain the original notes in accordance with company policy.

1.2 Priority shall be given to information that might quickly disappear. Any information given by members of the public shall be recorded with particular care as their terminology might not have the same meaning as railway terminology.

1.3 In addition to the specific information requested in the Test Guides the following shall be recorded:

a) Train identity, formation and vehicle number.

b) Train driver's name and depot.

c) Signaller's name.

d) Names of any other staff or public involved.

e) Witness information (staff/public).

f) Details of Protection arrangements made.

END

1. Test Result Reporting

1.1 All staff involved in the investigation of failures shall, when reporting rectification, provide the following test results as a minimum:

General

a) The Tester's name, Test Guide used and SMTH Log Sheet number.

b) The items of equipment that were replaced and why they were replaced. Details shall include the manufacturer, the date of last service (if known), serial numbers, mod states, any other references such as pin code, type, etc.

c) Environmental conditions depending on the nature of the failure / incident, e.g. rail head condition, ballast condition, weather conditions at the time of the failure / incident, position of the sun relevant to the affected equipment.

Signal Lamp/LED Failures

d) Lamp type and make, (e.g. SL35).

e) Lamp voltage.

f) If lamp voltage was adjusted, then the voltage before and after adjustment is required.

g) Batch number if available and last changed date.

h) LED module type and nature of failure.

Track Circuit Failures

i) Drop shunt value.

j) Pick-up shunt value.

k) Rail volts feed and relay end.

l) Relay coil volts.

Point Failures

m) FPL Test results.

n) Detection Test results.

TPWS Failures

o) Any fault indications displayed by the various modules.

AWS Failures

p) S&P meter readings for Electro and Permanent Magnets.

Cables Failures

i) Lowest insulation resistance reading core to core.

q) Lowest insulation resistance reading core to earth.

Blown Fuses

r) Current rating of fuse.

s) Current in circuit (measure AC and DC separately).

Changing Equipment

t) Test Plan used.

END

1. Signing Back

1.1 The equipment shall not be made available for use until those who are investigating are satisfied with the results and conclusions of the testing undertaken.

1.2 Any undue pressure or coercion prior to or during the testing shall be reported to an independent party, for example the Regional Engineer / Route Engineer or equivalent, Network Rail Testing & Commissioning Engineer, Close Call process, CIRAS, etc.

1.3 When work is completed and the equipment is in working order, the equipment shall be signed back as available for use in accordance with the Rule Book.

1.4 The decision whether to accept the equipment for use in normal service is the responsibility of the Network Rail operations staff.

2. Use of the Sign Back Matrix

2.1 Where no fault is found, a higher level of authority shall be required.

As a minimum:

a) Exempted failures listed in NR/SMTH/Part05/Module/S03 (Single Obvious Cause - Exempted Failures) require the authority of a Level 1 Tester.

b) Other protected or unprotected wrong side failures require the authority of a Level 2 Tester.

2.2 Except where stated in NR/SMTH/Part05/Module/S12 (Sign Back Matrix), Level 2 authority shall be required for signing back wrong side failures where the fault has been found and Level 3 where no fault is found.

2.3 If additional technical advice is sought from another technical expert, that technical expert is not expected to take over responsibility for signing the asset back into service. This also applies should details of the failure be discussed in relation to operational or performance issues.

2.4 A dash in the “fault found” or no “fault found indicates” the failure example is not wrong side and there requires no sign back level.

3. Feedback to the Organisation/Individual who Reported the Fault

3.1 Wherever possible, the Infrastructure Fault Control can provide feedback to the organisation / individual who originally reported the wrong side failure (e.g. the Signaller, or the Train Operating Company in respect of a report from a driver).

3.2 In the case of SPAD investigation, feedback is mandated in NR/L1/OPS/010.

END

1. Authority Level - Sign Back Matrix

SIGNALS		
All Types		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Aspect sighting of all signal types degraded by sunlight	L1	L1
Aspect sighting of main signal degraded by means other than sunlight	L1	L1
Aspect sighting of subsidiary or shunt signal degraded by means other than sunlight	L1	L1
Aspect sighting of main signal obscured	L1	L1
Aspect sighting of subsidiary or shunt signal obscured	L1	L1
Phantom aspect – which is, or is capable of being interpreted as being, less restrictive than the correct aspect at the time.	L2	L3
Phantom aspect – which is, or is capable of being interpreted as being, more restrictive than the correct aspect at the time	L1	L2
Broken / Missing Lens / Spectacle Glass	L1	L1
Main Colour Light Signal		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
No danger aspect – failed signal fitted with AWS/TPWS – signal in rear held at danger	L1	L1
No danger aspect – failed signal not fitted with AWS/TPWS – signal in rear held at danger	L1	L1
No proceed aspect – failed signal fitted with AWS– signal in rear held at danger	L1	L1
No proceed aspect – failed signal not fitted with AWS – signal in rear held at danger	L1	L1
Signal able to clear with non-lamp proved RI not displayed when it should be	L1	L1
Signal able to clear with lamp proved RI not displayed when it should be	L2	L3
Main signal of main / co-acting arrangement not displaying an aspect	L2	L2
Co-acting signal of main / co-acting arrangement not displaying an aspect	L2	L2
Unable to replace or maintain signal at danger by signal post replacement switch	L2	L2
Unable to replace or maintain signal at danger due to broken button	L1	L2
Filament failure where the auxiliary filament takes over	L1	L1
Fixed Distant Board		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Fixed distant board missing or obscured – No AWS fitted	L1	L2
Fixed distant board missing or obscured – AWS fitted	L1	L2
Position Light Signal		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
No red and no pivot aspect displayed – 3 lamp type, signal	L1	L1
No red or no pivot aspect displayed – 3 lamp type, signal	L1	L1
No reds displayed – 4 lamp type, signal	L1	L1
Only one red displayed – 4 lamp type, signal	L1	L1
No proceed aspect displayed	L1	L1
Position Light Junction Indicator		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Proceed aspect given with less than 3 lamps lit in a 5 lamp PLJI	L1	L2
Proceed aspect given with 3 or 4 lamps lit in a 5 lamp PLJI	L1	L1

SIGNALS		
Incorrect PLJI (position) lit – less restrictive route (higher speed)	L2	L3
Incorrect PLJI (position) lit – more restrictive route (equal or lower speed)	L1	L2
Miniature Route Indicator		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Indicator not lit with associated signal clear, indicator lamp not proven in aspect	L1	L1
Mechanical Signal - Stop / Distant		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Section signal / slot not restoring to ON – arm not proved in controls	L2	L3
Non-Section Signal / slot not restoring to ON – arm not proved in controls	L1	L2
Any Signal / slot not restoring to ON – arm proved in controls	L1	L2
No light displayed during the hours of darkness – light not proved in controls	L1	L1
No light displayed during darkness – light proved in controls	L1	L1
No light displayed during hours of daylight	L1	L1
Signal arm / spectacle casting missing	L1	L2
Mechanical Signal - Shunt / Calling On		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Signal not restoring to ON – arm not proved in controls	L1	L2
Signal not restoring to ON – arm proved in controls	L1	L2
Shunt – no light displayed during hours of darkness – light not proved in controls	L1	L1
Calling On – no light displayed during hours of darkness – light not proved on controls	L1	L1
Shunt – no light displayed during hours of darkness – light proved in controls	L1	L1
Calling On – no light displayed during hours of darkness – light proved on controls	L1	L1
No light displayed during daylight	L1	L1
Signal disc / spectacle casting missing	L1	L2
Mechanical Banner		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Banner On but lamp out during darkness – lamp not proved in controls	L1	L1
Banner On but lamp out during darkness – lamp proved in controls	L1	L1
Lamp out during daylight	L1	L1
Banner Off but lamp out – during darkness	L1	L1
Banner not restoring to On – not proved in controls	L2	L3
Banner not restoring to On – proved in controls	L1	L2
Fibre Optic Banner		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
ON aspect not displayed – proved in controls	L1	L1
ON aspect not displayed – not proved in controls	L1	L1
OFF aspect not displayed	L1	L1

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NR/SMTH/Part05/Module/S12		
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SIGNALS		
LED Banner		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
ON aspect (white) not displayed – not proved in controls	L1	L1
OFF (white) - aspect not displayed – proved in controls	L1	L1
OFF (green) - aspect not displayed – proved in controls	L1	L1
No aspect displayed	L1	L1
Limit of Shunt / Notice Board All Types		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Not illuminated – lamp proved	L1	L1
LOS or NB missing	L1	L2

POINTS		
All Types		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Incorrect detection – facing points. Points detected with points laid in opposite position or when not locked or with switch rail open and locked	L3	L3
Able to move under a train – facing points	L3	L3
Incorrect detection –trailing points. Points detected with points laid in opposite position or when not locked or with switch rail open and locked	L3	L3
Able to move under a train –trailing points	L3	L3
Points indicating opposite lie of points – failure determined to be indication only. Interlocking functioning correctly	L3	L3
Point operating mechanism not isolated when on manual control	L2	L3
Points not self-restoring – failure not detected or indicated	L3	L3
Points not self-restoring – failure detected or indicated	L1	L1
Loss of point detection	L1	L1

TRACK CIRCUITS		
All Types – Showing Clear when Occupied		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Which controls any Signal, Interlocking or Level Crossing (excluding where listed below)	L3	L3
Where due to Rail Head Contamination and whilst **not** being protected by Special Block Working (See SMTH Part5 Module S4)	L2	L3
Where protection by Special Block working (e.g. for leaf fall or sandite operation)	L1	L1
Remote Condition Monitoring - Alert or Alarm <300ms in duration (See SMTH Part5 Module S4)	L1	L2
Sequencing controls in place and effective (See SMTH Part5 Module S4)	L1	L2
Failure determined to be indication only (i.e. TKR / TKE and not TPR Circuits)	L2	L2
Showing occupied with no train	L1	L1

TRACK CIRCUITS		
All Types – Showing Clear		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Where track circuit interrupter is broken	L2	L3
All Types – Showing Occupied		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Where track circuit interrupter is broken	L1	L1
All Types – Remote Condition Monitoring		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Current exceeds high occupied current but does not exceed the track occupied current level	L2	L2

BLOCK CONTROLS		
Manual		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Irregular Line Clear release obtained and able to clear signals	L3	L3
Irregular Line Clear indicated - unable to clear signals	L2	L3
Irregular Train On Line indicated	L1	L1
Unable to obtain Line Clear or Train On Line	L1	L1
Token / RETB		
Fault Found	**Fault Found**	**No Fault Found**
Irregular token release obtained	L3	L3
Bell		
Fault Found	**Fault Found**	**No Fault Found**
Operating irregularly when used in an emergency	L2	L2
Operating irregularly when used routinely.	L1	L1

TRAIN PROTECTION		
Automatic Warning System (AWS)		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Code 2 - horn instead of bell, controlling signal displaying G aspect.	L1	L1
Code 3 - nothing received – controlling signals displaying G aspect (where associated with a signal- controlling signal displaying green. Only experienced at one signal or only reported by one train.)	L1	L2
Code 3 - nothing received – controlling signal displaying G aspect (where associated with a signal displaying Green, if experienced at two Green signals by the train or by two successive trains at the same signal)	L2	L3

TRAIN PROTECTION		
Automatic Warning System (AWS)		
Code 4 - bell and horn, controlling signal displaying YY, Y or R aspect.	L1	L1
Code 5 - bell instead of horn – controlling signal displaying YY, Y or R aspect	L2	L3
Code 6 - brake application but no horn – controlling signal displaying YY, Y or R aspect	L1	L1
Code 7 - nothing received - controlling signal displaying YY, Y or R aspect.	L2	L3

TRAIN PROTECTION		
Automatic Train Protection (ATP)		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Train under ATP supervision passes signal at danger – train stops beyond overlap	L3	L3
Train under ATP supervision passes signal at danger – train stops within overlap	L2	L3
ATP supervision allows train to exceed permissible / enhanced permissible speed	L3	L3
ATP supervision allows train to exceed ESR / TSRs when no indicator boards are provided.	L2	L2
ATP supervision allows train to exceed ESR / TSRs when indicator boards are provided.	L2	L3
ATP system displays train speed in excess of ATP supervision speed	L3	L3

TRAIN PROTECTION		
Train Protection and Warning System (TPWS)		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Code 16 Failure A. TPWS at a signal fails to operate when required. Signal in rear reverts to danger and Signaller is aware of the failure	L1	L2
Code 16 Failure B. TPWS at a signal fails to operate when required. Signal in rear does not revert to danger and Signaller is aware of the failure	L2	L3
Code 16 Failure C. TPWS at a signal fails to operate when required. Signal in rear does not revert to danger and Signaller is unaware of the failure	L2	L3
Code 16 Failure D. TPWS at a set of lamp proved buffer stops, fail to operate when required Signaller is aware of the failure	L1	L2
Code 16 Failure E. TPWS at a set of lamp proved buffer stops fails, to operate when required Signaller is unaware of the failure	L2	L3
Code 16 Failure F. TPWS at a PSR fails to operate when required Signaller is aware of the failure	L1	L2
Code 16 Failure G. TPWS at a PSR fails to operate when required Signaller is unaware of the failure	L2	L3
Code 16 Failure H. TPWS correctly initiates brake application, but train does not stop before conflict point and train travelling within design speed of TPWS	L2	L3

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TRAIN PROTECTION		
Train Protection and Warning System (TPWS)		
Code 16 Failure J. Intermittent latched failure indication, not seen by the Signaller, no change of aspect of the signal in rear (found by maintenance Technician to be working correctly)	L1	L1
Code 16 Failure K. Intermittent latched failure indication, seen by the Signaller, no change of aspect of the signal in rear	L2	L3
Code 16 Failure L. Intermittent latched failure indication, not seen by Signaller, change of aspect of the signal in rear	L1	L2
Code 17. TPWS operates when not required (Loops not found transposed)	L1	L1
TPWS Transposed arming and trigger loops	L2	L3
TPWS operates when the train is travelling within the speed limit.	L1	L2

TRAIN PROTECTION		
TASS / Balise		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
TASS functions (speed supervision or Tilt Authorised) cease within an area where Driver route knowledge indicates should be available,	L1	L1
TASS functions (speed supervision or Tilt Authorised) cease and are NOT re-instated at a later point in the journey.	L1	L1
TASS critical system fault detected resulting in application of train brakes and braking of train to a stand.	L1	L1
Spurious speed supervision intervention.	L1	L1
TASS intervention fails to operate correctly when train speed exceeds defined limits.	L3	L3
Erroneous indication of speed supervised in an area where TASS is not supervising speed resulting in an unauthorised overspeed event.	L1	L2
Erroneous Tilt authorisation on route not gauge cleared for tilt operation	L3	L3
Erroneous Tilt authorisation on route gauged cleared for tilt operation.	L2	L3
TASS Immediate Tilt Stop Balise failed (missing, not functioning or functioning incorrectly in a manner that Telegram is not capable of being read and acted upon by a TASS fitted train).	L2	L3
Selective Door Opening (SDO) – Incorrectly positioned or incorrectly programmed beacon allowing train doors to open when not permissible.	L2	L3
Defective ETCS Balise - Train incorrectly issued a Movement Authority (MA) into an unproven section	L2	L3
Missing ETCS Balise - ??	L2	L3

TRAIN PROTECTION		
Train Stop		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Fails to energise with train trip cock when required to	L3	L3
Energises when not required	L1	L1

LEVEL CROSSINGS (All Barrier Types)		
Road Traffic Lights / Boom / Audible Warnings		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
No road lights at one or more sides – all barriers down	L1	L2
One or more red road lights out in any cluster – other clusters on same side of crossing operating correctly	L1	L2
Full failure of audible warning devices	L1	L2
Partial failure of audible warning devices	L1	L2
All yellow road lights at one or both sides not operating.	L1	L2
All barrier boom lights out on one or more barriers – road lights operating correctly	L1	L2
Individual barrier boom light out	L1	L1

LEVEL CROSSINGS		
MCB / CCTV		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Barriers not fully lowered and all road lights not operating – able to clear protecting signals	L3	L3
One or more barriers not fully lowered – all road lights operating correctly and able to clear protecting signals	L3	L3
One or more barriers not fully lowered – all road lights operating correctly and not able to clear protecting signals	L1	L1
Able to lower barriers with reduced road traffic warning sequence	L2	L3
Spurious Crossing Clear able to be obtained and able to clear protecting signals	L3	L3
CCTV frozen or obscured picture, Signaller **not** aware	L2	L3
CCTV frozen or obscured picture, Signaller aware	L1	L2
Unable to see or obtain CCTV picture of the crossing	L1	L1

LEVEL CROSSINGS		
OD (Obstacle Detection) High Level COD / LIDAR		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
HL COD system spurious Crossing Clear (from ALL HL scanners forming the HL COD, with POD working correctly)	L2	L3

LEVEL CROSSINGS		
OD (Obstacle Detection) High Level COD / LIDAR		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
HL COD scanner(s) spurious Detection Area Clear (from one or more HL scanners forming the HL COD but not all HL scanners, with POD working correctly) where less than 50% of the HLCOD Detection Area is working correctly, e.g. on large skew crossings	L2	L3
HL COD scanner(s) spurious Detection Area Clear (from one or more HL scanners forming the HL COD but not all HL scanners, with POD working correctly) where 50% or more of the HL COD Detection Area is working correctly	L2	L3

LEVEL CROSSINGS		
OD (Obstacle Detection) Low Level COD / LIDAR		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
LL COD system spurious Crossing Clear (from ALL LL scanners forming the LL COD, irrespective of POD or HL COD working correctly)	L3	L3
LL COD scanner(s) spurious Detection Area Clear (from one or more LL scanners forming the LL COD but not all LL scanners, where less than 50% of the LL COD Detection Area is working correctly, e.g. on large skew crossings.	L2	L3

LEVEL CROSSINGS		
OD (Obstacle Detection) MCB CCTV		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
BPM / BOD (inductive loops) to protect barriers from being damaged, failure to detect a road vehicle	L1	L1
BPM / BOD (inductive loops) to protect barriers from being damaged, Loop failed	L1	L1
Spurious crossing clear from POD (derailment / vehicle protection lost)	L3	L3

LEVEL CROSSINGS		
AHBC		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
One or more barriers not fully lowered – all road lights operating correctly – train traverses crossing	L3	L3
No road lights at one or more sides – all barriers down – train traverses crossing	L2	L3
One or more red road lights out in any cluster – other clusters on same side of crossing operating correctly	L1	L2
Able to lower barriers with reduced road traffic warning sequence	L2	L3
Train passes over the crossing without the barrier sequence completed	L2	L3
Train arrives at crossing quicker than expected (possible timing issues)	L2	L3
Another Train Coming function not operating when needed – crossing lights operating correctly	L1	L2
Crossing Failed indication fails to operate when crossing has failed	L2	L2

LEVEL CROSSINGS		
ABCL		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Barriers not fully lowered and all road lights not operating at one or both sides – Drivers Red Light extinguished and Drivers White Light illuminated	L3	L3
One or more barriers not fully lowered – all road lights operating correctly Drivers Red Light extinguished – Drivers White Light illuminated.	L3	L3
No road lights at one or more sides – all barriers down Drivers Red Light extinguished and Drivers White Light illuminated	L3	L3
DWL illuminated with any other failure which is designed to prevent DWL being illuminated present and not detected	L3	L3
DWL not illuminated with detected failure mode present	L1	L1
Crossing operates with reduced warning sequence	L2	L3
Another Train Coming function not operating when needed – crossing remains operated	L1	L2

LEVEL CROSSINGS		
AFBCL		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Barriers not fully lowered and all road lights not operating at one or both sides – Drivers Red Light extinguished and Drivers White Light illuminated	L3	L3
One or more barriers not fully lowered – all road lights operating correctly Drivers Red Light extinguished – Drivers White Light illuminated.	L3	L3
No road lights at one or more sides – all barriers down Drivers Red Light extinguished and Drivers White Light illuminated	L3	L3
DWL illuminated with any other failure which is designed to prevent DWL being illuminated present and not detected	L3	L3

LEVEL CROSSINGS		
AFBCL		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
DWL not illuminated with detected failure mode present	L1	L1
Crossing operates with reduced warning sequence	L2	L3
Another Train Coming function not operating when needed – crossing remains operated	L1	L2

LEVEL CROSSINGS		
AOCL		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
No road lights operating at one or both sides and Drivers White Light illuminated	L3	L3
DWL illuminated with any failure present which should prevent the DWL being illuminated	L3	L3
DWL not illuminated with detected failure mode present	L1	L1
Crossing operates with reduced warning sequence	L2	L3
Another Train Coming function not operating when needed – crossing remains operated	L1	L2

LEVEL CROSSINGS		
AOCL+B		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Barriers not fully lowered and all road lights not operating at one or both sides – Drivers Red Light extinguished and Drivers White Light illuminated	L3	L3
One or more barriers not fully lowered – all road lights operating correctly Drivers Red Light extinguished – Drivers White Light illuminated.	L3	L3
No road lights at one or more sides – all barriers down Drivers Red Light extinguished and Drivers White Light illuminated	L3	L3
DWL illuminated with any other failure which is designed to prevent DWL being illuminated present and not detected	L3	L3
DWL not illuminated with detected failure mode present	L1	L1
Crossing operates with reduced warning sequence	L2	L3
Another Train Coming function not operating when needed – crossing remains operated	L1	L2
No road lights operating at one or both sides and Drivers White Light illuminated	L3	L3

LEVEL CROSSINGS		
AOCR		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
No road lights operating at one or both sides – train traverses crossing	L3	L3
Crossing operates with reduced warning sequence	L2	L3
Another Train Coming function not operating when needed – crossing remains operated	L1	L2
Crossing Failed indication fails to operate when crossing has failed	L2	L2

LEVEL CROSSINGS		
Train Crew Operated Barriers		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Barriers fully lowered with no road lights or DWL	L2	L2
Barriers not fully lower with DWL displayed	L3	L3
Able to lower barriers with reduced road traffic warning sequence	L2	L3
One or more barriers not fully lowered - all road lights operating correctly and able to clear signals	L2	L3

LEVEL CROSSINGS		
MSL		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
G aspect displayed vice R – train traverses crossing	L3	L3
No G aspect – user warning sign in place and clearly legible	L1	L1
No G aspect – user warning sign missing or illegible	L1	L2
No R aspect – user warning sign in place and clearly legible	L1	L2
No R aspect – user warning sign missing or illegible	L1	L2
Full failure of audible warning devices (where fitted)	L1	L2
Partial failure of audible warning devices (where fitted)	L1	L2
Crossing operates with reduced warning sequence	L2	L3

LEVEL CROSSINGS		
LC Protected by Audible Device		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Audible warning device not operating with train approaching crossing	L2	L3
Partial failure of audible warning devices (where fitted)	L1	L2
Crossing Failed indication fails to operate when crossing has failed	L2	L2

LEVEL CROSSINGS		
Rural Barriers		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Both barriers do not lower when required to – not detected in protecting signals	L2	L3
One barrier does not lower when required to – not detected in protecting signals	L2	L2
Both barriers do not lower when required to – detected in protecting signals	L2	L3
One barrier does not lower when required to – detected in protecting signals	L1	L2
All barrier boom lights out on one or more barriers	L1	L2

LEVEL CROSSINGS		
Staff or Barrow Crossing		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Warning light or alarm fails to extinguish for approaching train	L2	L3
Crossing operates with reduced warning time	L2	L3

LEVEL CROSSINGS		
Gated Crossing		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Able to open gate when crossing closed to road with locking device engaged. Locking not detected in protecting signals	L2	L3
Able to open gate when crossing closed to road with locking device engaged. Locking detected on protecting signals, but signal type does not return to danger (Mechanical Signal.)	L2	L3
Able to open gate when crossing closed to road with locking device engaged. Locking detected on protecting signals, but signal type does not return to danger (Multi Aspect Signal.)	L2	L3
Able to open wicket gate when required to be locked	L2	L3
No light displayed in gate lamps	L1	L2
Full failure of audible warning devices (where fitted)	L1	L2
Partial failure of audible warning devices (where fitted)	L1	L2

LEVEL CROSSINGS		
Power Operated Gate Opener (POGO		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
POGO performs un-commanded operation leading to a road vehicle to be in conflict area with train approaching	L2	L3

INTERLOCKING AND CONTROLS		
Relay or Electronic Interlocking		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Ineffective interlocking resulting in signals clearing prematurely	L3	L3
Ineffective interlocking resulting in conflicting routes able to be set and signals clearing	L3	L3
Ineffective interlocking resulting in conflicting routes able to be set -signals not clearing	L2	L3
Route self-sets and signals clear when signal being maintained at red	L3	L3
Route self-sets and signals clear without being set – route is safe / valid	L1	L1
Unable to replace all signals to On via “All Signals On facility”	L3	L3

INTERLOCKING AND CONTROLS		
Mechanical Frame		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Ineffective interlocking resulting in signals clearing prematurely	L3	L3
Mechanical interlocking or Electric Lock defect which results in or might result in an irregular release being available	L3	L3

SIGNAL BOX INDICATIONS		
All types		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Track circuit shows clear when occupied (indication only)	L2	L2
Route light fails to show	L1	L1
Point detection indication fails to show	L1	L1
Replacement switch fails to place signal at danger, but indication shows red	L2	L3

WARNING SYSTEMS		
Train Operated Warning System (TOWS)		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Warning tone fails to sound or warning lights fail to extinguish for an approaching train.	L2	L3
System operates with reduced warning time	L2	L3
Warning tone sounding constantly with no approaching train.	L1	L1
Safe tone sounding constantly with no approaching train.	L1	L1

MISCELLANEOUS SIGNALLING SYSTEMS		
Power Supplies		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Power failure causing more than one black signal with signals in rear **not** held at danger	L2	L3
Power failure causing more than one black signal with signals in rear held at danger	L2	L2
Power failure causing single black signal, with signals in rear **not** held at danger, fitted with AWS	L2	L3
Power failure causing single black signal, with signals in rear **not** held at danger, not fitted with AWS	L2	L3
Power failure causing single black signal, with signals in rear held at danger	L1	L2
Power “blip” causing a temporary blackout not exceeding 30 seconds (typically can be caused by a power change-over). System working as designed.	L1	L1
Hot Axle Box Detectors (HABD)		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
System fails to detect hot axle box within operating specification	L2	L3
System miscounts total axles	L1	L1
System gives false alarms	L1	L1
Detonator Placer		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Detonator placer fails to place detonators in the correct position – live detonators available	L2	L2
Detonator placer fails to place detonators in the correct position – operated in conjunction with signal when signal at On - live detonators available	L2	L2
Warning and Trip Wires		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Airport Runway Trip Wire fails to operate when required	L2	L3
Chalk Fall ‘or ‘Rock Fall’ (or similar) warning wire fails to operate when required.	L2	L3
Tunnel warning wire fails to operate when required.	L2	L3

TELEPHONES		
Signal Post Phones (SPT)		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Crosstalk or overhearing on SPTs	L2	L3
Call from signal connected to wrong position at signal box	L2	L3
Label incorrect	L2	L2
Label missing	L1	L2

TELEPHONES		
Level Crossing Phones (All types of Crossing)		
Failure Mode or Consequence	**Fault Found**	**No Fault Found**
Crosstalk or overhearing on telephones	L2	L2
Poor quality of transmission on telephone, which might result in misinterpretation of instructions	L2	L2
Telephone with incorrect labelling or no operating instructions	L1	L2
Telephone fails and generates signal box alarm	L1	L1
Level Crossing Phones (AHBC)		
If one telephone is out of order, but another is available	L2	L2
Level Crossing Phones (AOCL, AOCL+B, ABCL, and AFBCL)		
If one telephone is out of order, but another is available	L1	L2
Level Crossing Phones (MSL)		
Signaller cannot be contacted by any telephone	L2	L2
Level Crossing Phones (Any Automatic Crossing (not MSL)		
Signaller cannot be contacted by any telephone (where provided)	L1	L2
Crossing only Protected by Telephone		
Signaller cannot be contacted by any telephone	L2	L2

END

1. Wrong Side Failures on Equipment in Service but before formal 'take over' by Maintenance

1.1 Wrong side failures have been known to happen on newly commissioned equipment.

1.2 Any wrong side failure on in-service equipment shall be investigated in accordance with the Signal Maintenance Testing Handbook.

1.3 With the exception of (NR/SMTH/Part05/Module/S03 – Single Obvious Cause – Exempted Failures), details of wrong side failures of equipment that have been taken into operational use, but have not been taken back into maintenance, shall be advised to the Project Manager.

This will have normally been previously agreed between the Project Manager and the Maintenance organisation and documented in the Asset Management Plan.

During office hours, this should be undertaken before completion of the immediate investigation. This should also apply to allegations, even if these are subsequently disproved.

1.4 For the majority of wrong side failures, no formal action should be required from the project team in the immediate investigation of the failure. For certain complex failures, or failures requiring specialist equipment, or failures requiring specialist expertise to investigate them, the project team might supply additional resources to work under the direction of the testing team. In certain circumstances, such an involvement could be essential to investigate what happened.

1.5 In all cases of actual wrong side failure, the immediate cause of the fault shall be determined, and mitigation applied in accordance with Wrong Side Failure Test Guides.

END

1. Specialist Investigation of Equipment

1.1 All equipment suspected of, or confirmed as, causing a wrong side failure shall undergo specialist investigation unless the Route Engineer (Signalling), Principal Route Engineer (Signalling) or equivalent confirms this to be unnecessary, e.g. on the grounds that the failure mode is well known.

1.2 Any associated train-borne equipment which interfaces with the signalling system and which is suspected of causing a wrong side failure, shall also undergo specialist investigation, this shall be undertaken by the relevant stake holder/function.

1.3 Where equipment is sent away for specialist investigation, it shall be suitably packaged and labelled. All efforts shall be taken to avoid transit damage, particularly where evidence needs to be preserved.

1.4 Details of the equipment and its reported failure circumstances shall be provided with the equipment.

END

1. Derailments

1.1 In the event of a derailment at S&C, if the S&C is operated by signalling equipment or has detection fitted and there has been no report of an irregular aspect or SPAD of the protecting signals, then either:

a) Any derailment shall be assumed to be a result of either points moving when they should have been locked, or

b) Point detection was incorrectly set, combined with some reason for the switch rail not being in the correct position.

1.2 In these circumstances, incident testing using the relevant Test Guide shall be started immediately and can only be abandoned when either:

a) The Rail Incident Officer (RIO), (see NR/SMTH/Part05/Modules/S16 - Signals Passed At Danger (SPAD) and NR/SMTH/Part05/Modules/S17 - Serious Incident Procedure) states formally that a definite cause, unrelated to the signalling has been established, or

b) The S&TME instructs the investigation to be stopped so that it can be completed by an independent testing organisation, or

c) On the direct instructions of the Police.

END

1. Signals Passed At Danger (SPAD)

1.1 Where a reported signal passed at danger incident has not resulted in a derailment or collision, and there is no allegation against the signalling equipment, the actions detailed in NR/SMTH/Part09/U007 (Tests Following an Alleged Signal Passed at Danger (SPAD)) shall be carried out.

If a derailment or collision resulted, the serious incident testing procedures shall be followed.

1.2 If a driver makes an allegation against the signalling, the testing is to be arranged and carried out as detailed in the Test Guides. Test Guides NR/SMTH/Part08/T036, NR/SMTH/Part08/T037, NR/SMTH/Part08/T038 are specifically for allegations of signal sighting being degraded or obscured by an obstruction or by sunlight.

1.3 NR/SMTH/Part09/U008 (Tests Following an Alleged Change of Aspect (COA)) sets out the procedure to be adopted for dealing with a reported SPAD due to a colour light signal reverting to a more restrictive aspect, where a cause is not obvious at the commencement of the investigation.

1.4 If it cannot be confirmed that the signal concerned, or the signal in rear, was displaying the correct aspect prior to the reported incident, a WRONG SIDE FAILURE shall be assumed, which shall be investigated using the Test Guide(s) in the T series.

1.5 If the correct operation of any equipment is doubted it shall be treated as defective and tested.

END

1. Serious Incident Procedure

1.1 When a serious incident occurs, the rules of investigation and repair are changed.

1.2 GE/RT8000 (Rule Book), and Railway Group Standard RIS-3118-TOM (Incident Response Planning & Management) detail the requirements.

1.3 GE/RT8000 Module M3 states that “You must not move signalling equipment directly associated with the accident shall, even for testing purposes, until you are authorised to do so. This does not apply to equipment that must be used to protect the accident”.

1.4 A Rail Incident Officer (RIO) shall be appointed by Network Rail to co-ordinate the overall recovery process and shall be the single focus for dealing with other agencies involved, such as emergency services and Office of the Rail and Road (ORR).

1.5 No work on signalling or telecommunications equipment shall be attempted without specific authority from the RIO or someone who the RIO has delegated authority to.

1.6 Staff called to the incident shall log actions and observations made during attendance.

When recording notes, priority shall be given to equipment liable to be disturbed by traffic or by rescue/recovery services.

When recording details using a camera you should be mindful of taking photography that might cause distress and are of a sensitive nature.

Reports from train crews, Signallers or personnel from other departments are normally gathered by their respective management.

2. Use of Standard Test Guides

2.1 With the agreement of the RIO and RAIB, non-destructive testing can be conducted using standard Signalling Failure Investigation Test Guides.

However, before proceeding to destructive testing (which requires the further agreement of the RIO and RAIB), consideration should be given afresh as to whether the testing stated in the relevant Test Guide is correct given the knowledge of the incident and its possible causes.

2.2 In some cases, an additional test plan may be devised to address particular areas of concern.

END

1. RAIB led Investigations

1.1 Where the RAIB lead an investigation, in the circumstances where an incident has occurred which falls within Schedule 1 of the Railways (Accident Investigation and Reporting) Regulations 2005 (see Appendix A), then they shall specify the level of independence required.

Use of Standard Test Guides

With the agreement of the RIO and RAIB, non-destructive testing can be conducted using standard Signalling Failure Investigation Test Guides.

Before proceeding to destructive testing (which shall require the further agreement of the RIO and RAIB), consideration shall be given afresh as to whether the testing stated in the relevant Test Guide is correct given the knowledge of the incident and its possible causes.

In some cases, an additional test plan may be devised to address particular areas of concern.

2. Network Rail led investigations

2.1 Where a Schedule 1 incident has occurred, but the RAIB decide not to carry out an investigation, or ask Network Rail to undertake this for them, the investigation shall be led by a person authorised to Level 3 sign-back but independent of the Delivery Unit responsible for the assets involved in the incident.

2.2 This person would normally be drawn from an adjacent Delivery Unit. In exceptional circumstances, the Route Engineer (Signalling), Principal Route Engineer (Signalling) or equivalents could provide an independent lead.

This independent person shall attend on site to lead the investigation work, which will follow the normal SFI process (including local level 2 and level 3 signoffs).

2.3 The investigation team may include the local Signalling Technicians, but they shall work under the direct supervision of the independent person.

END

1. Rail Accident Investigation Board (RAIB) Liaison

1.1 Once notified of an incident by NR and agreement reached on the Schedule rating of the incident, RAIB may appoint an Accredited Agent (usually drawn from the NR pool of RIOs – note that an AA cannot also act as RIO) or elect to attend themselves. Regulation 6(1) applies. The scheduled events are shown in the Module S20.

1.2 Regulation 7(1) prohibits access to the signalling system for schedule 1 events without the consent of the RAIB or its Accredited Agent.

Every endeavour shall be made to contact RAIB or its Accredited Agent (via Infrastructure Fault Control) to request permission to commence non-destructive testing prior to independent SMTH (SFI) Testers arriving on site.

The RAIB or its Accredited Agent can elect to prevent such testing from starting and instigate its own investigations. RAIB duty controllers are available at all times.

1.3 NR/SMTH/Part05/Module/S06 (Wrong Side Failure Testing Procedure) requires that non-destructive testing is always carried out before destructive testing is authorised by the Level 2 or 3 staff.

1.4 The Level 3 SFI Tester shall inform Infrastructure Fault Control if a NR contracted agency is called out to assist on site. RAIB or its Accredited Agent shall then be informed by Infrastructure Fault Control.

2. Gathering Evidence

2.1 If inspection activities by NR Signal Engineering staff have been allowed to commence before RAIB, its Accredited Agent or the RIO are on site, then the senior NR Signal Engineer on site shall inform them as to how far the testing has proceeded and reach an agreement on the start of all subsequent steps.

2.2 The RAIB or its Accredited Agent shall always be given the opportunity to witness all tests.

2.3 No equipment shall be removed from its operational position without RAIB or its Accredited Agent's agreement – Regulation 9 applies. The RAIB or its Accredited Agent can remove equipment for investigation to specialist laboratories.

The RAIB or its Accredited Agent shall always consult with the NR senior Signal Engineer on site before doing so and would normally expect NR staff to undertake the removal under SMTH and arrange packaging.

2.4 Any application of scribe witness marks shall only be undertaken with the agreement of the RAIB or its Accredited Agent.

2.5 Any application of identification marks (e.g., bar codes) by RAIB or its Accredited Agent shall only be made with the agreement of the senior NR Signal Engineer on site and shall be applied to allow subsequent examination of the equipment without needing to remove the mark.

2.6 In all cases agreement shall be reached on site as to who has responsibility for the continuity of protection of evidence.

2.7 Where the laboratory investigation requirements fall within the capability of the NR appointed agents then that agent is likely to be used. In this instance NR shall be responsible for safe transportation of the equipment to the laboratory and for managing the activities of the agency.

2.8 RAIB shall always be given access to all steps of laboratory investigation and they shall also be involved in any decision to move from the non-destructive phase to the destructive phase.

In this case removing seals and covers from equipment is not considered to be destructive but RAIB shall be consulted before doing so. If RAIB requires tests in addition to those instructed by NR then RAIB shall fund and manage these tests.

2.9 Reports produced by the NR agency shall include NR and RAIB instructed work and be transmitted to NR Centre/Region and RAIB in parallel.

2.10 RAIB might well take witness statements from NR staff or contractor's staff. Regulation 10(2) prevents disclosure of the contents of the interview without a court order or consent of the individual.

Therefore, NR cannot rely on such witness statements to further its investigation and shall undertake its own interviews as necessary.

3. Use of Evidence

3.1 NR may disclose within NR any evidence jointly gathered, but any external release can only be made with the agreement of RAIB. Regulation 9(7) applies.

In the case of Schedule 2 events then NR are normally allowed to disclose externally.

3.2 Therefore, the issue of SINs or other notices to control or mitigate risks elsewhere is allowed.

END

1. Schedules of Reportable Events

1.1 Schedule 1 (report immediately)

a) An accident resulting in the death of a person or the serious injury of two or more persons.

b) An accident on a Level Crossing involving rolling stock, resulting in the death of a person or serious injury to a person.

c) A collision between rolling stock on a running line that was open to railway traffic at the time of the collision.

d) A derailment of rolling stock on a running line that was open to railway traffic at the time of the derailment, or which blocks a running line that was open to railway traffic at the time of the derailment.

e) A collision of rolling stock with an arrestor mechanism or buffer stop, other than in a siding, that causes damage to the rolling stock.

f) An accident involving the release or combustion of dangerous goods being carried on rolling stock that necessitates the evacuation of the area.

g) An accident or incident that is likely to result in suspension of a railway service for a period in excess of 6 hours.

h) An accident that causes extensive damage to rolling stock, the infrastructure or the environment.

i) An accident or incident which under slightly different conditions might have led to a death, serious injury or extensive damage to rolling stock, the infrastructure or the environment.

1.2 Schedule 2 (report within 3 working days)

a) A collision of rolling stock with an object on or adjacent to a running line which under slightly different conditions might have caused a derailment, except:

   i. If it is notifiable under regulation 4(1) (i.e. schedule 1).

   ii. If the object was an animal.

   iii. Where the obstruction was caused by an obvious act of vandalism.

b) An accident resulting in the serious injury of one person only except if it is notifiable under regulation 4(1) (i.e. schedule 1).

c) An obstruction of, or damage to, track, caused by a road vehicle encroaching onto a running line, except when the obstruction or damage occurs on a part of a tramway track that runs on a carriageway.

d) Any unintended division of a train or a tramcar.

e) The failure of rolling stock on a track caused by:

i. The failure of an axle.

ii. The failure of a wheel or tyre, including a tyre loose on its wheel.

iii. A fire or severe electrical arcing or fusing, whether or not extinguished by a fire-fighting service.

f) The failure of a cable or the fastening thereof of the winding plant or other equipment involved in working a railway operated by a cable haulage system.

1.3 Schedule 3 (report within 10 days of the end of the month in which the event occurred)

a) The failure of equipment at a level crossing which reduces the level of safety on the railway.

b) The failure of a rail, including a rack rail, on a running line whether by a complete fracture through its cross section, or by the buckling or detachment of a piece of rail which necessitates an immediate closure of that running line or speed reduction on that running line.

c) The failure of a structure on railway property, including a tunnel, bridge, viaduct, culvert, railway cutting, embankment, station, signal or fixed electrical equipment which under slightly different circumstances might have led to a serious accident or which otherwise reduces the level of railway safety.

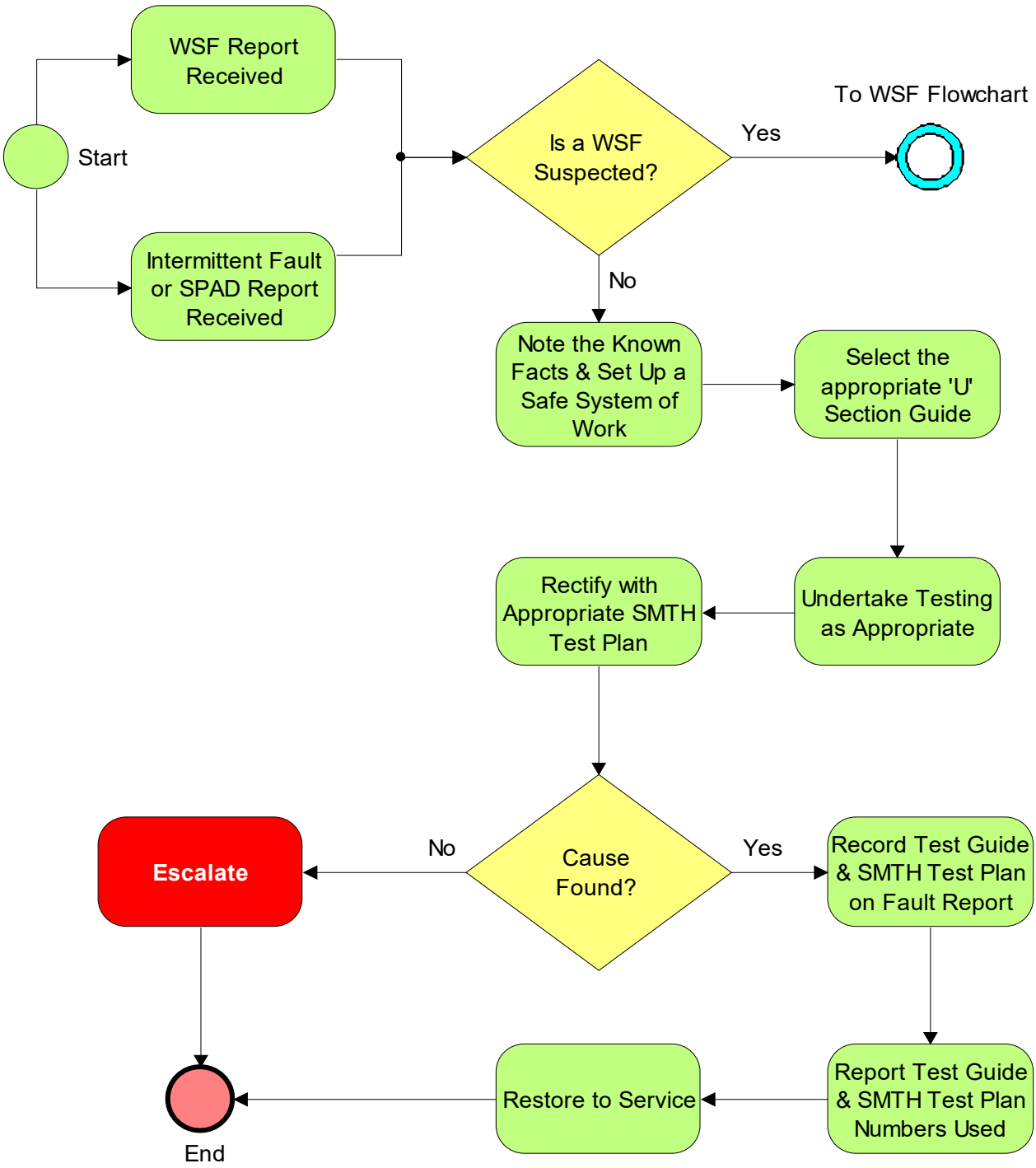
d) A failure in the signalling system which reduces the level of railway safety.

e) Rolling stock passing a railway signal displaying a stop aspect, unless either the driver had been given authority to pass the signal or the signal did not display in enough time to enable the driver to stop safely at the signal.

f) A collision between a tramcar and a road vehicle on a part of a tramway running along a carriageway.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part05/Module/S21		
Failure and Incident Testing Flowchart		
Issue No. 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021



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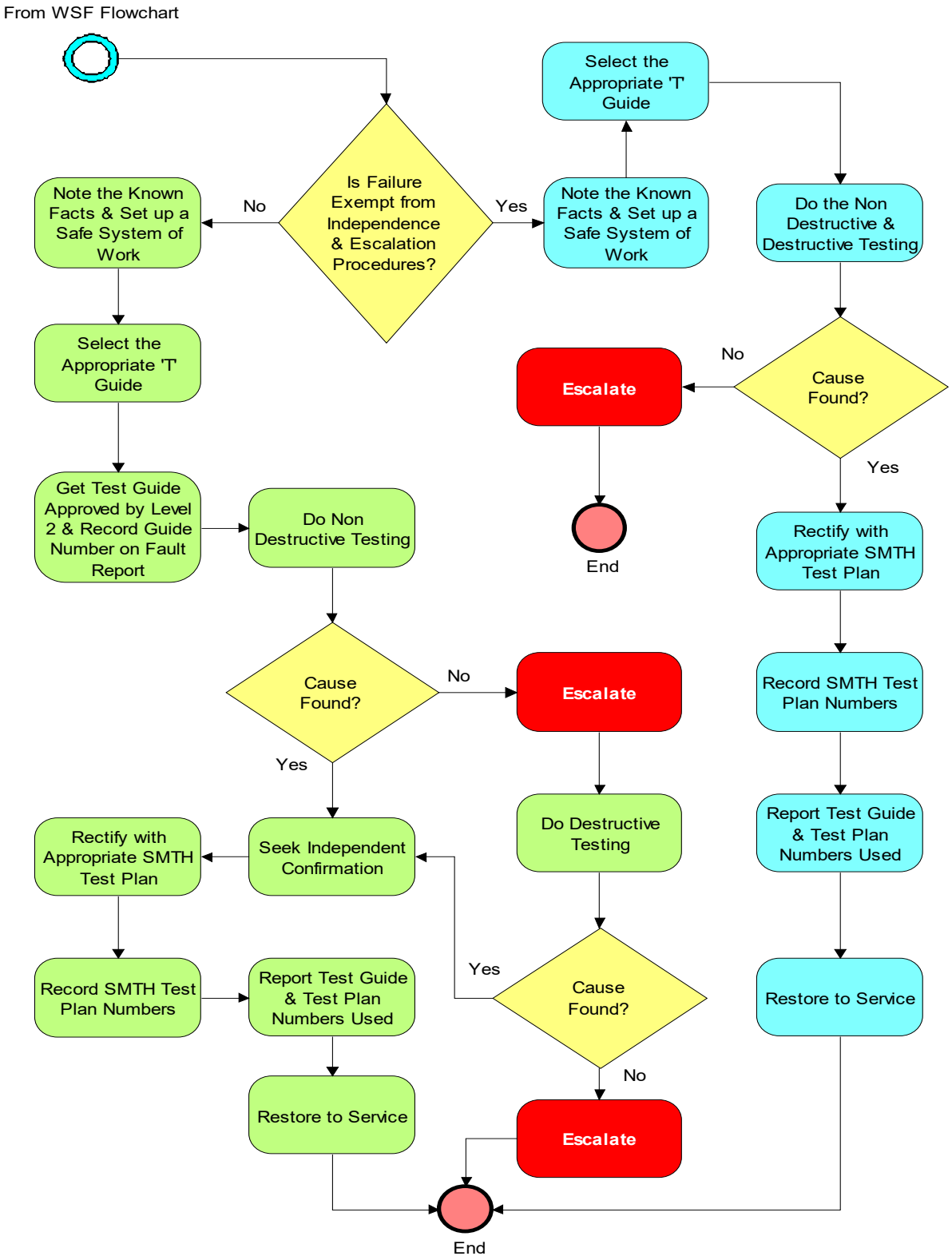

END

1. Scope

This module provides guidance on the categorisation, investigation and sign back of a Signal that is alleged to be difficult to see or *becoming* difficult to see.

This module applies to all Signals, including banner repeaters and associated indicators

2. Categorisation of Signals alleged to be difficult to see or are becoming difficult to see because of trees, foliage or other obstructions.

2.1 Report that a Signal is difficult to see or *becoming* difficult to see.

The Signaller should follow the Rule Book and establish certain information that will assist the investigation and prompt the correct response.

Examples of information the Signaller should obtain:

a) Whether the signal is visible at all times between the AWS and the Signal.

b) Where it became difficult to see.

c) The location of the obstruction.

d) What is causing the obstruction.

e) The estimated duration of the obstruction to sighting at permissible speed (less than 2 seconds or greater than 2 seconds).

This information should be captured on the RT3185 form.

Where an obscuration is judged to be affecting less than 10% of any signal element it may be considered as *becoming* difficult to see (ref. NR/L2/SIG/10157).

NOTE: *The terms "fully" and "partially" are no longer used.*

2.2 Signal difficult to see

A Signal shall be considered defective if any aspect or associated indicator is difficult to see between the designed Minimum Reading Distance (MRD) and the asset position.

This shall be treated as a Wrong Side Failure and investigated.

The Minimum Reading Distance (MRD) for a signal is defined on its Signal Sighting Record.

If the Signal Sighting Record is not available, the MRD shall be determined by using the process in NR/SMS/PartB/Test/302 (Signal Visibility Check).

NOTE: *Any known, permitted obscurations are also defined on the Signal Sighting Record*.

Examples of where the obscuration report may come from:

a) Reports from Drivers.

b) Reports from On Board staff.

c) Reports from Station Staff.

d) Reports from Cab Rides by staff.

e) Review of recorded video footage.

2.3 Signal *becoming* difficult to see.

A Signal becoming difficult to see is not classified as a Wrong-Side Failure because the Minimum Reading Distance (MRD) is not compromised.

The Minimum Reading Distance (MRD) for a signal is defined on its Signal Sighting Record. In the case this is not available, the MRD shall be determined by using the process in NR/SMS/PartB/Test/302 (Signal Visibility Check).

A Signal reported as *becoming* difficult to see is assumed to be currently unobscured but is at risk of obscuration, for example with further growth of vegetation.

Examples of where confirmation that the signal is not obscured but is at risk of obscuration may come from:

a) Report from subsequent driver(s) asked to report back following an initial allegation of a signal difficult to see.

b) Review of recorded video footage taken after the initial report.

c) Reports from follow up Cab Ride by S&T staff.

d) Site visit by S&T staff.

NOTE: *These reports might be a precursor that a Wrong Side failure of the Signal is imminent and should be actioned (e.g. Arrange for Clearance).*

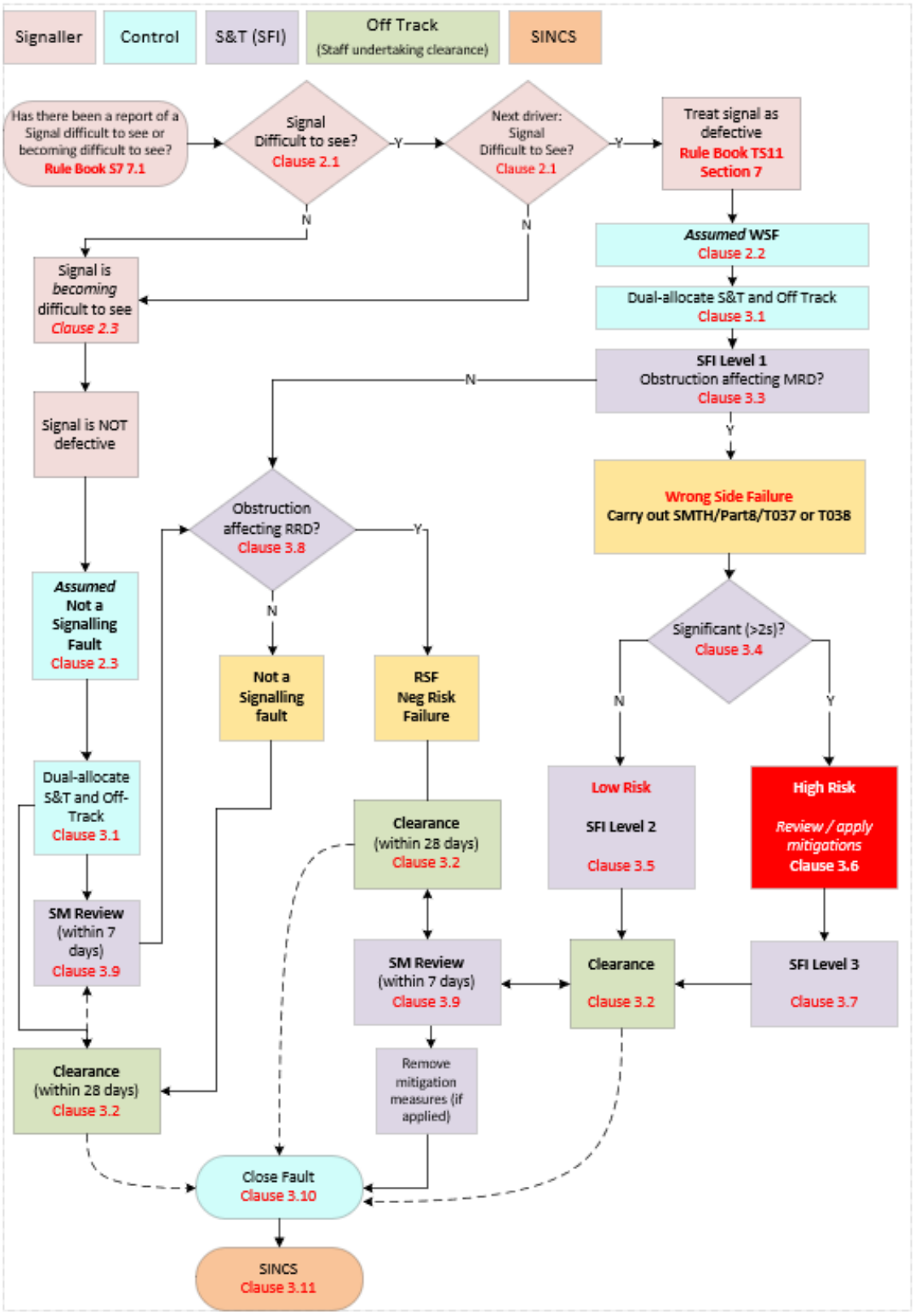

Figure 1 – Signal Obscuration Management Flowchart

3. Management of Obscured Signals

The flowchart (Figure 1) and the corresponding guidance describes the process to be followed when classifying, investigating and signing back Signals that are alleged to be difficult to see or *becoming* difficult to see.

3.1 Dual-Allocation of faults

A report of a Signal difficult to see or *becoming* difficult to see shall be raised and allocated in the Fault Management System to both SFI staff and to Vegetation Clearance staff, where these are different teams.

Teams shall co-operate to investigate, capture information, and then rectify the fault in a timely manner and without losing evidence.

3.2 Clearing vegetation / obstruction

The principle of SFI is to preserve evidence of a wrong side failure and investigate thoroughly to establish the root cause.

Staff undertaking clearance activities shall record all pertinent information (e.g. digital photos, recordings, measurements) to clearly show the situation as found, and when cleared.

3.3 SFI Level 1 Response

The SFI Level 1 shall ascertain the risk using the Signal Sighting Record (or NR/SMS/PartB/Test/302 (Signal Visibility Check)) and information collected from site following the initial report.

An obstruction between the Minimum Reading Distance (MRD) and the asset position shall be investigated using the process in SMTH/Part8/T037 or T038.

NOTE 1: *This is a wrong-side failure.*

NOTE 2: *Any known, permitted obscurations are defined on the Signal Sighting Record*.

3.4 Significance Assessment (High Risk / Low Risk)

Where the obstruction is between the Minimum Reading Distance (MRD) and the asset position, refer to NR/SMS/Part Z/Z01 (Signal – Reference Values) to calculate its significance.

Significant (High Risk) Obscuration is an obstruction affecting 2 seconds or more of reading time at permissible speed.

Minor (Low Risk) Obscuration is an obstruction affecting less than 2 seconds of reading time at permissible speed.

3.5 Low-Risk Obscuration

The SFI Level 2 shall be responsible for the review of Signal Visibility.

The SFI Level 2 may authorise normal use of a signal with a minor obscuration for a maximum of 72 hours from the initial report.

Train Operators shall be notified of the increased risk of SPAD at the location/asset.

NOTE: *The name of the person giving authorisation should be documented on the failure record along with the time the decision was made.*

Example considerations before authorising normal working:

a) Consult with a Signal Sighting Engineer.

b) Potential for mis-read from other signals nearby.

c) TPWS fitments.

d) Multi-SPAD.

e) Effect on Train Dispatch.

f) Overrun Risk (SORAT).

3.6 High Risk Obscuration

An obstruction that impacts sighting between the MRD and asset position for more than 2 seconds at the permissible line speed is high risk and shall be mitigated.

Examples of possible mitigation measures:

a) Emergency Speed Restriction.

b) Temporary Approach Control.

c) Double-Block Working.

d) Clear on Approach.

3.7 SFI Level 3 Review

The SFI Level 3 may authorise sign-back of mitigated working for a maximum of 7 days from the initial report.

3.8 RRD Risk Assessment

Where the obstruction is affecting the Required Reading Distance (RRD) but not the Minimum Reading Distance (MRD), this is “Negligible Risk”

The Off-Track / veg clearance allocation should be left open until the risk is confirmed cleared or a Work Order raised in Ellipse (M1 priority).

NOTE: *The Section Manager (Signalling) should consider whether further monitoring is required.*

3.9 Section Manager (Signalling) Review

The Signalling Section Manager shall be responsible for the review of signal visibility and managing the failure record.

All reports shall be reviewed within 7 days from the initial report.

If the review identifies an error in the initial decision or risk assessment this shall be corrected, and the correct response initiated as per this process.

If the review identifies an increase in risk (e.g. due to further vegetation growth) this shall be escalated, and the correct response initiated as per this process.

3.10 Closing the Failure Record

The failure record shall only be closed when both allocated groups have confirmed required actions are completed or resolved.

3.11 SINCS File.

The Section Manager (Signalling) shall arrange for information to be collected to support the investigation, sign back and closure of the SINCs file.

END

Ref:	**NR/SMTH/Part/06**
Issue:	07
Date:	04 June 2022
Compliance date:	03 September 2022

NR/L3/SIG/11231

NR/SMTH/Part/06

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END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part06/CAB001		
Replace or Repair a Telecoms Tail Cable		
Issue No: 05	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Telecoms tail cables having a maximum of 4 conductors and of a telecoms type construction.
Excludes:	Any other type of tail cable.

***** INDEPENDENCE EXEMPT *****

BEFORE INSTALLATION WORK

1. Check identity of existing cable by physically tracing or alternative methods.
2. Check for intermediate breakout points or terminations.
3. Check cable terminations are not damaged and are correctly labelled.
4. Check that the replacement cable is not damaged and is correct type.
5. Check that tail cable to be worked on is fully isolated.
6. Where cables are to be jointed, check that all joint enclosure component parts are available.

AFTER INSTALLATION WORK

7. Check that the cable is not damaged, is correctly installed and protected to the standards.
8. Check all physical connections. Check that all cable connections are firm, robust and mechanically sound.
9. CONTINUITY TEST all cable conductors.
10. INSULATION TEST all cable conductors.
11. Check the cable has been secured.
12. Check that the replacement tail cable has been correctly labelled.
13. Check any line fuses or links are replaced and any lightning protection is restored.
14. The Maintenance Test Plan/s for the equipment fed by the cable/s shall be checked and any requirement marked with an asterisk "*" carried out.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part06/DOO001		
Removal, Replacement and Adjustment of a CCTV Camera		
Issue No: 05	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	DOO CCTV Chilterns ONLY
Excludes:	All other DOO

***** INDEPENDENCE EXEMPT *****

Preliminary Considerations

The following testing protocol shall be adopted when replacing and/or adjusting a DOO CCTV camera or a part/component.

A part/component could be any or all of the following:

- Complete camera assembly.
- Camera lens.
- Printed Circuit Boards.
- Tube or equivalent.
- Mounting assembly.
- Cables or leads.

Use of Operationally Equivalent Equipment

Operational equivalence requires:

- The use of a camera, parts or components which provide the same or improved picture quality and field of view.
- That the output signal is compatible with other equipment in the system.

Independence of Testing from Installation Work

This Test Plan shall be used by a Technician/Engineer who is qualified in the Signalling or Telecoms maintenance testing process.

Independence of testing is not required.

BEFORE INSTALLATION

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check availability of set up and alignment information.

3. Check the replacement or part/component is compatible with that previously in service and is not damaged.

4. Check that the replacement camera is of the same size and the lens of the same size and type as that being replaced.

5. Check that the camera mountings and enclosure are in sound condition.

6. Check the condition of all equipment, wiring, connectors and labels.

AFTER INSTALLATION

7. Check that any replacement component is securely fixed and electrically connected.

8. Check the camera is properly secured in the camera housing, free of any movement and set to any alignment marks.

9. Check all physical connections. Check that plug and cable connectors are firm, correctly connected and mechanically sound.

10. Check earth bonding of enclosure.

11. Check the lens is correctly locked in position.

12. Check that the lens focus is set to infinity and the grub screw is tight.

13. Check power supply is properly restored.

14. Check the lens operating solenoid is working correctly (if fitted).

15. Check the lens auto iris operates correctly (if fitted).

16. Check the heater unit operates correctly.

17. Check video output signal is present.

18. Check that a complete and unobscured picture is present on all associated monitors.

19. Check for picture stability, clarity and focus, and that moving objects do not smear.

20. Check that the correct image of platform is shown in accordance with markers or drawings.

21. Check that a complete image of the viewing target appears in at least one monitor for all points covered by the system.

22. Check using the black side of the resolution target that the image size is more than 10% of the picture size.

23. Check using the chequered side of the resolution target that each individual white rectangle can be detected.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part06/DOO002		
Realign a CCTV Camera		
Issue No: 4	Issue Date: 03/03/2018	Compliance Date: 12/06/2018

Includes:	DOO CCTV Chilterns ONLY
Excludes:	All other DOO

***** INDEPENDENCE EXEMPT *****

Preliminary Considerations

The following testing protocol shall be adopted when replacing and/or adjusting a DOO CCTV camera or a part/component.

Independence of Testing from Installation Work

This Test Plan shall be used by a technician / engineer who is qualified in the signalling or telecoms maintenance testing process.

Independence of testing is not required.

BEFORE INSTALLATION WORK

1. Check the condition of all equipment, wiring, connectors and labels.
2. Check the camera mountings, enclosure and other visible components are in sound condition.
3. Check for availability of alignment information.

AFTER INSTALLATION WORK

4. Check the camera is properly secured in the camera housing and free of any movement.
5. Check earth bonding of enclosure.
6. Check that the correct image of the platform area is shown in accordance with markers or drawings.
7. Check that a complete image of the viewing target appears in at least one monitor for all points covered by the system.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part06/DOO003		
Remove and Replace a DOO CCTV Coaxial Cable		
Issue No: 4	Issue Date: 03/03/2018	Compliance Date: 12/06/2018

Includes:	DOO CCTV Chilterns ONLY
Excludes:	All other DOO

***** INDEPENDENCE EXEMPT *****

Preliminary Considerations

The following testing protocol shall be adopted when replacing and/or adjusting a DOO CCTV camera or a part/component.

A part/component could be any or all of the following:

- Complete Cable
- Cable Connector

Use of Operationally Equivalent Equipment

Operational equivalence shall require:

- The use of a cable or connectors which provide the same or improved picture quality.
- That the signal delivered is compatible with other equipment in the system.

Independence of Testing from Installation Work

This Test Plan shall be used by a technician / engineer who is qualified in the signalling or telecoms maintenance testing process.

Independence of testing is not required.

BEFORE INSTALLATION WORK

1. Check the replacement cable or connector is compatible with that previously in service and is not damaged.

AFTER INSTALLATION WORK

2. Check that any replacement cable or connector is securely fixed.
3. Check all physical connections. Make certain that plug and cable connectors are firm, correctly connected and mechanically sound.
4. Check earth bonding of enclosure.

5. Check that a picture is present on the monitor.

6. Check for a complete picture on the monitor.

7. Check for picture stability, clarity and focus.

8. Check the picture is free of any streaks, flaring or negative images.

9. Check that a complete image of the viewing target appears in at least one monitor for all points covered by the system.

10. Check cable is correctly labelled.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part06/DOO004		
Removal, Replacement and Adjustment of a DOO CCTV Monitor		
Issue No: 05	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	DOO CCTV Chilterns ONLY
Excludes:	All other DOO

***** INDEPENDENCE EXEMPT *****

Preliminary Considerations

The following testing protocol shall be adopted when replacing and/or adjusting a DOO CCTV camera or a part/component.

A part/component could be any or all of the following:

- Complete monitor assembly.
- Printed Circuit Boards.
- Tube or equivalent.
- Mounting assembly.
- Cables or leads.

Use of Operationally Equivalent Equipment

Operational equivalence shall require:

- The use of a monitor, parts or components which provide the same or improved picture quality and size.
- That the signal delivered is compatible with other equipment in the system.

Independence of Testing from Installation Work

This Test Plan shall be used by a Technician/Engineer who is qualified in the Signalling or Telecoms maintenance testing process.

Independence of testing is not required.

BEFORE INSTALLATION WORK

1. **For Missing Equipment Only:** Check for evidence on site, in signalling diagrams, plans, layouts and records that the equipment was previously installed. If no evidence is found stop and consult your SM(S).

2. Check the replacement or part/component is compatible with that previously in service and is not damaged.

3. Check that the mountings and enclosure are in sound condition.

4. Check the condition of all equipment, wiring, connectors and labels.

AFTER INSTALLATION WORK

5. Check that any replacement component is securely fixed and electrically connected.

6. Check the monitor is properly secured in the housing and free of any movement.

7. Check all physical connections. Check that plug and cable connectors are firm, correctly connected and mechanically sound.

8. Check power supply is properly restored.

9. Check earth bonding of enclosure.

10. Check the termination switch is correctly set (through/terminated).

11. Check that a picture is present on the monitor.

* 12. Check for a complete picture on the monitor.

* 13. Check for picture stability, clarity and focus.

* 14. Check the picture is free of any streaks, flaring or negative images.

15. Check that the monitor is correctly aligned.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part06/DOO005		
Remove and Replace a DOO CCTV Train Detection Unit		
Issue No: 4	Issue Date: 03/03/2018	Compliance Date: 12/06/2018

Includes:	DOO CCTV Chilterns ONLY
Excludes:	All other DOO

***** INDEPENDENCE EXEMPT *****

Preliminary Considerations

The following testing protocol shall be adopted when replacing a track circuit trigger feed or part/component or complete replacement of a Mass Detector in a DOO CCTV system.

A part/component could be any or all of the following:

- Complete Mass Detector
- Printed Circuit Boards
- Mounting assembly
- Cables or leads
- Track Circuit Trigger Feed

Use of Operationally Equivalent Equipment

Operational equivalence shall require:

- The use of detection which provides the same level of timing and control.

.

- That the signal delivered is compatible with other equipment in the system.

Independence of Testing from Installation Work

This Test Plan shall be used by a technician / engineer who is qualified in the signalling or telecoms maintenance testing process.

Independence of testing is not required.

BEFORE INSTALLATION WORK

1. Check the replacement or part / component is compatible with that previously in service and is not damaged.
2. Check the mountings and brackets are in sound condition.
3. Check the condition of all equipment, wiring, connectors and labels.

AFTER INSTALLATION WORK

4. Check that any replacement component is securely fixed and electrically connected.

5. Check the Mass Detector is properly secured, free of any movement, correctly aligned and adjusted.

6. Check all physical connections. Make certain that plug and cable connectors are firm, correctly connected and mechanically sound.

7. Check correct picture is present on the monitors

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part06/DOOTFI001		
Failure Investigation for Driver Only Operation (DOO) CCTV		
Issue No: 6	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	DOO CCTV Chilterns and Western Routes ONLY
Excludes:	All other DOO

Preliminary considerations

This guide shall be used to investigate reported failures on all types of DOO CCTV systems with the failure symptoms listed.

Use of this guide is not mandatory for other symptoms.

Where a single, obvious cause is apparent steps shall be taken to rectify the problem immediately. Rectification work shall be carried out using the relevant Telecommunications Failure Investigation Guide.

Maintenance Test Plan.

Both non-destructive testing and destructive testing shall be carried out by a Technician or Engineer certified as competent in the Maintenance Testing Process and authorised to work on the specific type of equipment which has failed.

There is no requirement to carry out the escalation processes during the investigation of failures in accordance with this test guide.

NON DESTRUCIVE TESTS

N01 Check whether the problem only appears on one monitor.

N02 Check whether the problem only appears on one bank of monitors.

N03 Check whether the problem appears on all monitors associated with one camera.

N04 Check whether the problem appears on all monitors on this system.

N05 Check if the monitors give incomplete coverage of the required platform edge.

N06 Is the problem associated with sunlight or station lighting?

N07 Check for any recent disturbance.

N08 Check for any damage.

DESTRUCTIVE TESTS

D01 Test any power feed to the affected equipment.

D02 Check that all connections to the affected equipment are correctly terminated and secure.

D03 Check that any control signal (Mass Detector/Track Circuit) is triggering the system correctly.

D04 Check that any T.V. Monitor hoods are secure.

D05 Check that the fixings of the affected equipment are secure.

D06 Check that each camera is correctly aligned.

D07 Check that the affected equipment is in the correct alignment.

D08 Check that the affected equipment is correctly terminated.

D09 Check that the monitor adjustments are correctly set.

D010 Check that the camera adjustments are correctly set.

D011 Test any cables connected to the affected equipment.

Other considerations

If, following investigation, the reported failure condition cannot be identified; the engineer can carry out the work described in Maintenance Test Plans DOO001 and DOO002 covering adjustment and alignment of cameras.

Exercise caution when using manufacturer's handbooks to avoid inadvertently carrying out destructive testing before non-destructive testing is complete.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 06/IR67		
Replace a Power Supply Module and Battery Pack		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Power Supply Module and Battery Pack
Excludes:	RETB Base Station Radio Modules

This unit contains a 230V AC Supply.

Battery packs (figure 1) used in the Invensys Modular Signalling System are very heavy. Correct Manual handling procedures should be used.

Figure 1 – Power Supply Module and Battery Pack

BEFORE INSTALLATION WORK

1. Check the replacement unit is not damaged and the correct type. Correlation check connections to the site diagram.

2. Check existing cables and connections are not damaged/corroded and have safe insulation.

3. Check existing cables and connections are correctly labelled.

4. Isolate main power supply and units as required.

AFTER RE-INSTALLATION WORK

5. Check replacement unit is correctly installed and secured.

6. Check all connections are replaced correctly to the diagram.

7. Check or arrange correctly labelling of the unit and connections.

8. Restore main power supply.
   If the main AC supply has been lost during the work, Test (064) is to be completed after power resumption.

9. Check status of the battery and power supply module and normal indications are illuminated.

10. Carry out NR/SMS/Part B/Test 064.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 06/IR68		
Replace a Base Station Radio Modules		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	LINK Radio, CELL Radio and Site Interface modules
Excludes:	UPS, Power Supply and Battery Modules

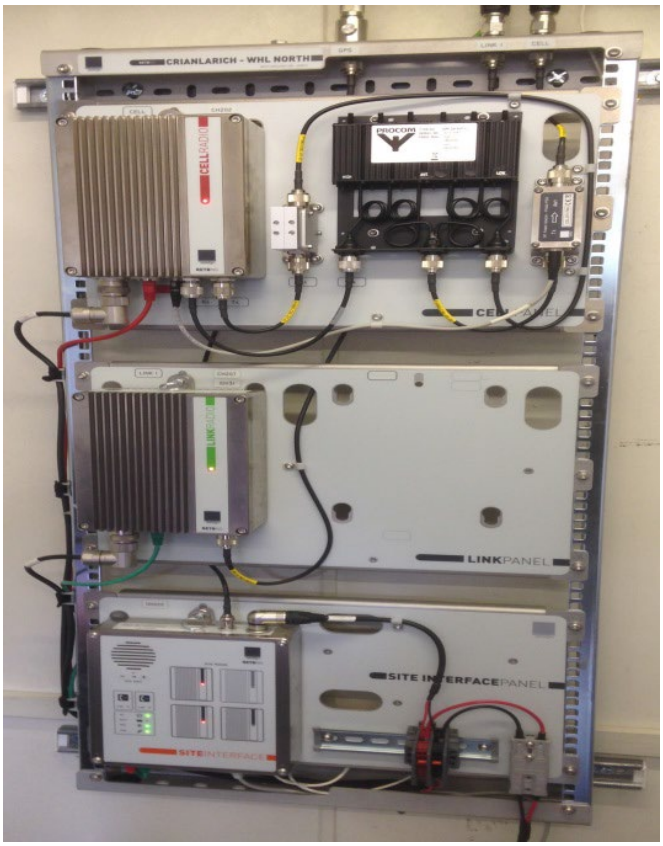


Figure 1 – Base Station Radio Modules

BEFORE INSTALLATION WORK

1. Check the replacement unit is not damaged and the correct type.
2. Correlation check modules and connections to the site diagram.
3. Check existing cables and connections are not damaged and safe insulation.
4. Check existing cables and connections are correctly labelled.
5. Isolate power supply as required.

AFTER RE-INSTALLATION WORK

6. Check replacement module is correctly installed and secured.

7. Check all connections are replaced correctly to the diagram.

8. Check or arrange correctly labelling of the unit and connections.

9. Restore power supply.

10. Check replaced module's normal indications are illuminated.

11. Connect Maintenance Laptop to Site Interface Unit and Undertake systems configuration checking correct Network ID and unit type.

12. Carry out NR/SMS/Part B/Test 066 as applicable.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 06/IR69		
Replace a system Control Radio Rack Card/Module		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	RETB System Control Radio Rack Card/Module
Excludes:	RETB Base Station Radio Modules, UPS, Power Supply and Battery Modules

Anti-static precautions shall be observed.

Cards can be plugged and unplugged with voltage applied when replacing cards. It is recommended that you remove only one card at a time from the system, as this will prevent one card being mistaken for another.

Figure 1 – RETB System Control Radio Rack

BEFORE INSTALLATION WORK

1. Check the replacement cards/modules are not damaged and the correct type.
2. Correlation check cards/modules and connections to the site diagram.
3. Check existing cables and connections are not damaged and safe insulation.
4. Check existing cables and connections are correctly labelled.
5. Isolate power supply as required.

AFTER RE-INSTALLATION WORK

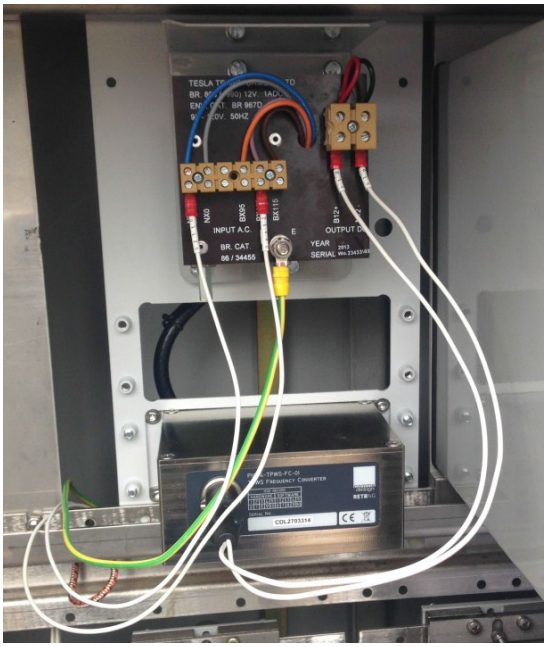
6. Check replacement card/ module is correctly installed and secured.
7. Check all connections are replaced correctly to the diagram.
8. Check or arrange correctly labelling and connections.
9. Restore power supply.
10. Check replaced card/module's normal indications are illuminated.
11. Carry out NR/SMS/Part B/Test 063.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 06/IR70		
Replace a RETB TPWS Frequency Converter		
Issue No. 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	RETB TPWS Frequency Converter
Excludes:	RETB Base Station Radio Modules, RETB TRCU/TRCM Modules, RETB System Control Radio Rack Card/Module

Front View



Rear View with PSU

Figure 1 – RETB TPWS Frequency Converter

BEFORE INSTALLATION WORK

1. Check the replacement unit is not damaged and the correct type.
2. Correlation check connections to the site diagram.
3. Check existing cables and connections are not damaged/corroded and safe insulation.
4. Check existing cables and connections are correctly labelled.
5. Isolate power supply to the unit as required.

AFTER RE-INSTALLATION WORK

6. Check replacement unit is correctly installed and secured.

7. Check all connections are replaced correctly to the diagram.

8. Check or arrange correctly labelling of the unit and connections.

9. Restore power supply.
   If the main AC supply has been lost during the work, Test (064) is to be completed after power resumption.

10. Configure required channels using switch settings.
    Switch covers shall be retained and replaced securely.

11. Check status of the LED indications. (The centre LED will blink periodically to show that the unit is operational).

12. Carry out NR/SMS/Part B/Test 066.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part06/TEL001		
Replace an Operational Telephone		
Issue No: 05	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

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.

***** INDEPENDENCE EXEMPT *****

BEFORE INSTALLATION WORK

1. Check that the replacement part is compatible with the telephone system and is not damaged.
2. Check the mountings, brackets and fixings are in good operational condition.
3. Check the condition of all equipment, wiring and connectors.
4. Check the condition of any weatherproofing/protection used.
5. Check any telephone specific configuration settings are correct for application.

AFTER INSTALLATION WORK

6. Check that any replacement component is securely fixed/safely mounted and electrically connected.
7. Check the telephone handset cord is properly secured and not in a position to be fouled.
8. Check any tail cable is properly secured and that all insulation is sound, and the line jack connection box is properly secured.
9. Check all physical connections are correct and mechanically sound.
10. Check correct operation of call set–up in accordance with calling instructions pertinent to the telephone.
11. Check correct operation of engaged tone by calling a telephone that is already in use (if applicable) to the system.
12. Check correct operation of sounder/bell by receiving a test call.

13. Check speech quality to make certain that speech level is acceptable.

14. Check that there is no noise or unwanted interference or excessive side tone.

15. Check functionality for all telephones associated with the same service. This is essential at level crossings and point zones where multiple telephones are used.

16. Check that the telephone is correctly labelled.

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.

NON-DESTRUCTIVE TESTS

N.1 Check for damaged or missing equipment.

N.2 Check security of associated equipment, cables, location cupboards and relay rooms.

DESTRUCTIVE TESTS

D.1 Check if the telephone operates correctly.

D.2 For IP telephones confirm the I/P address is correct for that location.

D.3 Check continuity of cables, links and jumpers.

D.4 Check the tail cable or local wiring for damage.

D.5 Check for any missing, links or jumpers.

D.6 Replace the telephone or associated equipment if it does not work correctly.

D.7 Check the telephone label is in place, compliant and legible.

OTHER CONSIDERATIONS

O.1 Care should be exercised when using manufacturer's handbooks to avoid inadvertently carrying out destructive testing before non-destructive testing is complete.

END

Ref:	**NR/SMTH/Part/08**
Issue:	04
Date:	02 December 2023
Compliance date:	02 March 2024

NR/L3/SIG/11231

NR/SMTH/Part/08

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END

1. Scope

1.1 These T series Fault Finding Guides have been introduced in the form of check lists to detail the suggested checks and tests which shall be carried out when investigating wrong side signalling failures and incidents.

1.2 Intermittent and obscure failures shall be investigated using the Test Guide(s) in the U series NR/SMTH/Part09 (Intermittent or Obscure Failure Guides).

1.3 Further faulting guidance can be found within the documents listed in NR/SMTH/Part10 (Faulting Guides) and in relevant Manufacturer's Documentation.

2. Records

2.1 Complete NR/SMTH/Part02/Form/13 (Wrong Side Failure or Incident Check Sheets).

Any measurement results or test records shall be included or attached as required.

2.2 If any item is replaced under NR/SMTH the SMTH Log Sheet shall also be included.

2.3 If you are investigating a SPAD, you shall also write down the results of each test that you complete and send it to your SM(S). Remember to identify any root cause as well as the actual cause of the failure.

2.4 If operating staff decline access to equipment for test/check purposes, this fact shall be recorded on the SMTH logbook sheet and advised to your SM(S).

END

GENERAL

Where rail head contamination is confirmed, and you have been authorised by the SFI Level 2 or above, one of the following test plans shall be used instead:

a) NR/SMTH/Part08/T025 (Wrong Side Failure Test Guide: Track Circuit Rail Head Contamination – Remote Condition Monitoring (Not Fitted)) or

b) NR/SMTH/Part08/T026 (Wrong Side Failure Test Guide: Track Circuit Rail Head Contamination – Remote Condition Monitoring (Fitted)).

All test measurements shall be recorded on the Record Card together with the reason for the test.

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note any relevant signal box indications.

N.2 Check the condition of lamps / other indicators.

N.3 Note the state of relevant train describer displays.

N.4 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc.).

N.5 Note the nature of any work being done or persons working in the area.

N.6 Note the time and type of train (including vehicle class or number), event or operation that first caused the reported failure to become apparent.

N.7 Note whether the train approach was particularly slow.

N.8 Note whether any Track Circuit Actuator (TCA) was fitted to the affected train and if it was working correctly.

N.9 Note the time and type of operation last made, prior to the report, which used the affected equipment.

N.10 Note any other train movements in the affected area.

N.11 Note any significant weather conditions in the area.

N.12 Download available condition monitoring and data logger evidence (e.g. Centrix, Asset View, SSI) and confirm that the data supports the allegation.

Running Rails

N.13 Check the rails for contamination and record the type of contamination and extent (Complete or sporadic).

Where rail head contamination is now confirmed, and you have been authorised by the SFI Level 2 or above, one of the following test plans shall now be used starting from step N13:

a) NR/SMTH/Part08/T025 (Wrong Side Failure Test Guide: Track Circuit Rail Head Contamination – Remote Condition Monitoring (Not Fitted)) or

b) NR/SMTH/Part08/T026 (Wrong Side Failure Test Guide: Track Circuit Rail Head Contamination – Remote Condition Monitoring (Fitted)).

Lineside Locations and Equipment Room

N.14 Check that the cupboard or room is correctly locked or padlocked.

N.15 Check for damage.

N.16 Review any relevant system terminal printout and remove any recording media for checking.

NOTE: *Evidence might have been recovered remotely as part of step N12.*

N.17 Check for signs of recent disturbances (wiring alterations or renewals activity).

N.18 Check for security or tightness of equipment.

N.19 Check and record the position and correspondence of relevant relays (energised, de- energised). Consider TR, TPR, TKR, etc.

N.20 Check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, strong smell, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

N.21 Check that relays correspond to the wiring diagram (type and specification, pin code, voltage, contact arrangement).

N.22 Record the last service date on the WSF form and forward to your Section Manager (Signals).

N.23 Check that equipment and settings correspond to the wiring diagram (specification, power, voltage rating, track capacitor, etc.).

N.24 Check the rear of relay bases for silver migration.

N.25 Check the equipment for short circuits (nuts, washers, solder, wire off-cuts, conducting dust, etc.).

N.26 Check the equipment for any unusual amounts of moisture.

N.27 Test bus bar and circuit voltages and record the results.

N.28 Carry out EARTH TEST (DC) or EARTH TEST (AC) on all circuits and bus bar power supplies.

Track Equipment

N.29 Check for damage.

N.30 Check for signs of recent disturbances (track maintenance or renewals activity, no unused rails in any tuned zones).

N.31 Check the condition of any stainless-steel strip.

N.32 Check that the track circuit bonding corresponds to the bonding diagram.

N.33 Check any insulated rail joint condition.

N.34 Check that the rail connections are properly insulated.

N.35 Check under the rails for short circuits.

N.36 Note the details of any H.T. electrical equipment nearby, associated with the track circuit (BR Point switch heaters, BR shore electrical supplies, etc.).

N.37 Test insulated rail joints.

N.38 Check any impedance bond phasing and connections.

N.39 Note the type of sleepers in use (timber, concrete, steel) with reference to high residual voltages and TCAID malfunction.

N.40 If a laptop is available, download the error log. (DIGITAL EBI TRACK 200 & 400 RX ONLY)

NOTE: *This can be done whilst the system is operational by connecting to the 9-way D type port on the front of the Digital Rx, using a laptop and the required software.*

DO NOT turn or remove the frequency key during this process.

Cables and Bonds

N.41 Check the insulation of cables and wires at terminations. Check that adjacent terminations are properly insulated from each other.

N.42 Remove covers from trunking and check for safe insulation (chafing, scorched, rodent damage).

N.43 Note any signs of obvious damage (fires, squashed cables, etc.).

N.44 Check for broken jumpers and broken or missing bonding.

N.45 Check that cables and jumpers comply with diagram.

Miscellaneous

N.46 Note any extraneous conditions or circumstances that could have an effect on the failure.

DESTRUCTIVE TESTS

Track Equipment

D.1 Carry out a Track Circuit Maintenance Test and compare readings with previous tests on the track circuit record card.

D.2 Connect the minimum permissible drop shunt to all extremities of the Track Circuit and confirm the track relay de-energises when the shunt is applied.

D.3 Carry out Residual Voltage Test / Interference Test and Record results.

D.4 Measure the track circuit voltage at the Relay or Receiver whilst a train passes over the length of the track circuit.

> ***NOTE:*** *This step is to ascertain that the train wheels are making good contact with the track throughout the length of the track circuit and to verify that the contamination observed would allow the track circuit to fail wrong side.*

D.5 Test for the polarity or phase (stagger) of adjoining track circuits.

D.6 Check and test the track circuits either side of the affected track circuit.

D.7 Record where TCAIDs are fitted and carry out NR/SMS/PartB/Test/043 (Track circuit Aid (TCAID) Test.

D.8 Record where Force Down Treadles are fitted and confirm that they are working / timing correctly.

Lineside Locations or Equipment Rooms

D.9 WIRE COUNT the relevant equipment or circuits to the wiring diagram.

D.10 Test drop away and pick-up voltages at the relay.

D.11 Connect the minimum permissible drop shunt at intervals throughout the length of the track circuit whilst observing the track relay de energises.

NOTE: *The normal interval is 15 Metres, longer intervals are possible for plain line and long track circuits. The interval shall be agreed with the SFI Level 2 (or above).*

D.12 Check relay base front for silver migration, damage, spades pushed too far forward or broken contact insulators.

D.13 Test any capacitor slug circuit that can prevent a relay from dropping for intermittent high resistance faults, unless relay stick contacts are wired in series with the capacitor.

D.14 Test common return, looping or spur circuits for intermittent high resistance faults.

D.15 Remove relays and check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

Cables

D.16 Carry out NR/SMTH/Part03/Test/B04 (Cable Function Test) on the Line Circuits.

D.17 Carry out NR/SMTH/Part03/Test/B03 (Insulation Test) on all cables (tail, lineside, rack to rack).

NOTE: *Tail cables connected to rails shall not normally be insulation tested.*

OTHER CONSIDERATIONS

O.1 Consider possible remote-control system failure.

O.2 Possible cathodic protection problems.

O.3 Consider possible invalid track circuit combination.

O.4 Consider possible design error.

O.5 Consider possible problem with train.

O.6 Consider if track circuit might be shorter than the minimum length required.

O.7 Consider and relevant Special Inspection notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction.

END

1. NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note relevant signal box indications.

N.2 Note the state of relevant train describer displays.

N.3 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc).

N.4 Note the nature of any work being done, or persons working in the area.

N.5 Note the time and type of train (including vehicle class or number), event or operation that first caused the reported failure to become apparent.

N.6 Note the time and type of operation last made, prior to the report, which used the affected equipment.

N.7 Note any other train movements in the affected area.

Lineside Locations or Equipment Rooms

N.8 Check that the cupboard or room is correctly locked or padlocked.

N.9 Note any significant weather conditions in the area (cloud cover, position and strength of sun and wind conditions).

N.10 Check for damage.

N.11 Check any relevant system terminal printout and remove any recording media for checking.

N.12 Check for signs of recent disturbances (wiring alterations, track maintenance or renewal activity).

N.13 Check for security or tightness of equipment.

N.14 Check the position of relevant relays (energised, de-energised).

N.15 Check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, strong smell, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

N.16 Check that relays correspond to the wiring diagram (type and specification, pin code, voltage, contact arrangement).

Record the last service date on the WSF form and forward to your Section Manager (Signals).

N.17 Check that equipment and settings correspond to the wiring diagram (specification, power, voltage rating, etc).

N.18 Check rear of relay bases for silver migration.

N.19 Check the equipment for possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, etc).

N.20 Check that cables and wires at terminations are properly isolated from each other.

N.21 Remove covers from trunking and check for safe insulation (chafing, scorched, rodent damage).

N.22 Test voltages, recording the results.

N.23 EARTH TEST (DC) or EARTH TEST (AC) circuits and supplies.

N.24 Test voltage across relay coil or track circuit feed equipment with depression bar in normal position and with bar depressed by train.

Track Equipment

N.25 Check for damage.

N.26 Check for signs of recent disturbances (wiring alterations, track maintenance or renewal activity).

N.27 Test height of depression bar from rail surface.

N.28 Check for security or tightness of equipment.

N.29 Check contact box interior for moisture, security and terminal insulation.

N.30 Check the contact box for possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, etc.).

N.31 Check for damage (fires, squashed cables, etc.).

Miscellaneous

N.32 Check SPECIAL INSPECTION NOTICES (SINs) and TECHNICAL INSTRUCTIONS (TIs) for any other relevant Non-Destructive tests.

DESTRUCTIVE TESTS

Lineside Locations or Equipment Rooms

D.1 WIRE COUNT relevant equipment or circuits to the wiring diagram.

D.2 Remove relays and check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

D.3 Check relay base front for silver migration, damage, spaded pushed too far forward or broken contact insulators.

D.4 Test current to relay coils or track circuit feed equipment with depression bar in normal position and with bar depressed by train.

Track Equipment

D.5 WIRE COUNT contact box to the wiring diagram.

Cables

D.6 CABLE FUNCTION TEST the line circuits.

D.7 INSULATION TEST all cables (tail, lineside, rack to rack).

Miscellaneous

D.8 Check SPECIAL INSPECTION NOTICES (SINs) and TECHNICAL INSTRUCTIONS (TIs) for any other relevant Destructive tests.

OTHER CONSIDERATIONS

1. Possible WSF of track circuit.
2. Possible design error.
3. Possible problem with train e.g. wheel profile.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part08/T004		
Wrong Side Failure Test Guide: Thales Axle Counters		
Issue No. 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Thales AzL systems
Excludes:	Any other axle counter system

GENERAL

The permission of the Signaller shall be obtained before any actions are taken that affect the normal working of an axle counter section.

The system shall not be restored to normal operation without permission of the Signaller.

On all systems, the Signaller is responsible for ensuring an axle counter section is clear before a system restore can take place.

A system re-set (if provided) can take place to assist with fault finding, providing the system is isolated from the signalling equipment it feeds (Disconnect TPR link or data output from the evaluator).

All test measurements shall be recorded on the NR/SMS record card together with the reason for the test.

For Further Information see NR/SMS/Appendix/15 – General Information on the Thales Axle Counter Systems

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note the relevant signal box indications for the relevant section(s).

Later series of systems with ‘2 out of 3’ evaluators can have multiple detection points; the failure of one of these evaluators may affect more than one section.

N.2 Note the state of any relevant train describer displays.

N.3 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc).

N.4 Note if any persons were working/ patrolling/ examining in the area and, if working, the nature of the work.

Any metallic object that is brought near to a rail contact will affect it.
Mobile phones used near any EAK or evaluator may affect them.

N.5 Note the time of the failure of the equipment and, if it occurred after the passage of a train, the type of train (passenger, freight, light engine etc).

An object hanging from a train can strike and damage rail contacts.

N.6 If a failure occurred after a passage of a train, note if there was anything unusual about it (slow moving train, long time in the section, emergency non-signalled movement).

N.7 Note any other train movements in the affected area.

Lineside Locations or Equipment Rooms

N.8 Check that the room or case is securely locked.

N.9 If the evaluator equipment is located in a cubicle, check this is securely locked.

N.10 On systems provided with a re-set button, check that the button cover is securely locked.

N.11 Check any site record cards or log books for relevant information.

N.12 Check for any signs of equipment damage.

N.13 Check the LED and other indications on the evaluator and associated cards and PSUs (LED indications (NR/SMS/Appendix/15)).

N.14 If provided, check any system logging or recording media for relevant information (PC based logger, Instead event recorder, Trackwatch, etc.).

N.15 On systems provided with a diagnostic interface, check using a laptop PC the stored historical data. (This includes the AzLM series).

N.16 Check for signs of any recent activity (new works, temporary wiring, diversion of circuits, track maintenance activity).

N.17 Check the equipment for security.

N.18 Visually check any cables or connecting leads for security.

N.19 Record the evaluator indications. NR/SMS/Appendix/15 gives details of evaluator indications.

N.20 Check the position and correspondence of relevant relays (energised, de-energised). Relays include TSR, TZR, TPR, TKR, etc.

N.21 Check for damage or contamination on or inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, strong smell, silver sulphide, metal flakes, bent or broken contact springs, corroded terminals).

N.22 Check that the relays correspond to the diagrams (type and specification, pin code, voltage, contact arrangement, single/double wound coils).

Record the last service date on the WSF form and forward to your Section Manager (Signals).

N.23 Check that the equipment and settings correspond to the diagrams (specification, power, voltage rating, etc).

N.24 Check for silver migration on the rear of relay bases.

N.25 Check the equipment and cards for any possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, etc).

N.26 Check the room/case heating/cooling systems for correct operation.

Extremes of heat or cold can affect the operation of electronic equipment.

N.27 Check the equipment for any signs of moisture or water contamination (leaking roofs, damaged or missing seals, flooding).

N.28 Check for possible radio interference (mobile phone masts, RETB aerials).

N.29 Test and record relevant waveforms and line levels (line voltages NR/SMS/AX11,AX12 or AX15))

N.30 EARTH TEST (DC) or EARTH TEST (AC) circuits and supplies.

Lineside Junction Box (EAK)

N.31 Check the EAK for damage.

N.32 Check the EAK cover is corrected fitted and secured.

N.33 Check that the earthing of the EAK is secure and effective.

N.34 Check the interior for signs of moisture.

N.35 Check the LED indications on the EAK cards (LED indications NR/SMS/Appendix/15).

N.36 Check the equipment for possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, moisture, etc).

N.37 Check for possible radio interference (mobile phone masts, RETB aerials).

N.38 Where applicable check the ARD plug is installed correctly.

Rail Contacts

N.39 Check the rail contacts for damage.

N.40 Check that the rail contacts are secure (NR/SMS/PartZ/Z03 Train Detection – Reference Values) - rail contact fittings.

N.41 Check for any debris or rubbish, around the rail contacts.

N.42 Check for signs of any recent activity (new works, track maintenance, etc.).

N.43 Check surrounding area for any other equipment / rail contacts that could cause an influence in some way.

Cables & Wires

N.44 Check cables for damage (cables squashed by rails in the cess, fire damage, rodent damage).

N.45 Check all cables and wires for safe insulation and check that all terminations are correctly insulated from each other.

Where cables or wires run in trunking or troughing, remove the covers to check.

Miscellaneous

N.46 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

N.47 Note any extraneous conditions or circumstances that could have an effect on the failure.

DESTRUCTIVE TESTS

Lineside Locations or Equipment Rooms

D.1 Wire Count the relevant equipment or circuits to the wiring diagram, including jumpers on cards and connecting leads/cables.

D.2 Remove relays and check for damage or contamination on or inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, strong smell, silver sulphide, metal flakes, bent or broken contact springs, corroded terminals).

D.3 Check relay base fronts for correct pin code, silver migration, damage, spades pushed too far forward or broken contact insulators.

D.4 Check evaluator cards for damage (hair-line cracks, dry joints, damaged edge connectors.

D.5 Check evaluator card slots for damage (damaged connectors in the card slots).

D.6 INSULATION TEST relevant circuits to earth and to other suspect circuits.

Check electronic components are disconnected as the high voltages evolved in this test damages them.

D.7 Test for intermittent high resistance faults in any capacitor slug circuits unless relay stick contacts are wired in series with the capacitor.

D.8 Test for intermittent high resistance faults in common return, looping or spur circuits.

Cables

D.9 CABLE FUNCTION TEST line circuits.

D.10 INSULATION TEST all cables (tail, lineside, rack to rack).

Check cables are totally disconnected for this test as the high voltages involved damages electronic components**.**

Lineside Junction Boxes and Rail Contacts

D.11 Test the operation of the system by a dummy wheel test at the detection points for the relevant section NR/SMS/PartB/Test/042 (Axle Counters Dummy Wheel Test - AzL 70, 70/30, 70/30S) or NR/SMS/PartB/Test/045 (Thales Axle Counters Dummy Wheel Test (AxLM & AzLE). Observe the indications on the LEDs at both the relevant EAKs and evaluator during this test.

Miscellaneous

D.12 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Destructive tests.

D.13 Undertake a Post Mortem analysis PMA for the ACE in question.

OTHER CONSIDERATIONS

O.1 Possible remote-control system fault/failure.

O.2 Possible design error.

O.3 Check compact flash/program plug against ISSR record

END

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note relevant lever, switch or commutator positions.

N.2 Note relevant signal box indications.

N.3 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc).

N.4 Note the nature of any work being done, or persons working in the area.

N.5 Note the time and type of train (including vehicle class or number), event or operation that first caused the reported failure to become apparent.

N.6 Note the time and type of operation last made, prior to the report, which used the affected equipment.

N.7 Note any other train movements in the affected area.

N.8 Note whether the instrument is padlocked or not.

N.9 Check for dust or particles inside the instrument.

N.10 Check for wear or freedom of movement on commutator block, where fitted.

Lineside Locations or Equipment Rooms

N.11 Check cupboard or room is correctly locked.

N.12 Check for any signs of equipment damage.

N.13 Check for signs of recent disturbances (wiring alterations, P Way activity).

N.14 Check for security or tightness of equipment (lever locks, circuit controllers, arm repeaters, etc).

N.15 Check for broken/loose contacts, or excessive wear in moving parts.

N.16 Check the position of relevant relays (energised, de-energised).

N.17 Check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, strong smell, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

N.18 Check that relays correspond to the wiring diagram (type and specification, pin code, voltage, contact arrangement).

Record the last service date on the WSF form and forward to your SM(S).

N.19 Check that equipment and settings correspond to the wiring diagram (specification, power, voltage rating, etc).

N.20 Check rear of relay bases for silver migration.

N.21 Check the equipment for possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, etc).

N.22 Check that cables and wires at terminations are properly isolated from each other.

N.23 Test voltages, recording the results.

N.24 EARTH TEST (DC) or EARTH TEST (AC) circuits and supplies.

Cables and Wires

N.25 Check for damage (fires, squashed cables etc).

N.26 Check the insulation of cables and wires at terminations. Confirm that adjacent terminations are properly isolated from each other.

N.27 Remove covers from trunking and check for safe insulation (chafing, scorched, rodent damage).

Miscellaneous

N.28 Check SPECIAL INSPECTION NOTICES (SINs) and TECHNICAL INSTRUCTIONS (TIs) for any other relevant Non-Destructive tests.

DESTRUCTIVE TESTS

Signal Box

D.1 BLOCK CONTROLS TEST equipment.

D.2 BLOCK RECOVERY TEST equipment.

D.3 Test block operation by creating the effect of a passing train.

Lineside Locations or Equipment Rooms

D.4 WIRE COUNT relevant equipment or circuits to the wiring diagram.

D.5 Remove relays and check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

D.6 Check the relay base front for silver migration, damage, spades pushed too far forward or broken contact insulators.

D.7 Check any contact adjustment (lever bands, etc).

D.8 INSULATION TEST relevant circuit to earth.

D.9 INSULATION TEST relevant circuit to other suspect circuits.

D.10 INSULATION TEST any lightning arrestors.

D.11 Test for intermittent high resistance faults that might prevent a relay from dropping in any capacitor slug circuit, unless relay stick contacts are wired in series with capacitor.

D.12 Test for intermittent high resistance faults in common return, looping or spur circuits.

Cables

D.13 CABLE FUNCTION TEST the line circuits.

D.14 INSULATION TEST all cables (tail, lineside, rack to rack)

Miscellaneous

D.15 Check SPECIAL INSPECTION NOTICES (SINs) and TECHNICAL INSTRUCTIONS (TIs) for any other relevant Destructive tests.

OTHER CONSIDERATIONS

O.1 Possible WSF with treadle circuit.

O.2 Possible WSF of track circuit (Berth track).

O.3 Possible WSF of mechanical signal wire.

O.4 Possible design error in block circuits.

END

***** ESCALATION EXEMPT *****

GENERAL

A lamp out in a signal, barrier boom or crossing road light is a wrong side failure. The equipment's design cannot be fail-safe because lamps will always fail.

The escalation exempt shall **not** apply in the following circumstances:

a) The rectification is not a straightforward equipment change or

b) There is any doubt as to the cause of failures or

c) The equipment has not functioned as expected or

d) The failure appears to be caused by defects not able to be identified by the checks and tests in this guide.

The Escalation Exemption shall only apply where the rectification is a straightforward equipment replacement, and a single, obvious cause has been identified. Steps shall be taken to rectify the problem immediately.

If non-destructive or destructive testing is required, it can be carried out by a Maintenance Tester attending the failure without further authority.

All test measurements shall be recorded on the NR/SMS record card together with the reason for the test. The failure shall be logged as soon as convenient.

NON-DESTRUCTIVE TESTS

N.1 Check for obscured lamp.

N.2 Check for damage.

N.3 Check which lamp is not working.

N.4 Test for defective lamp.

N.5 Test for correct voltage.

N.6 Check that the EKR is working, where applicable.

N.7 Test for blown fuses.

N.8 Test for defective lamp holder.

N.9 Test for disconnection in the lamp circuit.

N.10 ASPECT TEST the signal.

N.11 Note any extraneous conditions or circumstances that could have an effect on the failure.

DESTRUCTIVE TESTS

D.1 CABLE FUNCTION TEST line circuits.

D.2 INSULATION TEST all cables (tail, lineside, rack to rack).

END

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note any other train movements in the affected area.

N.2 Note relevant signal box indications.

N.3 Note relevant lever or switch positions.

N.4 Note the state of any relevant train describer displays.

N.5 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc).

N.6 Check whether the signal was replaced in front of the train.

N.7 Note the nature of any work being done, or persons working in the area.

N.8 Note the time and type of train (including vehicle class or number), event or operation that first caused the reported failure to become apparent.

N.9 Note the time and type of operation last made, prior to the report, which used the affected equipment.

N.10 Check that lever locks are correctly padlocked.

N.11 Check that the signal can display the aspect reported, using any aspect sequence chart, control table or diagram.

> ***NOTE:*** *Establishing that a signal could not have displayed the reported aspect does not mean that a wrong side failure did not occur.*

Lineside Locations or Equipment Rooms

N.12 Check that the cupboard or room is correctly locked or padlocked.

N.13 Note the position of relevant relays (energised, de-energised).

N.14 Check for damage to equipment.

N.15 Check any relevant system terminal printout and remove any recording media for checking.

N.16 Where an SSI Trackside Functional Module (TFM) operates an external function via an interface relay, check the diagrams to confirm that the system actually proves the correct operation of the external function concerned.

The diagrams should show an input to a TFM which proves the external function has responded correctly. It is not sufficient to prove simply that the interface relay has operated.

N.17 Check the insulation of cables and wires at terminations. Check that adjacent terminations are properly isolated from each other.

N.18 Check for signs of recent disturbances (wiring alterations, track maintenance or renewal activity).

N.19 Check for equipment security or tightness.

N.20 Check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, strong smell, silver sulphide , metal flakes, bent or broken contact springs, or corroded terminals).

N.21 Check that relays correspond to the wiring diagram (type and specification, pin code, voltage, contact arrangement).

Record the last service date on the WSF form and forward to your SM(S).

N.22 Check that equipment and settings correspond to the wiring diagram (specification, power, voltage rating, etc).

N.23 Check rear of relay bases for silver migration.

N.24 Check equipment for possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, etc).

N.25 Check equipment for any unusual amounts of moisture.

N.26 Test voltages and record the results.

N.27 EARTH TEST (DC) and/or EARTH TEST (AC) circuits and supplies.

Signal Equipment

N.28 Note any significant weather conditions in the area (cloud cover, position and strength of sun).

N.29 Note aspects displayed.

A camera can be used to record the signal aspects, but it should be noted that because of the shutter speed it is possible to record the aspect flickering (LED Only). This flickering cannot be seen by the human eye.

N.30 Check that equipment is correctly locked or padlocked.

N.31 Check background and any relevant street lighting.

N.32 Check for damage. Check interior of signal head for dirt, deterioration, or moisture ingress.

N.33 Check for safe insulation of cables and wires at terminations. Check that adjacent terminations are properly isolated from each other.

N.34 Check for signs of any recent disturbances (wiring alterations, track maintenance or renewal activity).

N.35 Check for correct beam and hot strip alignment NR/SMS/PartC/SG00 (Signals: General).

N.36 Check condition of interior and exterior lenses (colour, type, clean, not damaged, contaminated or discoloured, etc.). Pay attention to the red aspect. If the lenses are polycarbonate, check lens is not beyond renewal date and not opaque with excessive scratching.

N.37 Check condition of any hoods (length, type, etc).

N.38 Check position of signals in sequence for possible reading through of aspects.

N.39 Note voltage of all aspects in the signal head whether lit or not.

N.40 Visually check from the sighting distance of the signal that all aspects and indications are clear and visible. NR/SMS/PartZ/Z01 (contains sighting distance details.

Cables

N.41 Check for damage to tail cables (fires, squashed cables, etc).

This includes fibre optic harnesses.

N.42 Remove covers from trunking and check for safe insulation (chafing, scorched, rodent damage).

Miscellaneous

N.43 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

N.44 Note any extraneous conditions or circumstances that could have an effect on the failure.

DESTRUCTIVE TESTS

Signal Box

D.1 Check switch, button or circuit controller condition and security and look for signs of metallic dust which could have caused a short circuit.

D.2 Check that any polarised needle type indicators operate in correspondence with any polarised relays wired in series with the indicator.

Lineside Locations or Equipment Rooms

D.3 WIRE COUNT relevant equipment or circuits to the wiring diagram.

D.4 Check that latched relays do not unlatch when lightly tapped.

D.5 Test effectiveness of approach locking by recreating the effect of a train.

D.6 After clearing the suspect signal, Test for voltage at the final control relay, or equivalent, whilst recreating the passage of a train on the section ahead from the entrance signal up to the end of the overlap of the exit signal.

When reproducing the effect of a passing train, the tests shall be carried out twice; once for a ‘light engine’ and once for the longest likely train.

D.7 After clearing the suspect signal, Test for voltage at the final control relay, or equivalent, whilst alternative overlaps are selected and occupied.

D.8 Test for voltage at the final control relay, or equivalent, with no route set forward from the suspect signal while each point in the route ahead of the signal is operated (one at a time) to both reverse and normal.

D.9 Remove relays and check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

D.10 Remove mechanical searchlight mechanism and check for damage inside (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

D.11 Check relay base for silver migration, damage, spades pushed too far forward or broken contact insulators.

D.12 Check the contact adjustment or pressure of any relevant contacts (lever bands, circuit controllers, etc).

D.13 Check for loose connections or crimps in any circuit affecting the reported signal.

D.14 CABLE FUNCTION TEST line circuits.

D.15 INSULATION TEST suspect circuit to earth.

D.16 INSULATION TEST suspect circuit to other relevant circuits.

D.17 INSULATION TEST all cables (tail, lineside, rack to rack).

D.18 Test the lamp circuit current, with lamp lit and with the lamp removed.

D.19 Check that the TFM current proving function is in use, by carrying out NR/SMS/PartB/Test/022 (Signal Lamp and Light Module Proving Tests) for each current-proved output, (ALSTOM Mk3, MOD STATE 4, SSI SIGNAL MODULE ONLY).

It is not necessary to carry out the first filament failure test, but only to confirm with the Signaller that the lamp-out condition has been detected.

If the module fails to detect lamp out, current proving links in the 75-way plug coupler shall be verified by visually checking for correct position of the pins and measurement of electrical continuity. If the links and plug coupler are in place, the module itself shall be sent for investigation.

D.20 Test the position light junction indicator transformer current with the indicator lamps removed (where relays are used for lamp proving position light junction indicators fitted with transformers).

D.21 Test for intermittent high resistance faults in common return, looping or spur circuits.

Signal Equipment

D.22 Check signal post replacement switch condition.

D.23 Check that the lamp is securely held in the lamp holder.

D.24 Test and note time of approach locking and check that any indication of signal being approach locked is effective to the Signaller.

D.25 Test and note time of any approach control.

D.26 ASPECT TEST the signal for the affected route while maintaining alternative exit signals at their least restrictive aspect.

It is not necessary to clear alternative exit shunt signals unless the suspect signal pre-sets the shunt signal.

D.27 Check filament change-over relays for correct operation.

Miscellaneous

D.28 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Destructive tests.

OTHER CONSIDERATIONS

O.1 Possible right side failure of signal in advance (masked by report of WSF to signal in rear).

O.2 Possible WSF of signal in advance.

O.3 Possible remote-control system failure.

O.4 Possible failure of track circuit.

O.5 Possible design error in signal circuits.

O.6 Possible WSF of AWS misleading driver into expecting a less restrictive aspect.

O.7 Possible WSF of interlocking.

O.8 Possible WSF of lever lock.

O.9 Possible WSF of block circuits.

O.10 Possible timing mismatch between SSI interlockings and conventional relay circuits.

END

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note relevant lever or switch positions.

N.2 Note relevant signal box indications.

N.3 Note the state of any relevant train describer displays.

N.4 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc).

N.5 Note the nature of any work being done, or persons working in the area.

N.6 Note the time and type of train (including vehicle class or number), event or operation that first caused the reported failure to become apparent.

N.7 Note the time and type of operation last made, prior to the report, which used the affected equipment.

N.8 Note any other train movements in the affected area.

N.9 Note any significant weather conditions in the area (cloud cover, position and strength of sun).

Lineside Locations or Equipment Rooms

N.10 Check cupboard or room is correctly locked or padlocked.

N.11 Check for damage.

N.12 Check for signs of recent disturbances (wiring alterations, P Way activity).

N.13 Check for security or tightness of equipment (lever locks, circuit controllers, arm repeaters, etc).

N.14 Check the position of relevant relays (energised, de-energised).

N.15 Check for damage (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, strong smell, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

N.16 Check that any relays correspond to the wiring diagram (type and specification, pin code, voltage, contact arrangement).

Record the last service date on the WSF form and forward to your SM(S).

N.17 Check that equipment and settings correspond to the wiring diagram (specification, power, voltage rating, etc).

N.18 Check rear of relay bases for silver migration.

N.19 Check equipment for possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, etc).

N.20 Check equipment for any unusual amounts of moisture.

N.21 Test voltages, recording the results.

N.22 EARTH TEST (DC) or EARTH TEST (AC) circuits and supplies.

Signal Equipment and Wire Run

N.23 Check for any signs of equipment damage.

N.24 Check for signs of any recent disturbances (wiring alterations, track maintenance or renewals activity).

N.25 Check the signal's position.

N.26 Check background and any relevant street lighting.

N.27 Check that the spindle is not seized or frozen.

N.28 Check that the return weights are not missing.

N.29 Check for any excessive vegetation holding signal arm off.

N.30 Check for any mechanical detection holding signal arm off.

N.31 Check for excessive wear in moving parts.

N.32 Check the counterweights and pulley wheels are not binding on adjacent weights and crank arms.

N.33 Check the wire run for fouling objects.

N.34 Check for wire caught in other wires or rods.

N.35 Check that the wire is not frozen to the ballast, troughing or pipes.

N.36 Check for correct regulation of the signal wire.

N.37 Check cleanliness and state of lubrication.

Cables and Wires

N.38 Check for damage (fires, squashed cables, etc).

N.39 Check the insulation of cables and wires at terminations. Check that adjacent terminations are properly isolated from each other.

N.40 Remove covers from trunking and check for safe insulation (chafing, scorched, rodent damage).

Miscellaneous

N.41 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

DESTRUCTIVE TESTS

Signal Box

D.1 MECHANICAL LOCKING FUNCTION TEST affected levers.

D.2 Check that any polarised needle type indicators operate in correspondence with any polarised relays wired in series with the indicator.

D.3 Test operation of signal by slowly returning the lever to the normal position in the frame whilst observing the movement of the signal arm or disk.

Lineside Locations or Equipment Rooms

D.4 WIRE COUNT relevant equipment or circuits to the wiring diagram.

D.5 Remove relays and check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

D.6 Check relay base front for silver migration, damage, spades pushed too far forward or broken contact insulators.

D.7 Check contact adjustment and pressure of any relevant contacts (lever bands, circuit controllers, etc).

D.8 INSULATION TEST relevant circuit to earth.

D.9 INSULATION TEST relevant circuit to other suspect circuits.

D.10 Test for intermittent high resistance faults in any capacitor slug circuit, unless relay stick contacts are wired in series with capacitor.

D.11 Test for intermittent high resistance faults in common return, looping or spur circuits.

Signal Equipment

D.12 Check contact adjustment and pressure of any relevant contacts (arm repeaters, point detection, etc).

D.13 Carry out NR/SMS/PartB/Test/012 (Detection Test (Mechanical)) and record the test measurements on the NR/SMS record card, together with the reason.

D.14 Carry out the electrical detection test as required, from the following list and record the test measurements on the NR/SMS record card, together with the reason for the test.

a) NR/SMS/PartB/Test/010 (998 Detector Electrical Tests).

b) NR/SMS/PartB/Test/011 (Electrical Detection Test (Machine)).

c) NR/SMS/PartB/Test/013 (Detection Test (Clamp Lock)).

D.15 Test the minimum 'hold off' voltage of a motor operated signal.

D.16 Check signal machine brake releases when de-energised (Motor operated signals).

Cables and Wires

D.17 CABLE FUNCTION TEST line circuits.

D.18 INSULATION TEST all cables (tail, lineside, rack to rack).

Miscellaneous

D.19 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Destructive tests.

OTHER CONSIDERATIONS

O.1 Possible WSF of treadle circuits.

O.2 Possible WSF of block circuits.

O.3 Possible WSF of track circuit.

END

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note relevant lever or switch positions.

N.2 Note relevant signal box indications.

N.3 Note the state of any relevant train describer displays.

N.4 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc).

N.5 Note the nature of any work being done, or persons working in the area.

N.6 Note the time and type of train (including vehicle class or number), event or operation that first caused the reported failure to become apparent.

N.7 Note the time and type of operation last made, prior to the report, which used the affected equipment.

N.8 Note any other train movements in the affected area.

N.9 Note the condition of sealed releases.

Lineside Locations or Equipment Rooms

N.10 Check that the cupboard or room is correctly locked or padlocked.

N.11 Check for damage.

N.12 Check any relevant system terminal printout and remove any recording media for checking.

N.13 Where an SSI Trackside Functional Module (TFM) operates an external function via an interface relay, check the diagrams for the system to prove the correct operation of the external function concerned. The diagrams show an input to a TFM which proves the external function has responded correctly. It is not enough to prove simply that the interface relay has operated.

N.14 Check for signs of recent disturbances (wiring alterations, track maintenance or renewals activity).

N.15 Check for security or tightness of equipment.

N.16 Check the position of relevant relays (energised, de-energised).

N.17 Check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, strong smell, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

N.18 Check that relays correspond to the wiring diagram (type and specification, pin code, voltage, contact arrangement).

N.19 Record the last service date on the WSF form and forward to your SM(S).

N.20 Check that equipment and settings correspond to the wiring diagram (specification, power, voltage rating, etc).

N.21 Check rear of relay bases for silver migration.

N.22 Check equipment for possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, etc).

N.23 Check equipment for any unusual amounts of moisture.

N.24 Test voltages, recording the results.

N.25 EARTH TEST (DC) or EARTH TEST (AC) circuits and supplies.

On-Track Equipment

N.26 Check that the equipment is correctly locked or padlocked.

N.27 Check for damage.

N.28 Check for signs of any recent disturbances (wiring alterations, track maintenance or renewals activity).

N.29 Check ECU is correct type, (HPSS ONLY).

N.30 Check for excessive wear in moving parts.

N.31 Check that the points have not been run through.

N.32 Check that the machine casting is not broken or cracked.

N.33 Check for correct movement in mechanical detectors, rodding runs and compensators.

N.34 Check security of fastenings and sole plate.

N.35 Check the reservoir oil level and for any leaks in the hydraulic system (clamp locks).

N.36 Check rail openings and record any track defects.

N.37 Check for cracks in Mk1 clamp lock bodies, FPL castings and detector castings.

N.38 Check hollow steel bearers for cracks or damage.

N.39 Check torsion supplementary drive for cracks or damage.

N.40 Check the break-out devices have not been operated, (Hy-Drive System ONLY).

N.41 Check the by-pass valve has not been operated or damaged such as would cause a loss of hydraulic pressure, (Hy-Drive System ONLY).

N.42 Check the plug/socket connectors are not damaged and that the connector plug has been properly connected and locked in place. Do not disconnect at this stage.

Cables

N.43 Check for damage (fires, squashed cables, etc).

N.44 Check for safe insulation of cables and wires at terminations. Check that adjacent terminations are properly isolated from each other.

N.45 Remove covers from trunking and check for safe insulation (chafing, scorched, rodent damage).

Miscellaneous

N.46 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

DESTRUCTIVE TESTS

Signal Box

D.1 Test that swinging overlaps can only be swung when alternative overlaps are free.

D.2 Test that points respond to their being called and that any FPL lever operation is effective.

D.3 Check the independent point switch to confirm it is secure and that there are no short circuits (e.g. metallic dust, wire strands) across the contacts.

Lineside Locations or Equipment Rooms

D.4 WIRE COUNT relevant equipment or circuits to the wiring diagram.

D.5 Check that latched point relays do not unlatch when lightly tapped.

D.6 Test that the route locking holds after the protecting signal is replaced to danger by recreating the effect of a passing train and cancelling the route.

D.7 Test that occupying the berth track circuit of the protecting signal(s) correctly locks the points for the designed time (where required by the control tables).

D.8 Remove relays and check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

D.9 Check relay base front for silver migration, damage, spades pushed too far forward or broken contact insulators.

D.10 Check contact adjustment or pressure of any relevant contacts (lever bands, etc).

D.11 INSULATION TEST relevant circuit to earth.

D.12 INSULATION TEST relevant circuit to other suspect circuits.

D.13 INSULATION TEST motor in both normal and reverse positions.

D.14 Test for intermittent high resistance faults in any capacitor slug circuit, unless relay stick contacts are wired in series with capacitor.

D.15 Test for intermittent high resistance faults in common return, looping or spur circuits.

On-Track Equipment

D.16 WIRE COUNT on-track point operating equipment to the wiring diagram.

D.17 Test effectiveness of power/manual selector switch interlock (clamp lock).

D.18 Check for any excessive point operation time.

D.19 Test and note hydraulic pressure and that any pressure detection is effective, e.g. train operated points.

D.20 Test that air has been excluded from the hydraulic system before continuing check system for air, NR/SMS/PartB/Test/015 (Clamp Lock: Test for air in the system), (CLAMP LOCKS ONLY).

D.21 Check plug coupler condition and security and look for signs of metallic dust which could have caused a short circuit.

D.22 Check contact adjustment or pressure of any relevant contacts (drive, detection, etc).

D.23 Check the clutch.

D.24 Test the time of motor cut-out when point movement is obstructed.

D.25 Carry out POINT DETECTION AND CORRESPONDENCE TEST.

D.26 Test Facing point lock NR/SMS/PartB/Test/001-005 and record the test measurements on the NR/SMS record card, together with the reason for the test.

D.27 Test for electrical leakage, NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests), (APPLICABLE BR998 DETECTORS ONLY).

D.28 Connect the HPSA Handset to the ECU. From the "Main Menu" select the "Get Log Dump" function. Once the data has been transferred to the Handset (approx 2 minutes), select the "Get Status" function. Note the readings and report any discrepancies between the handset readings, the physical lie of the points and the number of LVDTs (Linear Variable Differential Transducer) installed, (HPSS ONLY).

The Handset shall be sealed (e.g. by bagging) and advice sought on the facilities to interpret the data. Do not use the handset on another ECU as this causes data to be over written. The same handset may be used to reset the HPSS datum on the ECU concerned.

D.29 Check the brake torque (holding capability) is correct, testing each brake separately NR/SMS/PartC/PC51 (High Performance Switch System (HPSS)), (HPSS ONLY).

D.30 Manually release both brakes and attempt to bar the points to the opposite position by applying force to the open switch rail. Repeat for the opposite lie of the points (this is to check the integrity of the Acme leadscrew, located in the gearbox, which performs the function of the FPL), (HPSS ONLY).

D.31 Check each LVDT is working correctly by conducting the detection test NR/SMS/PartB/Test/011 (Electrical Detection Test (Machine)), (HPSS ONLY).

D.32 Where air is suspected in the system it shall be bled by:

a) Opening the by-pass valve.

b) Manually operating the points in only one direction for at least 90 seconds.

c) And closing and locking the by-pass valve (Hy-Drive System ONLY).

D.33 Check each SO Unit is working correctly by conducting the detection test NR/SMS/PartB/Test/009 (Detection Test (SO Hydraulic Supplementary Point Drive System)), (Hy-Drive System ONLY).

Cables

D.34 CABLE FUNCTION TEST line circuits.

D.35 INSULATION TEST all cables (tail, lineside, rack to rack).

Miscellaneous

D.36 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Destructive tests.

OTHER CONSIDERATIONS

O.1 Possible remote-control system failure.

O.2 Possible WSF of track circuit.

O.3 Possible WSF of protecting signal.

O.4 Possible design error in point circuits.

O.5 Possible WSF of lever lock.

O.6 Possible timing mismatch between SSI interlockings and conventional relay circuits.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part08/T011		
Wrong Side Failure Test Guide: Automatic Warning System (AWS)		
Issue No: 02	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Standard Automatic Warning System
Excludes:	Temporary Magnets (see NR/SMTH/Part08/T042)

GENERAL

All test measurements shall be recorded on the record card together with the reason for the test.

For Temporary Magnets instead refer to NR/SMTH/Part08/T042 (Wrong Side Failure Test Guide: Temporary Automatic Warning System (AWS) associated with Speed Restrictions).

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note any unusual operating methods in place (hand-signalling, possessions, single line working, speed restrictions (ESR/TSR), etc).

N.2 Note the nature of any work being done, or persons working in the area.

N.3 Note the time and type of train (including vehicle class or number), event or operation that first caused the reported failure to become apparent and whether the train approach was particularly slow.

Class 319 electric multiple units automatically sense the traction system, so will display to the driver if the traction is DC. The AWS setting defaults to standard strength and will remain so until the driver selects the extra-strength setting (for DC traction areas). If the driver does not correctly set the AWS system to the right sensitivity, the AWS might indicate a Code 5 WSF.

On routes operating class 377/2, 377/5, and 376/6 electric multiple units, confirm that the AWS receiver on the rail vehicle is operating in the correct mode of operation (AC or DC).

This is particularly applicable to failures on services that are operating on a route that has traversed an AC & DC electrified boundary.

N.4 Note the time and type of operation last made, prior to the report, which used the affected equipment.

N.5 Note any other train movements in the affected area.

N.6 If practicable, arrange to have the OTMR (On-Train Monitor and Recorder) download and analysed from the train involved in the failure.

Lineside Locations or Equipment Rooms

N.7 Check that the location case, apparatus case or room is correctly locked.

N.8 Check for damage.

N.9 Check any relevant system terminal printout and remove any recording media for checking.

N.10 Check for signs of recent disturbances (wiring alterations, track maintenance or renewals activity).

N.11 Check for security or tightness of equipment.

N.12 Check the position of relevant relays (energised, de-energised).

N.13 Check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, strong smell, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

N.14 Check that relays correspond to the wiring diagram (type and specification, pin code, voltage, contact arrangement).

Record the last service date on the WSF form and forward to your SM(S)

N.15 Check that equipment and settings correspond to the wiring diagram (specification, power, voltage rating, etc.).

N.16 Check rear of relay bases for silver migration.

N.17 Check equipment for possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, etc).

N.18 Check equipment for any unusual amounts of moisture.

N.19 Test voltages, recording the results.

N.20 EARTH TEST (DC)] or EARTH TEST (AC) circuits and supplies.

On-Track Equipment

N.21 Check position of magnets (height, centre of track).

N.22 Check equipment is correct type (Standard - yellow or Extra-Strength - green).

N.23 Check for other potential sources of magnetic field nearby (e.g. impedance bonds, DC traction cables).

N.24 Take several digital photographs of the magnet with at least one showing the complete installation.

N.25 Check for any other magnets within 250m (274 yards) in either direction on the same line as the AWS under investigation. If one is found, measure and record the distance between the two magnets.

N.26 Check for damage.

N.27 Check for signs of any recent disturbances (wiring alterations, track maintenance or renewals activity).

N.28 Check for track defects in the area of the inductors.

N.29 Check security of internal and external connections, in the inductor disconnection box.

N.30 Check security of cable gland or plug coupler, where fitted.

Cables

N.31 Check for damage (fires, squashed cables, etc).

N.32 Check the insulation of cables and wires at terminations if provided. Check that adjacent terminations are properly isolated from each other.

N.33 Remove covers from trunking, and check for safe insulation (chafing, scorched, rodent damage).

Miscellaneous

N.34 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

DESTRUCTIVE TESTS

Lineside Locations or Equipment Rooms

D.1 WIRE COUNT relevant equipment or circuits to the wiring diagram.

D.2 Remove relays and check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

D.3 Check relay base front for silver migration, damage, spades pushed too far forward or broken contact insulators.

D.4 Test current to inductor with signal at all possible aspects.

D.5 Test AWS diode if present carry out NR/SMS/PartB/Test/024 (AWS Tests) and record the test measurements on the record card.

NOTE: *The Vortok AWS magnets are designed with spark quench diodes as part of their internal circuitry and there is no requirement to perform this test.*

D.6 Test that lamp proving relays function correctly when the lamps are disconnected.

D.7 INSULATION TEST relevant circuit to earth.

D.8 INSULATION TEST relevant circuit to other suspect circuits.

D.9 Test for intermittent high resistance faults in common return, looping or spur circuits.

On-Track Equipment

When testing a plug coupled unit you shall use a “Breakout box”. Do not use test equipment directly on the plug coupler pins and/or sockets.

D.10 If provided, disconnect plug coupler and check for damage (cracked casing, internal moisture, foreign matter, contact arcing, metal flakes, bent or broken or corroded contacts) to either male or female contacts.

D.11 Test resistance or impedance of inductor and compare with voltage and current readings.

D.12 Test (for each aspect) the signal’s permanent and electro-magnets for correct strength and polarity (using S&P meter).

D.13 Test voltage and polarity at the electro-magnet, recording the results.

D.14 Test (for each aspect) the signal’s electro-magnets for incorrect operation by any adjacent signal (using S&P meter).

D.15 Test voltage and polarity at the electro-magnet for incorrect operation by any adjacent signal at each of its aspects.

Cables

D.16 CABLE FUNCTION TEST line circuits.

D.17 INSULATION TEST all cables (tail, lineside, rack to rack).

Miscellaneous

D.18 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Destructive tests.

OTHER CONSIDERATIONS

O.1 Consider possible right side failure of signal in advance of AWS.

O.2 Consider possible failure of train borne equipment.

O.3 Where suppression is switched by occupation of track circuit, consider if joints could be too close to suppressed inductor. They shall not be less than 40 metres.

O.4 Consider possible WSF of track circuit where occupation of track circuit switches off suppression or ISR circuit is involved.

O.5 Consider possible design error in AWS circuits.

END

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note relevant lever or switch positions, stopping or non-stopping selection.

At some sites the selection is controlled by the train describer and this should be noted.

N.2 Note relevant signal box indications.

N.3 Note the state of any relevant train describer displays.

N.4 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc).

N.5 Note the nature of any work being done, or persons working in the area.

N.6 Note the time and type of train (including vehicle class or number), event or operation that first caused the reported failure to become apparent and whether the train approach was particularly slow.

N.7 Note the time and type of operation last made, prior to the report, which used the affected equipment.

N.8 Note any other train movements in the affected area.

N.9 Note any significant weather conditions in the area (cloud cover, position and strength of sun and wind conditions).

Lineside Locations or Equipment Rooms

N.10 Check that the cupboard or room is correctly locked or padlocked.

N.11 Check for damage.

N.12 Check any relevant system terminal printout and remove any recording media for checking.

N.13 Where a SSI Trackside Functional Module (TFM) operates an external function via an interface relay, check the diagrams to confirm that the system actually proves the correct operation of the external function concerned.

NOTE: *The diagrams should show an input to a TFM which proves the external function has responded correctly. It is not enough to prove simply that the interface relay has operated.*

N.14 Check for signs of recent disturbances (wiring alterations, track maintenance or renewal activity).

N.15 Check for security or tightness of equipment.

N.16 Check the position of relevant relays (energised, de-energised).

N.17 Check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, strong smell, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

N.18 Check that relays correspond to the wiring diagram (type and specification, pin code, voltage, contact arrangement).

Record the last service date on the WSF form and forward to your SM(S).

N.19 Check that equipment and settings correspond to the wiring diagram (specification, power, voltage rating, etc).

N.20 Check rear of relay bases for silver migration.

N.21 Check the equipment for possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, etc).

N.22 Check the equipment for any unusual amounts of moisture.

N.23 Check the time clock setting.

N.24 Check with diagrams, that vital relay contacts are not by-passed by non-vital contacts.

N.25 Check that a power off relay contact is in the driver's white light (DWL) circuit.

N.26 Test voltages, recording the results.

N.27 Test voltages on Agastat relay coils.

N.28 EARTH TEST (DC) or EARTH TEST (AC) the circuits and supplies.

Crossing Equipment

N.29 Check that the equipment is correctly locked or padlocked.

N.30 Check for damage.

N.31 Check for clearance around the counterweight when the boom has risen.

N.32 Check for signs of any recent disturbances (wiring alterations, track maintenance or renewals activity).

N.33 Check aspects displayed, if showing.

If this step is carried out during the hours of darkness, it shall be repeated during daylight.

N.34 Check for correct road lamp beam alignment.

N.35 Check red road light flashing rates are correct.

N.36 Observe road lights from road approaches and check the background, any relevant side lighting and any obstructions such as fencing or vegetation.

N.37 Measure sighting distance of road lights and signs.

N.38 Measure sighting distance of any driver's red and/or white light.

N.39 Check any driver's crossing indicator (DCI) signals for correct beam alignment.

N.40 Test voltages, recording the results.

N.41 Check condition of any hoods (length, type, etc).

N.42 Check that all lenses are correctly installed and in good condition (colour, type, correct way up, etc).

N.43 Check the condition and colour of boom lights.

N.44 Check the Local Control Switch position and connections.

N.45 Check the oil level in the hydraulic system's reservoir.

N.46 Check security and tightness of circuit controllers.

N.47 Check treadle interior for moisture, security and insulation of terminals.

N.48 Test and record the arm clearances on the treadle, NR/SMS/PartB/Test/177 (Treadle - Gauge Test), together with the reason for the test.

Cables

N.49 Check for damage (fires, squashed cables, etc).

N.50 Check the insulation of cables and wires at terminations. Check that adjacent terminations are properly isolated from each other.

N.51 Remove covers from trunking and check for safe insulation (chafing, scorched, rodent damage).

Miscellaneous

N.52 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

DESTRUCTIVE TESTS

When reproducing the effect of a passing train the tests shall be carried out twice; once for a 'light engine' and once for the longest likely train.

Lineside Locations or Equipment Rooms

D.1 WIRE COUNT relevant equipment or circuits to the wiring diagram.

D.2 Check that latched relays do not unlatch when lightly tapped.

D.3 Test the effectiveness of the red road lamp proving.

D.4 Test the effectiveness of comprehensive approach locking by recreating the effect of a train, to prove the locking.

D.5 Test the time of approach locking of protecting signals.

D.6 Test the time of approach control circuits.

D.7 Remove relays and check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

D.8 Check relay base front for silver migration, damage, spades pushed too far forward or broken contact insulators.

D.9 Check adjustment and any contamination of any relevant contacts (lever bands, etc). Check contactors for arc damage or evidence of welding.

D.10 INSULATION TEST relevant circuit to earth.

D.11 INSULATION TEST relevant circuit to other suspect circuits.

D.12 Test current in relevant lamp feed circuits with and without lamp(s) lit (road lamps, boom lamps, driver indication lamps as required).

D.13 Test for intermittent high resistance faults in any capacitor slug circuit, unless relay stick contacts are wired in series with capacitor.

D.14 Test for intermittent high resistance faults in common return, looping or spur circuits.

Crossing Equipment

D.15 Check aspects if not showing.

> If this step is carried out during the hours of darkness, it shall be repeated during daylight.

D.16 Test time of warning light operation by recreating the effect of a passing train.

D.17 Test audible warning operates correctly by recreating the effect of a passing train.

D.18 Check that any driver's white light operates correctly by recreating the effect of a passing train.

D.19 Check that any floodlights operate, by recreating the effect of a passing train.

D.20 Recreate the effect of a passing train over-running any protecting signals and check the warning sequence is initiated.

D.21 Recreate the effect of an approaching train after the STOP and NON-STOP switch is turned to the NON-STOP position and check that the earlier warning was given.

D.22 Check that turning STOP or NON-STOP switch back to STOP position does not reduce the warning time after the effect of a train strike in.

D.23 Test by simulating the effect of the final approach track circuit clearing before the exit track circuit and any clearance treadle has been reached.

D.24 Test and record the timings on the treadle, NR/SMS/PartB/Test/044 (Mechanical Treadle Timing and Adjustment Test), together with the reason for the test.

D.25 Test drop shunt and pick-up shunt of track circuits and test that repeat relays correspond with TRs.

D.26 Check adjustment of any contacts.

D.27 Operate Local Control Switch and check that AUTO position breaks all other contacts.

Cables

D.28 CABLE FUNCTION TEST line circuits.

D.29 INSULATION TEST all cables (tail, lineside, rack to rack).

Miscellaneous

D.30 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Destructive tests.

OTHER CONSIDERATIONS

O.1 Possible WSF of track circuit.

O.2 Possible WSF of protecting signal reducing warning time.

O.3 Possible design error in crossing circuits.

O.4 Strike in point (treadle or track circuit) might not be far enough out for speed of route.

O.5 Possible timing mismatch between SSI interlockings and conventional relay circuits.

END

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note relevant lever or switch positions.

N.2 Note relevant signal box indications.

N.3 Note the state of any relevant train describer displays.

N.4 Check picture quality on CCTV crossings. Look for any obstruction to view of crossing, such as fencing or vegetation.

N.5 Check effectiveness of any floodlighting.

N.6 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc).

N.7 Note the nature of any work being done, or persons working in the area.

N.8 Note the time and type of train (including vehicle class or number), event or operation that first caused the reported failure to become apparent and whether the train approach was particularly slow.

N.9 Note the time and type of operation last made, prior to the report, which used the affected equipment.

N.10 Note any other train movements in the affected area.

N.11 Note any significant weather conditions in the area (cloud cover, position and strength of sun and wind conditions).

Lineside Locations or Equipment Rooms

N.12 Check that the cupboard or room is correctly locked or padlocked.

N.13 Check for damage.

N.14 Check any relevant system terminal printout and remove any recording media for checking.

N.15 Where a SSI Trackside Functional Module (TFM) operates an external function via an interface relay, check the diagrams to confirm that the system actually proves the correct operation of the external function concerned.

NOTE: *The diagrams should show an input to a TFM which proves the external function has responded correctly. It is not enough to prove simply that the interface relay has operated.*

N.16 Check for signs of recent disturbances (wiring alterations, track maintenance or renewals activity).

N.17 Check for security or tightness of equipment.

N.18 Check the position of relevant relays (energised, de-energised).

N.19 Check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, strong smell, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

N.20 Check that relays correspond to the wiring diagram (type and specification, pin code, voltage, contact arrangement).

Record the last service date on the WSF form and forward to your Section Manager (Signals).

N.21 Check that equipment and settings correspond to the wiring diagram (specification, power, voltage rating, etc).

N.22 Check rear of relay bases for silver migration.

N.23 Check equipment for possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, etc).

N.24 Check equipment for any unusual amounts of moisture.

N.25 Check time clock setting.

N.26 Check with diagrams that vital relay contacts are not by-passed by non-vital contacts.

N.27 Test voltages, recording the results.

N.28 Test voltages on Agastat relay coils.

N.29 Carry out EARTH TEST (DC) or EARTH TEST (AC) on circuits and supplies.

Crossing Equipment

N.30 Check that the equipment is correctly locked.

N.31 Check for damage.

N.32 Check for signs of any recent disturbances (wiring alterations, track maintenance or renewals activity).

N.33 Check aspects displayed if showing.

If this step is carried out during the hours of darkness, it shall be repeated during daylight.

N.34 Check for correct road lamp beam alignment.

N.35 Check red road light flashing rates are correct.

N.36 Observe road lights from road approaches and check the background, any relevant side lighting and any obstructions such as fencing or vegetation.

N.37 Measure sighting distance of road lights and signs.

N.38 Test voltages, recording the results.

N.39 Check the condition of any hoods (length, type, etc).

N.40 Check that all lenses are correctly installed and in good condition (colour, type, right way up, etc.).

N.41 Check condition and colour of boom lights.

N.42 Check completeness and effectiveness of boom skirts.

N.43 Check Local Control Switch position and connections.

N.44 Check the oil level in the hydraulic system's reservoir.

N.45 Check security and tightness of circuit controllers.

N.46 Measure barrier side arm clearance to the pedestal (between 95mm and 105mm).

N.47 Check any treadle interior for moisture, security and insulation of terminals.

N.48 Test and record the arm clearances on the treadle, NR/SMS/PartB/Test/177 (Treadle - Gauge Test), together with the reason for the test.

Cables

N.49 Check for damage (fires, squashed cables, etc).

N.50 Check the insulation of cables and wires at terminations. Check that adjacent terminations are properly isolated from each other.

N.51 Remove covers from trunking and check for safe insulation (chafing, scorched, rodent damage).

Miscellaneous

N.52 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

DESTRUCTIVE TESTS

When reproducing the effect of a passing train the tests shall be carried out twice; once for a 'light engine' and once for the longest likely train.

Lineside Locations or Equipment Rooms

D.1 Carry out WIRE COUNT relevant equipment or circuits to the wiring diagram.

D.2 Check that latched route calling relays does not unlatch when lightly tapped.

D.3 Test effectiveness of comprehensive approach locking of protecting signals by reproducing the effect of track circuit occupation in rear of the signal, one at a time.

D.4 Test that the route locking holds the protecting signal at danger by reproducing the effect of a passing train.

D.5 Test that the route locking holds after the protecting signal is replaced to danger by the recreated effect of a passing train and route cancelled.

D.6 Test time of approach locking on protecting signals.

D.7 Test time of approach control circuits.

D.8 Check that local crossing controls cannot irregularly by-pass normal controls.

D.9 Remove relays and check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

D.10 Check relay base front for silver migration, damage, spades pushed too far forward or broken contact insulators.

D.11 Check contact adjustment of any relevant contacts (lever bands, etc). Check contactors for arc damage or evidence of welding.

D.12 Carry out INSULATION TEST relevant circuit to earth.

D.13 Carry out INSULATION TEST relevant circuit to other suspect circuits.

D.14 Test current in circuit with and without lamp lit.

D.15 Test for intermittent high resistance faults in any capacitor slug circuit, unless relay stick contacts are wired in series with capacitor.

D.16 Test for intermittent high resistance faults in common return, looping or spur circuits.

Crossing Equipment

D.17 Measure gaps between booms and height off road when lowered.

D.18 Check aspects if not showing.

> If this step is carried out during the hours of darkness, it shall be repeated during daylight.

D.19 Test the warning light operation time during the lowering sequence.

D.20 Test that the audible warning operates correctly during lowering sequence.

D.21 Check that booms can be halted part way through the rising or lowering operation.

D.22 Check that the barriers do not rise prematurely whilst in AUTO RAISE mode by recreating the effect of a passing train.

D.23 Recreate the passage of a train over-running any protecting signals, and check that the warning sequence is initiated.

D.24 Test and record the timings on the treadle, NR/SMS/PartB/Test/044 (Mechanical Treadle Timing and Adjustment Test), together with the reason for the test.

D.25 Test drop shunt and pick-up shunt of track circuits and that repeat relays correspond with TRs.

D.26 Check any contact or limit switch adjustments.

D.27 Operate Local Control Switch and check that AUTO position breaks all other contacts.

Cables

D.28 Carry out CABLE FUNCTION TEST line circuits.

D.29 Carry out INSULATION TEST all cables (tail, lineside, rack to rack).

Miscellaneous

D.30 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Destructive tests.

OTHER CONSIDERATIONS

O.1 Possible WSF of track circuit(s).

O.2 Possible WSF of protecting signals.

O.3 Possible design error in crossing circuits.

O.4 Possible WSF with treadle circuits.

O.5 Possible remote-control system failure.

O.6 Possible timing mismatch between SSI interlockings and conventional relay circuits.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part08/T014		
Wrong Side Failure Test Guide: Staff Warning Systems		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Train operated warning systems, Fixed warning systems, barrow crossing lights, staff warning lights
Excludes:	ILWS (Inductive Loop Warning System)

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note the relevant lever or switch positions, stopping or non-stopping selection.

At some sites the selection is controlled by the train describer and shall be noted.

N.2 Note the relevant signal box indications.

N.3 Note the state of any relevant train describer displays.

N.4 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc).

N.5 Note the nature of any work being done, or persons working in the area.

N.6 Note the time and type of train (including vehicle class or number), event or operation that first caused the reported failure to become apparent and whether the train approach was particularly slow.

N.7 Note the time and type of operation last made, prior to the report, which used the affected equipment.

N.8 Note any other train movements in the affected area.

Lineside Locations or Equipment Rooms

N.9 Note any significant weather conditions in the area.

N.10 Check that the equipment is correctly locked.

N.11 Check for damage.

N.12 Check any relevant system terminal printout and remove any recording media for checking.

N.13 Check for signs of any recent disturbance (wiring alterations, track maintenance or renewals activity).

N.14 Check for security or tightness of equipment.

N.15 Check the position of relevant relays (energised, de-energised).

N.16 Check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, strong smell, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

N.17 Check that relays correspond to the wiring diagram (type and specification, pin code, voltage, contact arrangement).

Record the last service date on the WSF form and forward to your SM(S).

N.18 Check that equipment and settings correspond to the wiring diagram (type and specification, power, voltage rating, etc.).

N.19 Check the rear of relay bases for silver migration.

N.20 Check the equipment for possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, etc.).

N.21 Check for any unusual amounts of moisture.

N.22 Check the time clock setting.

N.23 Check, with diagrams, that vital relay contacts are not by-passed by non-vital contacts.

N.24 Test voltages, recording the results.

N.25 Carry out EARTH TEST (DC) or EARTH TEST (AC) on circuit and supplies.

Switch Boxes and Audible Alarms.

N.26 Check for damage.

N.27 Check for recent disturbance (wiring alteration, track maintenance or renewals activity).

N.28 Check for security and tightness of equipment.

N.29 Check for possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, etc.).

N.30 Check for any unusual amounts of moisture.

Cables and Wires

N.31 Check for damage (fires, squashed cables, etc.).

N.32 Check for safe insulation at terminals.

N.33 Remove covers from trunking, and check for safe insulation (chafing, scorching, rodent damage).

Miscellaneous

N.34 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

DESTRUCTIVE TESTS

Audible Alarm

D.1 Check that the audible warning operates correctly by recreating the effect of a train.

D.2 Test that controlled signals does not clear to a proceed aspect until a warning has sounded for the required time.

D.3 Recreate the effect of a train over-running any protecting signals, and check that the warning sequence is initiated.

Visual Alarm

D.4 Check that warning lights function correctly with all protecting signals at red and free of approach locking.

D.5 Check that the warning lights function correctly by recreating the effect of a train approaching with clear signals.

D.6 Check that controlled signals does not clear to a proceed aspect until the warning light has correctly responded for the required time.

D.7 Check that the warning sequence is initiated if a protecting signal is overrun by recreating the effect of a train passing the signal.

Lineside Locations or Equipment Rooms

D.8 Carry out WIRE COUNT relevant equipment or circuits to the wiring diagram.

D.9 Check that latched relays does not unlatch when lightly tapped.

D.10 Test and record the time of approach locking for all associated protecting signals.

D.11 Remove relays and check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

D.12 Check relay base front for silver migration, damage, spades pushed too far forward or broken contact insulators.

D.13 Carry out INSULATION TEST relevant circuit to earth.

D.14 Carry out INSULATION TEST relevant circuit to other suspect circuits.

D.15 Test for intermittent high resistance faults in any capacitor slug circuit unless relay stick contacts are wired in series capacitor.

D.16 Test for intermittent high resistance faults in common return, looping or spur circuits.

D.17 Test drop shunt and pick-up shunt of track circuits and that repeat relays correspond with TRs.

D.18 Check all lamp proving circuits associated with the staff warning system operate correctly.

D.19 Check any staff warning system lamp filament changeover relays for correct operation.

Switch Boxes and Audible Alarms

D.20 Carry out WIRE COUNT the equipment to the wiring diagrams.

Cables

D.21 Carry out CABLE FUNCTION TEST on the line circuits.

D.22 Carry out INSULATION TEST on all related cables (tail, lineside, rack to rack).

Miscellaneous

D.23 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Destructive tests.

OTHER CONSIDERATIONS

O.1 Possible RSF of track circuit at exit of warning system area.

O.2 Possible WSF of track circuit within warning system area.

O.3 Possible WSF of treadles within warning system area.

O.4 Strike in point for warning system might not be far enough out for line speed.

O.5 Second train could have struck in before first train had cleared TOWS or FWS area.

O.6 Possible design error with warning system circuits.

END

GENERAL

All test measurements shall be recorded on Trainstop (Electro-Hydraulic) Calibration Test NR/SMS record card together with the reason for the test.

NON-DESTRUCTIVE TESTS

Lineside Locations or Equipment Rooms

N.1 Check that the cupboard or room is correctly locked.

N.2 Check for damage.

N.3 Check any relevant system terminal printout and remove any recording media for checking.

N.4 Check for signs of recent disturbance (wiring alterations, track maintenance or renewals activity).

N.5 Check for equipment security or tightness.

N.6 Note the position of relevant relays (energised, de-energised).

N.7 Check for damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, strong smell, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

N.8 Check that relays correspond to the wiring diagram (type and specification, pin code, voltage, contact arrangement).

Record the last service date on the WSF form and forward to your Section Manager (Signals).

N.9 Check that equipment and settings correspond to the wiring diagram (specification, power, voltage rating, etc.).

N.10 Check the rear of relay bases for silver migration.

N.11 Check for possible short circuits (nuts, washers, solder, off-cuts of wire, metallic dust, etc.).

N.12 Check the equipment for any unusual amounts of moisture.

N.13 Test voltages recording the results.

N.14 Test voltage across coil of trainstop valve while signal at all possible aspects.

N.15 EARTH TEST (DC) or EARTH TEST (AC) circuit and supplies.

On-Track Equipment

N.16 Note the signal aspect displayed.

N.17 Note whether the trainstop arm is up or down.

N.18 Check the trainstop position (height, distance from rail).

N.19 Check that the equipment is correctly locked or padlocked.

N.20 Check that the arm is not obstructed.

N.21 Check for damage (return spring).

N.22 Check for unusual amounts of moisture.

N.23 Check security and tightness of equipment.

Cables and Wires

N.24 Check for damage (fires, squashed cables, etc.).

N.25 Check that the insulation of cables and wires at terminations are properly isolated from each other.

N.26 Remove covers from trunking and check for safe insulation (chafing, scorched, rodent damage).

Miscellaneous

N.27 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

DESTRUCTIVE TESTS

Trackside Cupboard or Equipment Rooms

D.1 WIRE COUNT relevant equipment or circuits to the wiring diagram.

D.2 Remove relays and check for damage inside (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

D.3 Check relay base front for silver migration, damage, spades pushed too far forward or broken contact insulators.

D.4 Test current to trainstop valve while signal at all possible aspects.

D.5 Test air pressure (where applicable).

D.6 Carry out an INSULATION TEST of the suspected circuit to earth.

D.7 Carry out an INSULATION TEST of the suspected circuit to other relevant circuits.

D.8 Carry out an INSULATION TEST all cables (tail, lineside, rack to rack).

D.9 Check that the arm is not obstructed externally or within trainstop.

On-Track Equipment

D.10 Check the position of trainstop ram and arm for each aspect of the signal.

Miscellaneous

D.11 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Destructive tests.

OTHER CONSIDERATIONS

01 Possible WSF of signal.

02 Possible WSF of track circuit if trainstop valve energised by track circuit occupied.

03 Possible failure of trainborne equipment.

04 Possible design error in trainstop valve circuit.

END

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc).

N.2 Note the nature of any work being done, or persons working in the area.

N.3 Note the time and type of train (including vehicle class or number), event or operation that first caused the reported failure to become apparent and whether the train approach was particularly slow.

N.4 Note the time and type of train or operation last made, prior to the report, which used the affected equipment.

N.5 Note any other train movements in the affected area.

N.6 Note any significant weather conditions in the area.

Balise

N.7 Check for any signs of damage or missing equipment.

N.8 Check for security or tightness of equipment.

N.9 Check for signs of any recent disturbances (track maintenance or renewals activity, replacement mountings, equipment re-located).

N.10 Check location of equipment in conjunction with Balise Positioning Form or other form of local record.

N.11 Check that equipment is correctly installed and centrally mounted.

N.12 Check the 14-character identifier is identical on both the balise and the mounting bracket assembly.

N.13 Test the Balise telegram data through the air gap using a balise reading tool.

Miscellaneous

N.14 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

OTHER CONSIDERATIONS

O.1 Possible design error in telegram data.

O.2 Possible design error in specifying balise position.

O.3 Possible failure of train borne equipment.

END

GENERAL

All test measurements should be recorded on the appropriate record card together with the reason for the test.

TPWS is not a 'fail safe' piece of equipment, because it requires energisation to stop trains.

The failure to transmit when required is protected by the TPWS fault circuit (VCR), usually by replacing the signal in rear and indicating a lamp failure at the signal with the failed TPWS in the signal box.

The signalling interface is designed such that any 'right side' failure will cause TPWS to transmit.

This failure mode is generally not indicated by the TPWS fault circuit and will instead be identified by TPWS fitted trains having an unwarranted emergency brake application.

Where a TPWS failure is identified by either the stopping of a train, or the extinguishing of a lamp out indication or other means of TPWS failure reporting, any testing required may be carried out by a certified Maintenance Tester attending the failure without further authority.

Where there is any doubt as to the cause of the failure, or where failure of TPWS to transmit is not reported correctly, or the speed of a train is not correctly reduced, the normal escalation procedures shall be followed.

Fault finding flowcharts are provided in NR/SMTH/Part10/FF13 (Faulting Guide: Train Protection Warning System (TPWS) Flow Charts).

NON-DESTRUCTIVE TESTS

General

N.1 Note the mechanism by which it was discovered that TPWS was not operating correctly (maintenance testing, TPWS fitted train not stopped, lineside observation of loops active, SSI out of correspondence report, etc.).

Signal Box

N.2 Note the signal box indication for the relevant signal, the display of the relevant TPWS failure indication.

N.3 Note the aspects displayed by signals approaching the failure and at the TPWS fitted signal.

N.4 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc.).

N.5 Note the nature of any work being done, or persons working in the area.

N.6 Note the time and type of train (including vehicle class or number), event or operation that first caused the reported failure to become apparent and, where possible, the likely speed of the train on the approach to the signal, PSR or buffer stops.

N.7 Note if the train was being propelled or not driven from the leading cab.

N.8 If practicable arrange to have the train OTMR (On-Train Monitor and Recorder) downloaded and/or to interview the train crew.

N.9 Note if the train had been fitted with TPWS, and if the train has a record of TPWS equipment failure or isolation.

N.10 Note the distance past the signal the train came to a stand if the train passed the signal at danger.

N.11 Note the time and type of any train movements made over the failed equipment immediately prior to the failure.

N.12 Note any other train movements in the affected area at the time of the failure.

N.13 Note any specific control table requirements for the control or reporting of TPWS failures at this installation.

Lineside Locations or Equipment Rooms

N.14 Check that the cupboard or room is correctly locked.

N.15 Note the date of the latest routine maintenance visit and any measurements taken.

N.16 Check for damage.

N.17 Check any relevant system terminal printout and remove any recording media for checking.

N.18 Check for signs of recent disturbances (wiring alterations etc.).

N.19 Check for security or tightness of equipment.

N.20 Check the position of relevant relays (energised, de-energised) and the status of LED indications on TPWS modules (lit, un-lit).

N.21 Check for visible damage inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, strong smell, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

N.22 Check that relays and TPWS modules correspond to the wiring diagram (type and specification, part numbers, serial numbers, mod state, pin code, voltage, contact arrangement).

N.23 Record the last service date on the WSF form and forward to your SM(S)

N.24 Check that any other equipment and settings correspond to the wiring diagram (specification, power, voltage rating, etc.).

N.25 Check rear of relay and module bases, where accessible, for silver migration.

N.26 Check equipment for possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, etc.).

N.27 Check equipment for any unusual amounts of moisture or dirt.

N.28 Check status of any ELDs or surge arrestor cartridges.

N.29 Test voltages, recording the results (in particular test power supply voltage, main and suppression input voltages, voltage and frequency of the transmitter loop circuit at the TSS/OSS module output links).

N.30 EARTH TEST (DC) or EARTH TEST (AC) circuits and supplies.

On-Track Equipment

N.31 Note the weather conditions at the time of investigation and those when the reported failure occurred.

N.32 Check position of loops (centre line, height and distances between arming and trigger loops). Check that the TPWS OSS/OSS+ positioned at correct distance from signal.

N.33 Check for correct operation of any TPWS loops on the same track and in close proximity to the TPWS installation under investigation (note the separation distance, function and frequency of any other TPWS transmitter loops that are within 75 metres and on the same route as the loops under test.)

N.34 Check for damage to on-track equipment (loops, plug couplers, disconnection boxes etc.).

N.35 Check for any other signs of recent disturbances (track maintenance or renewals activity, etc.).

N.36 Check security of internal and external connections in the disconnection boxes.

N.37 Note and record the presence of any significant metal objects lying on or near the TPWS transmitter loops (i.e. within 3 metres).

N.38 Note the characteristics of the track associated with the loops e.g. tight horizontal and vertical curves of the line, loops positioned within points or crossings, check rails, concrete slab track, steel bridges, wet track beds or poor track condition.

N.39 Note the type of track circuits that the loops are installed on.

Cables

N.40 Check for damage (fires, squashed cables, etc.).

N.41 Check the insulation of cables and wires at terminations. Check that adjacent terminations are properly isolated from each other.

N.42 Remove covers from trunking and check for safe insulation (chafing, scorched, rodent damage etc.).

Miscellaneous

N.43 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

DESTRUCTIVE TESTS

Signal Box

D.1 Test the signal box failure indication of each relevant TPWS function by arranging for each TPWS installation to be separately isolated using the 250mA fuse on the Baseplate or Trackside Enclosure with the signal at danger.

Lineside Locations or Equipment Rooms

D.2 WIRE COUNT relevant equipment or circuits to the wiring diagram.

D.3 Before disturbing the modules, individually Test that each module proving contact functions correctly. This can be done by slipping the OSM/TSM links to the outgoing transmitter loop circuit, hence creating a fault.

As the OSS and TSS SIM proving contacts are connected in series, removing the fuse powering an OSS and a TSS will not identify which module has failed.

A potential cause of TPWS failing to transmit without initiating a failure indication might be a welding of the proving relay contact within the SIM.

As the OSS and TSS SIM proving contacts are connected in series, a single contact welding might not immediately be apparent.

Furthermore, in these fault conditions the status of the proving contact might not necessarily correspond to the status of the Loops Active LED on the same SIM.

D.4 Check that unused suppression circuits are linked out correctly.

D.5 Check that the wetting current resistors are connected in place across main and suppression circuits.

D.6 Place digital multi-meter onto wetting current resistor leads where provided or Module input terminals (IP BX/IP NX) and measure voltage. Disconnect TPWS inputs (at baseplate, plugboard or trackside enclosure links) and Check that voltage remains the same.

D.7 Remove modules and relays. Check for damage on relays and modules (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

D.8 Check relay and module bases for signs of silver migration, damage to spades, spades pushed too far forward or broken contact insulators.

D.9 INSULATION TEST relevant circuits to earth.

D.10 INSULATION TEST relevant circuits to other suspect circuits.

D.11 Test for intermittent high resistance faults in common return, looping or spur circuits.

D.12 Test the voltage of the outgoing links to the transmitter loop circuit of TSS / OSS modules, with a 75ohm shunt resistor. (See Voltage Testing and Dummy Load Testing in NR/SMTH/Part10/FF12 (Faulting Guide: Train Protection Warning System (TPWS).

D.13 Test that any relevant wetting current resistors are still within specification.

D.14 Check all VCR and other TPWS specific relays are able to drop by removing connection to coil.

D.15 Check any suppression stick / timer circuits for relays failing to drop.

On-Track Equipment

D.16 Check the security of the plug coupler. Test the loop voltage whilst moving the loop plug coupler back and forth, look for fluctuations in voltage. Do not subject the plug coupler to any excessive twisting stress, as this causes damage.

D.17 Disconnect plug coupler. Check terminals for moisture, foreign matter, arcing, corroded contacts, broken or bent springs.

D.18 Test DC resistance of loops (between 0.5 and 1.5 ohms across the two smaller pins of the transmitter loop plug coupler). See Transmitter Loop Related Failures in NR/SMTH/Part10/FF12 (Faulting Guide: Train Protection Warning System (TPWS).

D.19 Test (for each signal aspect) the TPWS loop outputs for correct voltage and frequency at 310mm above rail level (using the TPWS commissioning test jig), Record the results. In complex areas, Test the TPWS loop output voltages for each permutation of signal aspect and points position; according to control table entries (see NR/SMS/Part/Z03, for correct values).

D.20 Test (for each signal aspect) the TPWS loop output voltages for incorrect operation by any adjacent signal. In complex areas, test the TPWS loop output voltages for each permutation of signal aspect and points position, for incorrect operation by adjacent signals.

Cables

D.21 CABLE FUNCTION TEST signalling interface line circuits.

D.22 INSULATION TEST all relevant cables (tail, lineside, rack to rack).

D.23 Do not perform an insulation test of either the TPWS loop feeder cable or the SPOSS treadle cable, with the transmitter loop connected, as this damages the loops.

Miscellaneous

D.24 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Destructive tests.

OTHER CONSIDERATIONS

O.1 Possible WSF of the signal aspect lighting circuits.

O.2 Possible failure of train borne equipment.

O.3 Possible train exceeding design speed.

O.4 Possible WSF of track circuit or points operation / indication, where occupation of track circuits or the position of points affects TPWS suppression.

O.5 Possible design error in TPWS circuits or loop position.

O.6 Possible signalling power supply problems.

END

NON-DESTRUCTIVE TESTS

Before opening EBI Gate Post

N.1 Note the weather conditions.

N.2 Check that the posts are correctly closed and padlocked.

N.3 Check for visible signs of damage.

N.4 Check for signs of recent disturbances (track maintenance/cable damage).

N.5 Check for correct LED beam alignment of the Post LED's.

N.6 Observe LED illumination (Red/Green) from road and or foot approaches and Check the background, any relevant side lighting and 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).

N.7 Check the "On Demand" buttons (if fitted) are lit.

After opening EBI Gate Post

N.8 Check the equipment for possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, etc).

N.9 Check the equipment for any unusual amounts of moisture.

N.10 Check that the Green and Red LEDs are correctly installed and in good condition (colour, type, correct alignment, etc).

N.11 Check and record the DC power light (Green)/overload indication (Red) on the PULS Power supply unit.

N.12 Check status LEDS on the UPS Controller, OK/BAT, BAT.>85%, Alarm and BAT.FAULT. (Red, Yellow or Green).

N.13 Check that no trains are traversing the EBI block sections and Record the indications on the ACB cards.

N.14 Check that no trains are traversing the EBI block sections and Record the LED status indications on the IMC card.

Wheel sensors (Only if the ACB card indicates a problem at the wheel sensor)

N.15 Check the condition of the cables and troughing route to the wheel sensor (fire damage, squashed cables, etc).

N.16 Check GAK box for damage.

N.17 Check for the safe insulation of cables and wires at terminations.

N.18 Check that adjacent terminations are properly isolated from each other.

N.19 Check sensor head for damage.

N.20 Check the sensor head is correctly mounted on the running line, as shown in NR/SMS/PartC/AX41 (Frauscher: RSR123 Wheel Sensors).

Miscellaneous

N.21 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

DESTRUCTIVE TESTS

EBI Gate Post

D.1 Press the “On Demand button” (if fitted) and observe the passage of a train take note of indications and audio alarm.

D.2 Record the time at which the button was pressed so this information can be compared to the data recorded the system log later.

D.3 Check for the safe insulation of cables and wires at terminations.

D.4 Check that adjacent terminations are properly isolated from each other.

D.5 Power down the post.

D.6 Remove and secure the SD cards as per NR/SMS/PartB/Test/079 (Interrogation of the EBI Gate 200 SD Card).

D.7 Following the removal of the SD Cards both DayLogs for the day concerned shall be downloaded and the operation observed in step D1 has been recorded correctly. For additional information related to interpreting the result refer to NR/SMS/PartB/Test/079 (Interrogation of the EBI Gate 200 SD Card).

Crossing Equipment

D.8 INSULATION TEST cables between Master and Slave Posts as well as tail cables to sensors via the GAK.

Miscellaneous

D.9 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Destructive tests.

OTHER CONSIDERATIONS

O.1 Possible design error in crossing circuits.

O.2 Strike in point might not be far enough out for speed of route.

O.3 Train travelling over the speed limit.

O.4 P way issues.

END

NON-DESTRUCTIVE TESTS

Before opening any equipment

N.1 Note the weather conditions.

N.2 Check that the Vamos equipment case and indication posts are correctly closed and padlocked.

N.3 Check for visible signs of damage.

N.4 Check for signs of recent disturbances (track maintenance/cable damage), on ALL detector heads.

N.5 Check for correct LED beam alignment of the Indication Post LED's.

N.6 Observe LED illumination (Red/Green) from road and or foot approaches and Check the background, any relevant side lighting and any obstructions such as fencing or vegetation.

N.7 Check the "On Demand" buttons (if fitted) and record if they are :

a) Illuminated - If the system is in "Standby Mode" the button is yellow, and it turns blue when its operated.

b) Extinguised - If the indicator posts are displaying and red or green LEDs.

After opening Vamos Equipment Case

N.8 Check the equipment for possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, etc).

N.9 Check the equipment for any unusual amounts of moisture.

N.10 Check and record all of the LED indications on each item of equipment.

N.11 Check that no trains are traversing the crossing area and record the LED status indications on the IMC card.

N.12 Record info on Telemetry Module display shown only.

Indication Posts

N.13 Check that the Green and Red LEDs are correctly installed and in good condition (colour, type, correct alignment, etc).

a) Check for any chafing, rodent damage or cables being trapped when the hinged door is open or closed.

Wheel sensors

N.14 Check the condition of the cables and troughing route to the wheel sensor (fire damage, squashed cables, etc).

N.15 Check GAK box for damage.

N.16 Check the insulation of cables and wires at terminations. Check that adjacent terminations are properly isolated from each other.

N.17 Check for safe insulation (chafing, scorched, rodent damage).

N.18 Check sensor head appears secure and is undamaged.

Miscellaneous

N.19 Check Special Inspection Notices (NR/SIN), or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

DESTRUCTIVE TESTS

Vamos Equipment Case

D.1 Press the “On Demand button” (if fitted) as a train approaches and observe the passage of a train take note of indications and audio alarms.

D.2 Record the time “actual” at which the button was pressed so this information can be compared to the data recorded the system log later.

D.3 Check the insulation of cables and wires at terminations. Check that adjacent terminations are properly isolated from each other.

D.4 Check for safe insulation (chafing, scorched, rodent damage).

D.5 Check all data in the Telemetry module buffer is downloaded to the card. As described in NR/SMS/PartB/Test/158 (Interrogation of the Vamos Crossing System SD Card).

D.6 Remove and replace the SD card, and secure the removed SD card.

D.7 Interrogate the SD card as driscribed in NR/SMS/PartB/Test/158 (Interrogation of the Vamos Crossing System SD Card). This test contains additional information related to interpreting of the results.

D.8 Power down the System.

Crossing Equipment

D.9 INSULATION TEST cables between Indication Posts and the Vamos equipment case as well as tail cables to sensors via the GAK.

Miscellaneous

D.10 Check Special Inspection Notices (NR/SIN), or Letters of Instruction (NR/BS/LI/) for any other relevant Destructive tests.

OTHER CONSIDERATIONS

O.1 Possible design error in crossing circuits.

O.2 Strike in point might not be far enough out for speed of route.

O.3 Train travelling over the speed limit.

O.4 Pway issues.

O.5 Malice has occurred.

END

1. NON-DESTRUCTIVE TESTS

Signal Box Tests

N.1 Note any relevant Signal Box indications.

N.2 Note any relevant switch or push button states, stopping or non-stopping selection.

At some sites the selection is controlled by the train describer and this should be noted.

N.3 Note the state of any relevant train describer displays.

N.4 Note any unusual operating methods in place (possessions, single line working, etc.).

N.5 Note the nature of any work being done, or persons working in the area.

N.6 Note the time and type of train or operation that first caused the reported failure to become apparent and whether the fault developed without train interference.

N.7 Note the time and type of train or operation last made prior to the report, which made use of the affected equipment.

N.8 Note any other train movements in the affected area.

N.9 Note any significant weather conditions in the area.

N.10 Check that any signals or points that have been reported to be part of or connected to any incident can display the aspect reported/move in the direction reported (i.e. not clipped and plugged).

N.11 Download available condition monitoring and data logger evidence (e.g. Centrix, Asset View, SSI) and confirm that the data supports the allegation.

On Track Equipment/Running Rails

N.12 Check the rails for contamination and record the type of contamination and extent (Complete or sporadic).

N.13 Test and record the arm clearances on the treadle, NR/SMS/PartB/Test/177 (Treadle - Gauge Test), together with the reason for the test.

Trackside Cupboards Or Equipment Rooms

N.14 Check that the cupboard or room is correctly locked or padlocked.

N.15 Check for any signs of damage and/or disturbance.

N.16 Check for any signs of recent work (wiring alterations, stage work, etc.).

N.17 Check for security or tightness of equipment (modules, racking cable connectors, etc.).

N.18 Check the position of any relevant relays (energised or de-energised).

N.19 Check for any visual signs of damage.

N.20 Test voltages and record results.

HXP-3 Specific Tasks

N.21 Download event data from the site recorder (Recorder Memory Module(RMM)), this data is time critical and therefore priority.

N.22 Select SD on the IDK and analyse any self-diagnostic codes that have been stored by the HXP-3, as described in NR/SMS/PartC/IS30 (Harmon LX Predictor (HXP-3)) - Appendix E . All codes are preceded by the date and time they were logged with the most recent entry being shown first.

N.23 Check the configuration settings correspond to the site record, with particular note of the loss of shunt setting. Site records showing configuration settings of N/A are treated as a records deficiency and shall be escalated to supervisor.

N.24 Check if configurations have changed using the IDK, option 94. Note, loss of site configuration information is associated with an expired BIOS battery.

N.25 Contact Manufacturer second line support, liaise with manufacturer to review event data for indicator of cause of failure. If unsure how to conduct this step, contact the SFI Level 2.

N.26 Check and record the RX value for each track using the IDK.

N.27 Check and record the Track Circuit Phase angle (PHASE) value for each track using the IDK.

N.28 Where a failure is identified on an island track section, perform the island check out test NR/SMS/PartB/Test/151 (Harmon Crossing Processor (HXP-3) Tests - Section 3.

N.29 Check that the Power LED on each module is on. If all Power LEDs are off, check the Master On/Off Switch is on and that the fuse is intact.

N.30 Check that the MDR LED is on, as this indicates the presence of MDR Drive voltage and hence that the problem is elsewhere in the equipment.

N.31 Check that the CWE1 LED is on for single track lines and that CWE1 and CWE2 LEDs are on for double track lines. If these LEDs are not lit, this indicates that the associated track is in Motion Detect mode - this causes warning times to be longer than expected.

N.32 Check each TRM to see if the High Signal LED is on. This could be caused by an open track circuit.

N.33 Check for intermittent bond wire terminations or a defective insulated joint coupler.

N.34 Check outgoing track cables are of correct type (twisted pair) and are correctly terminated.

N.35 Check for open termination shunts.

N.36 Check for open or defective insulated joint couplers.

N.37 Check for improper application of the track frequency when overlapping with another HXP-3.

N.38 Check for defective sleepers, tie bars and point insulations.

DESTRUCTIVE TESTS

Common Destructive Tests

D.1 WIRE COUNT relevant equipment or circuits and controls to the wiring diagrams.

D.2 Test and record the timings on the treadle, NR/SMS/PartB/Test/044 (Mechanical Treadle Timing and Adjustment Test), together with the reason for the test.

HXP-3 Power Loss

D.3 If some or all of the Power LEDs are not on, apply pressure to each module to make sure that the DIN connectors are properly seated.

D.4 If the HXP-3 lost power while the Master On/Off switch was On and the fuse was intact, check to see if the AAR terminals N12 and B12 have 12 volts applied to them. If not, the problem can be related to the battery, battery buss, battery charger or Motion Detector Surge Arrester (MDSA).

LED Indications

D.5 If any of the CWE1, CWE2, AUX, ISL1, ISL2, MDR, AX1, AX2 or AX3 LEDs are not illuminated as expected, check for a 12 Vdc current across the AAR terminals directly above the LED.

D.6 Check that the ISL1 and ISL2 LEDs are illuminated. These correspond to the RSI modules for tracks 1 and 2 respectively. If the RSI Modules are present and the equivalent ISL1 or ISL2 LEDs are not illuminated, check that the RSI Module is correctly adjusted and operating.

D.7 Check that the Stall Timer LED (located on the CPU module) is not illuminated.

D.8 If the ISL LED is not illuminated, check the RSI module to see if the (green) HIGH LED is on constantly. When the RSI Module detects a malfunction the (green) HIGH LEDs, (yellow) CALIBRATE LEDs and (red) LOW LEDs flash on and off in a distinct pattern. The pattern varies with the type of fault detected.

D.9 If a pattern is noticed check that the B12 voltage is between 10 and 14 Vdc.

D.10 If the B12 voltage is correct, check the LOS jumpers. One mini shunt shall be installed on LOS 0, LOS 1, and LOS 2.

D.11 If the LOS jumpers are correct, check the fault jumpers. One mini shunt shall be installed on FAULT 0 or FAULT 1.

D.12 If, after these checks, no correctable faults are detected and the fault remains, replace the RSI module.

High Signal (High Impedance or Open Track Circuit)

D.13 Check the Ballast Compensation parameter (BC) using the IDK .

D.14 Place a hard wire shunt, approximately 50% of the distance of the approach away from the crossing. If the value of RX decreases to approximately "50", there is an open circuit in the last 50% of the approach that was shunted. To locate the open circuit, move the hard wire shunt to positions of 60%, 70%, 80%, 90%. If the value of RX does not decrease to approximately "50" and the possibility of an incorrect Ballast Compensation setting has been eliminated, the open circuit is located between the hard wire shunt and the opposite approach termination. To locate the open circuit, move the hard wire shunt to positions of 10%, 20%, 30%, 40%.

D.15 Check if the open circuit has been caused by a defective termination shunt. The three types of termination shunt are hard wire, wideband, and narrow band (NBS). To test an approach termination, connect a hard wire shunt where the approach termination is connected. Note the RX change on the HXP-3.

a) When the approach termination is of the hard wire type, no change is visible.

b) When the approach termination is of the wideband type, RX decreases by no more than 2.

c) When the approach termination is of the narrow band (NBS) type RX can decrease by as much as 25. If RX increases when the hard wire shunt is connected at the termination, the NBS is defective.

D.16 Test for defective joint couplers using the following procedure.

a) Place a hard wire test shunt on the crossing side of the joint coupler.

b) Observe and record the drop in RX.

c) Remove the test shunt.

d) Place the hard wire test shunt on the termination side of the joint coupler.

e) Observe and record the drop in RX.

f) Remove the test shunt.

Low Phase (Phase angle <32°)

D.17 Check that the frequency is correct for the approach length using the table found in NR/SMS/PartZ/Z04 (Level Crossing - Reference Values) - Predictor HXP-3.

D.18 If track conditions are extremely wet, especially in the island circuit, carry out a Phase Compensation adjustment, as described in NR/SMS/PartC/IS30 (Harmon LX Predictor (HXP-3)) - Appendix B.

Open Track Tail Cables

D.19 An open track tail cable does not always cause a high signal condition, but can indicate a broken or high impedance track tail cable condition, such as resistive track wires, track connections, or defective bonds in the island circuit. A broken transmitter tail cable can cause a high signal condition and code C527 for track 1 or c547 for track 2 to be displayed. A broken receiver tail cable can cause condition code C620 for track 1 or C630 for track 2 to be displayed.

D.20 When an MDSA is used and an open condition has been narrowed to the track tail cable, the MDSA is a possible cause for the open circuit. The MDSA has a fusible link in series with each track tail cable: T1, T2, R1, and R2. Finding defects with these fuseable links is done by bypassing or jumpering around each of them. For example, to jumper around the T2 fuse link, connect a clip jumper from the T1 TRACK terminal to the T1 equipment terminal on the MDSA.

D.21 To make sure that no more than one track tail cable fuse link is causing the open, jumper around all four at one time. This determines whether the open is caused by the MDSA or some other portion of the track tail cable.

Rising RX on an Inbound Train

D.22 Check for rising RX for inbound trains. A slight rise in RX can be seen with a shunt or train near the termination. For this RX increase to occur the termination is usually a NBS and some HXP-3 signal is leaking past the termination creating this phenomenon. Poor ballast conditions or a defective NBS can also cause this.

Tail Ringing

Tail ringing is a term used in US applications to describe the re-activation of the crossing signals after the train has cleared the island. This could happen with the HXP-3 if RX decreased as the train was travelling outbound or in association with a diagnostic code.

D.23 Analyse diagnostic codes as described in NR/SMS/PartC/IS30 (Harmon LX Predictor (HXP-3)) - Appendix E.

D.24 If tail ringing was caused by RX decreasing as the train was travelling outbound; this is usually an indication of a defective TJC.

OTHER CONSIDERATIONS

O.1 Possible WSF of protecting signal reducing warning time.

O.2 Strike in point (treadle or track circuit) might not be far enough out for speed of route.

O.3 Possible mis-match of interlocking functionality with HXP-3.

END

1. NON-DESTRUCTIVE TESTS

Signal box tests

N.1 Note any relevant Signal Box indications.

N.2 Note any relevant switch or push button states.

N.3 Note the state of any relevant train describer displays.

N.4 Note any unusual operating methods in place (possessions, single line working, etc.)

N.5 Note the nature of any work being done, or persons working in the area.

N.6 Note the time and type of train or operation that first caused the reported failure to become apparent and whether the fault developed without train interference.

N.7 Note the time and type of train or operation last made prior to the report, which made use of the affected equipment.

N.8 Note any other train movements in the affected area.

N.9 Note any significant weather conditions in the area.

N.10 Check that any signals or points that have been reported to be part of or connected to any incident can display the aspect reported/move in the direction reported (i.e. not clipped and plugged).

Trackside cupboards or equipment rooms

N.11 Check that the cupboard or room is correctly locked or padlocked.

N.12 Check for any signs of damage and or disturbance.

N.13 Check for any signs of recent work (wiring alterations, stage work, etc.).

N.14 Check for security or tightness of equipment (modules, racking cable connectors, etc.).

N.15 Check the position of any relevant relays (energised or de-energised).

VHLC specific tasks

N.16 Check for any visual signs of damage.

N.17 Carry out Power Supply Testing, see NR/SMTH/Part10/FF18 (Faulting Guide: VHLC).

N.18 Carry out General Fault diagnosis (see NR/SMTH/Part10/FF18 (Faulting Guide: VHLC).

DESTRUCTIVE TESTS

Common destructive tests

D.1 Carry out a WIRE COUNT on relevant equipment or circuits and controls to the wiring diagrams.

D.2 Remove any relays associated with the VHLC interlocking (interface relays) and check for damage inside, such as cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, silver sulphide, metal flakes and bent or broken springs.

D.3 Check relay bases for any damage, silver migration, spades pushed in too far or broken contact insulators.

D.4 Carry out Auxiliary Communications Processor (ACP) checks, see NR/SMTH/Part10/FF18 (Faulting Guide: VHLC).

D.5 Carry out Vital Signal Driver AC (VSDAC) checks, see NR/SMTH/Part10/FF18 (Faulting Guide: VHLC).

D.6 INSULATION TEST any affected cable cores associated with the final function and the VSDAC.

D.7 As required, carry out a CABLE FUNCTION TEST on the final function to the VSDAC using the LCP.

D.8 Carry out VGPIO and Input/Output faults checks, see NR/SMTH/Part10/FF18 (Faulting Guide: VHLC).

D.9 INSULATION TEST any affected cable cores associated with the final function and the VSDAC.

D.10 As required, carry out a CABLE FUNCTION TEST on the final function to the VSDAC using the LCP.

D.11 Carry out Vital Logic Processor (VLP) checks, see NR/SMTH/Part10/FF18 (Faulting Guide: VHLC).

D.12 Replacing a battery or 5VDC power supply, see NR/SMTH/Part10/FF18 (Faulting Guide: VHLC).

END

NON-DESTRUCTIVE TESTS

Before opening any equipment

N.1 Note the weather conditions.

N.2 Check that the Flex equipment case and indication posts are correctly closed and padlocked.

N.3 Check for visible signs of damage.

N.4 Check for signs of recent disturbances (track maintenance / cable damage).

N.5 Check for correct LED beam alignment of the Indication Post LED's.

N.6 Observe LED illumination (Red/Green) from road and or foot approaches and check the background, any relevant side lighting and any obstructions such as fencing or vegetation.

N.7 Check GAK housing and Frauscher head for any damage and that cables are not damaged.

After opening Flex Equipment Case

N.8 Take a photo and video to show all LED's.

N.9 Check the equipment for possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, etc).

N.10 Check the equipment for any unusual amounts of moisture, check heater function.

N.11 Check and record all of the LED indications on each item of equipment by photographing each item.

N.12 Check that no trains are traversing the crossing area and record the LED status indications on the IMC card.

N.13 Check the Flex Life display for any alarms.

Indication Posts

N.14 Check that the Green and Red LEDs are correctly installed and in good condition (colour, type, correct alignment, etc).

N.15 Open housing to check for wiring / cable from any chafing, rodent damage or being trapped with opening of door.

Wheel sensors

N.16 Check the condition of the cables and troughing route to the wheel sensor (fire damage, squashed cables, etc).

N.17 Check GAK box for damage.

N.18 Check the insulation of cables and wires at terminations. Check that adjacent terminations are properly isolated from each other.

N.19 Check for safe insulation (chafing, scorched, rodent damage).

N.20 Check sensor head appears secure and is undamaged.

Miscellaneous

N.21 Check Special Inspection Notices (NR/SIN), or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

DESTRUCTIVE TESTS

Flex Equipment Case

D.1 Observe the passage of a train and take note of indications and audio alarms.

D.2 Record the time “actual”, at which the button was pressed, so this information can be compared later, to the data recorded on the system log.

D.3 Check for safe insulation (chafing, scorched, rodent damage).

D.4 Check all data in the Flex Life module buffer is downloaded onto a USB, which is inserted into one of the ports on the bottom of the Flex life case, by using the Logfiles Screen.

D.5 Remove USB Device.

D.6 Interrogate the Flex life data by inserting the USB in a Laptop. The logs are shown in Microsoft notes format and can be transferred to excel for easier interpretation.

Crossing Equipment

D.7 INSULATION TEST cables between Indication Posts and the Flex equipment case as well as tail cables to sensors via the GAK.

Miscellaneous

D.8 Check Special Inspection Notices (NR/SIN), or Letters of Instruction (NR/BS/LI/) for any other relevant destructive tests.

OTHER CONSIDERATIONS

O.1 Possible design error in crossing circuits.

O.2 Strike in point might not be far enough out for speed of route.

O.3 Train travelling over the speed limit.

O.4 Pway issues.

O.5 Malice has occurred.

END

GENERAL

These test guides are for use where rail head contamination is suspected and shall only be used with the authorisation of the SFI level 2 (or above).

Where the results of this test plan are inconclusive OR where evidence of rail head contamination cannot be found at step N13, Test Plan NR/SMTH/Part08/T002 (Wrong Side Failure Test Guide: Track Circuits) shall be used instead.

Where a train fails to operate a series of track circuits on the same line of route, it is permissible to test only the first, middle and last track circuit in addition to any track circuit containing S&C.

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note any relevant signal box indications.

N.2 Check the condition of lamps / other indicators.

N.3 Note the state of relevant train describer displays.

N.4 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc.).

N.5 Note the nature of any work being done or persons working in the area.

N.6 Note the time and type of train (including vehicle class or number), event or operation that first caused the reported failure to become apparent.

N.7 Note whether the train approach was particularly slow.

N.8 Note whether any Track Circuit Actuator (TCA) was fitted to the affected train and if it was working correctly.

N.9 Note the time and type of operation last made, prior to the report, which used the affected equipment.

N.10 Note any other train movements in the affected area.

N.11 Note any significant weather conditions in the area.

N.12 Download available condition monitoring and data logger evidence (e.g. Centrix, Asset View, SSI) and confirm that the data supports the allegation.

Running Rails

N.13 Check the rails for contamination and record the type of contamination and extent (complete or sporadic).

Where rail head contamination is unconfirmed, the SFI Level 2 or above shall be consulted for further guidance.

Lineside Locations and Equipment Room

N.14 Check and record the position and correspondence of relevant relays (energised, de- energised). Consider TR, TPR, TKR, etc.

Track Equipment

N.15 Check for signs of recent disturbances (track maintenance or renewals activity, no unused rails in any tuned zones).

N.16 If a laptop is available, download the error log. (DIGITAL EBI TRACK 200 & 400 RX ONLY).

NOTE: *This can be done whilst the system is operational by connecting to the 9-way D type port on the front of the Digital Rx, using a laptop and the required software.*

DO NOT turn or remove the frequency key during this process.

DESTRUCTIVE TESTS

Track Equipment

D.1 Carry out a Track Circuit Maintenance Test and compare readings with previous tests on the track circuit record card.

D.2 Connect the minimum permissible drop shunt to all extremities of the Track Circuit and confirm the track relay de-energises when the shunt is applied.

D.3 Connect the minimum permissible drop shunt at intervals throughout the length of the track circuit whilst observing the track relay de energises.

NOTE: *The normal interval is 15 Metres, longer intervals are possible for plain line and long track circuits. The interval shall be agreed with the SFI Level 2 (or above).*

D.4 Carry out Residual Voltage Test / Interference Test and record results.

D.5 Measure the track circuit voltage at the Relay or Receiver whilst a train passes over the length of the track circuit.

NOTE: *This step is to ascertain that the train wheels are making good contact with the track throughout the length of the track circuit and to verify that the contamination observed would allow the track circuit to fail wrong side.*

D.6 Record where TCAIDs are fitted and carry out NR/SMS/PartB/Test/043 (Track Circuit Aid Test).

D.7 Record where Force Down Treadles are fitted and confirm that they are working / timing correctly.

OTHER CONSIDERATIONS

O.1 Consider possible remote-control system failure.

O.2 Consider possible invalid track circuit combination.

O.3 Consider possible design error.

O.4 Consider possible problem with train.

O.5 Consider if track circuit might be shorter than the minimum length required.

O.6 Consider and relevant Special Inspection notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction.

END

GENERAL

These test guides are for use where rail head contamination is suspected and shall only be used with the authorisation of the SFI level 2 (or above).

Where the results of this test plan are inconclusive OR where evidence of rail head contamination cannot be found at step N13, Test Plan NR/SMTH/Part08/T002 (Wrong Side Failure Test Guide: Track Circuits) shall be used.

Where a train fails to operate a series of track circuits on the same line of route, it is permissible to test only the first, middle and last track circuit in addition to any track circuit containing S&C.

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note any relevant signal box indications.

N.2 Check the condition of lamps / other indicators.

N.3 Note the state of relevant train describer displays.

N.4 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc.).

N.5 Note the nature of any work being done or persons working in the area.

N.6 Note the time and type of train (including vehicle class or number), event or operation that first caused the reported failure to become apparent.

N.7 Note whether the train approach was particularly slow.

N.8 Note whether any Track Circuit Actuator (TCA) was fitted to the affected train and if it was working correctly.

N.9 Note the time and type of operation last made, prior to the report, which used the affected equipment.

N.10 Note any other train movements in the affected area.

N.11 Note any significant weather conditions in the area.

N.12 Download available condition monitoring and data logger evidence (e.g. Centrix, Asset View, SSI) and confirm that the data supports the allegation.

Running Rails

N.13 Check the rails for contamination and record the type of contamination and extent (complete or sporadic).

Where rail head contamination is unconfirmed, the SFI Level 2 or above shall be consulted for further guidance.

Track Equipment

N.14 Check for signs of recent disturbances (track maintenance or renewals activity, no unused rails in any tuned zones).

N.15 Correspond the Remote Condition Monitoring system to the Track Circuit under investigation.

NOTE: *This test is to confirm that the RCM equipment is connected to the correct track and is functioning correctly.*

DESTRUCTIVE TESTS

Track Equipment

D.1 Carry out a Track Circuit Maintenance Test and compare readings with previous tests on the track circuit record card.

D.2 Connect the minimum permissible drop shunt to all extremities of the Track Circuit and confirm the track relay de-energises when the shunt is applied.

D.3 Carry out Residual Voltage Test / Interference Test and record results.

D.4 Record where TCAIDs are fitted and carry out NR/SMS/PartB/Test/043 (Track Circuit Aid (TCAID) Test).

D.5 Record where Force Down Treadles are fitted and confirm that they are working / timing correctly.

OTHER CONSIDERATIONS

O.1 Consider the impact rail head treatment has had by reviewing the RCM traces post treatment. If treatment is ineffective consideration shall be given to applying T002 in full.

O.2 Consider if track circuit might be shorter than the minimum length required.

O.3 Consider possible problem with train.

O.4 Consider any relevant Special Inspection Notices (NR/SIN), Technical Instructions.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part08/T027		
Wrong Side Failure Test Guide: Automatic Train Protection (ATP) (GWML)		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Great Western Main Line ATP
Excludes:	Chiltern Line ATP

GENERAL

All test measurements shall be recorded on ATP (GWML) Test NR/SMS record card together with the reason for the test.

NON-DESTRUCTIVE TESTS

General

N.1 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc).

N.2 Note the nature of any work being done, or persons working in the area.

N.3 Note the time and the type of train or operation which first caused the reported failure to become apparent.

N.4 Note the time and type of operation last made, prior to the report which used the affected equipment.

Lineside Locations or Equipment Rooms

N.5 Check ATP enclosure and signal location or room is correctly locked or padlocked.

N.6 Check and record encoder indications.

N.7 Check for equipment security and tightness.

N.8 Check that equipment and settings correspond to the wiring diagram (specification, power, voltage rating, etc).

N.9 Check the insulation of cables and wires at terminations. Check that adjacent terminations are properly isolated from each other.

N.10 Check equipment for possible short circuits (nuts, washers, solder, off-cuts of wire, metallic dust, etc.).

N.11 Check for any unusual amounts of moisture.

Track Equipment

N.12 Check beacon is not damaged and is correctly positioned.

N.13 Check that all ATP beacons in the area on the same line are correctly offset from the centre of the track.

N.14 Check ATP loop is not damaged and correctly positioned.

N.15 Check for any signs of recent disturbances (wiring alterations, track maintenance or renewals activity).

N.16 Check for equipment security and tightness.

N.17 Check that equipment and settings correspond to the wiring diagram (specification, power, voltage rating, etc).

N.18 Check the insulation of cables and wires at terminations. Check that adjacent terminations are properly isolated from each other.

N.19 Check equipment for possible short circuits (nuts, washers, solder, off-cuts of wire, metallic dust, etc.).

N.20 Check for any unusual amounts of moisture.

Cables

N.21 Check ATP cables are not damaged (fires, squashed cables, etc).

N.22 Remove covers from trunking and check for safe insulation (chaffing, scorched, rodent damage).

N.23 Simulate reported condition, then:

Track Equipment

N.24 Test and record beacon(s) telegram/message.

N.25 Test and record beacon(s) signal strength.

N.26 Test and record loop telegram/message.

N.27 Test and record loop signal strength.

N.28 WIRE COUNT relevant equipment or circuits to the wiring diagram.

Lineside Locations or Equipment Rooms

N.29 Test ATP and UT output voltage, at input terminals of ATP enclosure.

N.30 Test ATP volts, level, etc.

N.31 EARTH TEST 110V AC bus bar.

N.32 WIRE COUNT relevant equipment or circuits to the wiring diagram.

Miscellaneous

N.33 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

DESTRUCTIVE TESTS

Track Equipment

D.1 WIRE COUNT relevant equipment or circuits to the wiring diagram.

D.2 Test resistance of loop.

Lineside Locations or Equipment Rooms

D.3 WIRE COUNT relevant equipment or circuits to the wiring diagram.

D.4 Simulate reported condition, Test back-up BITE memory and Record results.

D.5 Test ATP LIT and UT primary current.

Cables

D.6 INSULATION TEST all ATP cables.

D.7 INSULATION TEST signal head tail cable(s).

After reconnecting cables, check encoder indications.

Miscellaneous

D.8 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Destructive tests.

OTHER CONSIDERATIONS

O.1 Possible right-side failure not noticed by train crew.

O.2 Possible wrong side failure of signal not noticed by train crew.

O.3 Possible that signal to signal distance is different from ATP design details.

O.4 Possible that PSRs/TSRs have changed without ATP modification.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part08/T028		
Wrong Side Failure Test Guide: ATP (GWML) Reported WSF of signal, no allegation against ATP equipment		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Great Western Main Line ATP
Excludes:	Chiltern Line ATP

GENERAL

All test measurements shall be recorded on ATP (GWML) Test NR/SMS record card together with the reason for the test.

Follow normal WSF investigation procedures listed in NR/SMTH/Part08/T007 (Wrong Side Failure Test Guide: Lamp – No Light (Any Type)) or NR/SMTH/Part08/T008 (Wrong Side Failure Test Guide: Colour Light Signal), with the addition of the following steps:

NON-DESTRUCTIVE TESTS

N.1 Before any disconnections are made check and record ATP encoder indications. If they are working correctly, this can be taken as proof that there are no internal encoder faults which could affect signal head circuit.

N.2 If encoder indications are not correct there might be an internal fault and after all relevant conditions have been simulated, encoder shall be renewed and original sent for investigation.

DESTRUCTIVE TESTS

D.1 Carry out an INSULATION TEST on signal tail cable. This can be carried out in the normal way. ATP equipment shall be disconnected from signal head circuit by disconnecting ATP LITS.

D.2 Carry out an INSULATION TEST on the ATP cable from signal location to encoder. This can be carried out in the normal way after disconnecting ATP LITS in signal location and unplugging encoder.

D.3 After above tests, plug-in encoder and re-connect signal and ATP LITS. Check encoder indications and check they are working correctly.

END

Includes:	Siemens Class 700 rolling stock within the Thameslink ETCS Area
Excludes:	All other rolling stock and ETCS Areas and implementations

NOTE:

Tasks requiring the use of the WESTCAD Technician's Terminal (TT), WESTLOCK Technician's Facility (TF), Radio Block Centre Technician's Facility (RBC TF) and GSM-R Qualitative Analysis & Troubleshooting System (QATS) can be undertaken from locally or remotely (from another site) as listed in the table below.

System	Site	
	TBROC	LBER / Arch 886
WESTCAD Technician's Terminal (TT)	✓	
WESTLOCK Technician's Facility (TF)	✓	✓
GSM-R Qualitative Analysis & Troubleshooting System (QATS)	✓	✓
Radio Block Centre Technician's Facility (RBC TF)		✓

NON-DESTRUCTIVE TESTS

Three Bridges Rail Operating Centre

N.1 Note any other train movements in the affected area.

N.2 Note which Signaller is controlling the affected section of line.

N.3 Note the relevant indications.

N.4 Note the state of any relevant train describer displays.

N.5 Note the time and type of train (including vehicle class and number), event or operation that first caused the reported failure to become apparent.

N.6 Note the operating level & mode of the train (Level 2 / Level NTC, Full Supervision (FS) mode etc.) as shown on the WESTCAD-E (Service Control Workstation) General Information Display's Train List.

N.7 Note whether the train is at a signal or ETCS block marker and the relevant designation number.

N.8 Check and note if the movement authority was issued and then withdrawn.

N.9 Check and note if there are ESR/TSR's in place.

N.10 Note any unusual operating methods in place (hand-signalling, possessions, Single line working etc.)

N.11 Note the nature of any work being carried out on the suspect or associated equipment and any persons working in the area of the allegation.

N.12 Note the time and type of operation made prior to the report using the affected equipment.

N.13 Note any error reports occurring at the time of the allegation on the WestCad-E TT.

N.14 Note any failure alarms displayed on the WestCad-E TT that were present at the time of the allegation.

N.15 Using the WESTCAD Technician's Terminal, interrogate the WESTCAD-E (Service Control Workstation) Event Log to establish if a route request was made by the signaller or ARS (or equivalent of ARS where provided) and what that route was.

NOTE: *It is also possible to interrogate the WESTLOCK TF log to confirm if a route request was made by the signaller or ARS (or equivalent of ARS where provided) and what that route was.*

N.16 If a temporary speed restriction was active at the time and is suspected to be incorrect, download the SCS Event Log for retention and review it to determine what was entered by the user.

NOTE: *The RBC Event Log and QATS shows the temporary speed restriction in the movement authority issued to the train.*

N.17 Download electronic copies of the WESTCAD-E (Service Control Workstation) Status and Event Logs from the TT for retention, the copies shall where possible start when the route against which the allegation is made was last used.

N.18 Download electronic copies of the WESTCAD-E Trace Logs from the TT for retention and send copies to Siemens for analysis. The file shall, where possible, start when the route against which the allegation is made was last used.

N.19 Review any voice recordings relating to the allegation.

N.20 Obtain a statement if practicable from the Signaller which records the events that he / she recalls of the allegation.

N.21 Contact the Route Control Manager and request a statement from the driver which records the events that he / she recalls of the allegation.

N.22 Obtain a statement if practicable from any other person which records the events that he / she recalls of the allegation.

London Bridge Equipment Room / Arch 886

N.23 Note any error reports occurring at the time of the allegation on the WestLock and RBC TF(R).

N.24 Note any failure alarms displayed on the WestLock and RBC TF(R) that were present at the time of the allegation.

N.25 Interrogate WestLock and RBC TF(L) History File to establish if and the content of a movement authority sent by the RBC to the train. Print a copy of relevant information.

N.26 Download an electronic copy of the WESTLOCK log pertaining to the allegation via the TF for retention, the copy shall where possible start when the route against which the allegation is made was last used.

N.27 Download an electronic copy of the following logs for retention; RBC Event Log, Interlocking Log, Signalling Model Log, Alarms and Access Control Logs from the TF pertaining to the allegation by running a Test Log, the copies shall where possible start when the route against which the allegation is made was last used.

N.28 Interrogate the RBC Event Log to establish the content of the movement authority sent by the RBC to the train (including any temporary speed restriction if relevant).

N.29 Contact the Route Control Manager and request an annotated download of the on-board Juridical Recording Unit (JRU) data from the train pertaining to the allegation, the annotations shall start at the route prior to the one against which the allegation is made. For comparison, request the same for the last train to have used the route before the incident.

N.30 Interrogate the log of the GSM-R QATS (Qualitative Analysis & Troubleshooting System) to identify any irregularities or errors in the GSM-R system.

N.31 Interrogate the log of the GSM-R QATS (Qualitative Analysis & Troubleshooting System) to identify any irregularities or errors in the messages exchanged between the infrastructure and train.

N.32 Download an electronic copy of the GSM-R QATS data pertaining to the allegation for retention, the copy shall where possible start when the route against which the allegation is made was last used. For comparison, download the same for the last train to have used the route before the incident.

DESTRUCTIVE TESTS

D.1 Download an electronic copy of the WestCad-E data from the TT pertaining to the allegation, the copy shall where possible start when the route against which the allegation is made was last used.

OTHER CONSIDERATIONS

1. Possible error in Balise position.

2. Possible failure of train-borne equipment.

END

NON-DESTRUCTIVE TESTS

Route Control Centre

N.1 Note any other train movements in the affected area.

N.2 Note which Signaller is controlling the affected section of line.

N.3 Note the relevant indications.

N.4 Note the state of any relevant train describer displays.

N.5 Note any unusual operating methods in place (hand-signalling, possessions, single line working etc.)

N.6 Check if the movement authority was issued and then withdrawn.

N.7 Note the nature of any work being carried out on the suspect or associated equipment and any persons working in the area of the allegation.

N.8 Note the time and type of train (including vehicle class and number), event or operation that first caused the reported failure to become apparent.

N.9 Note the time and type of operation made prior to the report using the affected equipment.

N.10 Note any error reports occurring at the time of the allegation on the TT or SICAM.

N.11 Note any failure alarms displayed on the TT or SICAM that were present at the time of the allegation.

N.12 Interrogate the TT History File to establish if a route request was made by the Signaller and what that route was. Print a copy of relevant information.

N.13 Interrogate SICAM History File to establish if and the content of a movement authority sent by the RBC to the train. Print a copy of relevant information.

N.14 Review any voice recordings relating to the allegation.

N.15 Obtain on board data from the train pertaining to the allegation.

N.16 Obtain a statement if practicable from the Signaller which records the events that he/she recalls of the allegation.

N.17 Obtain a statement if practicable from the driver which records the events that he/she recalls of the allegation.

N.18 Obtain a statement if practicable from any other person which records the events that he/she recalls of the allegation.

DESTRUCTIVE TESTS

D.1 Download an electronic copy of the TT and SICAM data pertaining to the allegation, the copy shall where possible start when the route against which the allegation is made was last used.

D.2 Recreate the situation that prevailed at the time of the allegation and record the results.

END

NON-DESTRUCTIVE TESTS

Route Control Centre

N.1 Note the nature of any work being carried out on the suspect or associated equipment and any persons working in the area of the allegation.

N.2 Note the time and type of train (including vehicle class or number), event or operation that first caused the reported failure to become apparent.

N.3 Note any error reports occurring at the time of the allegation on the SICAM.

N.4 Note any failure alarms displayed on the SICAM that were present at the time of the allegation.

N.5 Interrogate SICAM History File to establish what position information was received by the RBC from the train at the suspect Balise Group and the two previous Balise Groups. Print a copy of relevant information.

N.6 Download an electronic copy of the SICAM data pertaining to the allegation, the copy shall where possible start when the route against which the allegation is made was last used.

N.7 Obtain on board data from the train pertaining to the allegation in particular Balise positioning information.

N.8 Obtain a statement if practicable from the Signaller which records the events that he/she recalls of the allegation.

N.9 Obtain a statement if practicable from the driver which records the events that he / she recalls of the allegation.

N.10 Obtain a statement if practicable from any other person which records the events that he / she recalls of the allegation.

On Site

N.11 Check the longitudinal position of the Balise Group.

N.12 Check the height and position between the rails of the individual Balise that make up the group.

N.13 Check the security of the Balise and brackets, including the condition of the sleepers and other track components to which the brackets are secured.

N.14 Check the messages programmed into the Balise Group involved in the allegation as well as the preceding two groups.

DESTRUCTIVE TESTS

D.1 Recreate the situation that prevailed at the time of the allegation and record the results.

END

GENERAL

The permission of the Signaller shall be obtained before any actions are taken that affect the normal working of an axle counter section.

The system shall not be restored to normal operation without permission of the Signaller.

On all systems, the Signaller is responsible for checking an axle counter section is clear before a system restore can take place.

Keep switched on mobile phones away from the counting heads (3m) as they can cause false counts/readings.

Keep metallic objects away from the counting heads. The movement of metallic objects including tools and jewellery across the upper surface of the counting heads can cause occupation of the track sections.

All test measurements shall be recorded on the record card together with the reason for the test.

There are three different ways of resetting and restoring an axle counter. NR/SMS/PartC/AX00 (Axle Counters General) details these different methods.

Certain forms might need to be completed before any restore procedure is enacted.

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note the relevant signal box indications for the relevant section(s).

NOTE: *The ACM100 system can have multiple detection points; the failure of one ACM100 might affect more than one track section.*

N.2 Note the state of any relevant train describer displays.

N.3 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc).

N.4 Note if any persons were working/ patrolling/ examining in the area and, if working, the nature of the work.

N.5 Note the time of the failure of the equipment and, if it occurred after the passage of a train, the type of train (passenger, freight, light engine etc).

NOTE: *An object hanging from a train can strike and damage rail contacts*

N.6 If a failure occurred after a passage of a train, note if there was anything unusual about it (slow moving train, long time in the section, emergency non-signalled movement).

N.7 Note any other train movements in the affected area.

Lineside Locations or Equipment Rooms

N.8 Check that the room or enclosure containing the ACM100 system is securely locked.

N.9 Check any site record cards or logbooks for relevant information.

N.10 Check for any signs of equipment damage.

N.11 Check and record the LEDs on the ACM100 system components.

NOTE: *The relevant SMS for the ACM100 system give some details of the equipment indications (NR/SMS/Appendix/13).*

N.12 If provided, check any system logging or recording media for relevant information.

N.13 Check the diagnostic website of the ACM100 system and record any details.

N.14 Check for signs of any recent activity (new works, temporary wiring, diversion of circuits, track maintenance activity).

N.15 Check that all equipment covers are securely fitted with no sign of tampering or attempted access to internal parts.

N.16 Visually inspect all cables or connecting leads are correctly inserted and secure.

N.17 Check the position and status of the reset relays (energised, de-energised).

N.18 Check for damage or contamination on or inside relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, strong smell, silver sulphide, metal flakes, bent or broken contact springs, corroded terminals).

N.19 Check that the relays correspond to the diagrams (type and specification, pin code, voltage, contact arrangement, single/double wound coils).

Record the last service date on the WSF form and forward to your SM(S).

N.20 Check that the equipment and settings correspond to the diagrams (specification, power, voltage rating, etc).

N.21 Check for silver migration on the rear of relay bases.

N.22 Check the equipment for any possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, etc).

N.23 If provided, check the room/case heating/cooling systems for correct operation.

NOTE: *Extremes of heat or cold can affect the operation of electronic equipment.*

N.24 Check the equipment for any signs of moisture or water contamination (leaking roofs, damaged or missing seals, flooding).

N.25 Check for possible radio interference (mobile phone masts, RETB aerials).

N.26 EARTH TEST (DC) or EARTH TEST (AC) circuits and supplies.

Lineside Connection Box (DISBOX)

N.27 Check the DISBOX for damage.

N.28 Check the DISBOX cover is correctly fitted and secure.

N.29 If in an electrified area, check that the earthing of the DISBOX is secure and effective.

N.30 Check the interior for signs of moisture.

N.31 Check for any possible short circuits (nuts, washers, solder, wire off-cuts, metallic dust, etc).

N.32 Check for possible radio interference (mobile phone masts, RETB aerials).

Wheel Detectors

N.33 Check the wheel detectors for damage.

N.34 Check the wheel detectors are secure.

N.35 Check for any debris or rubbish around the wheel detectors, particular check for any metal objects.

N.36 Check for signs of any recent activity (new works, track maintenance, etc.).

Cables & Wires

N.37 Check the trackside cabling for signs of damage cables squashed by rails in the cess, fire damage, rodent damage).

N.38 Check all cables and wires for safe insulation and check that all terminations are correctly insulated from each other.

Miscellaneous

N.39 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

N.40 Note any extraneous conditions or circumstances that could have an effect on the failure.

DESTRUCTIVE TESTS

Lineside Locations or Equipment Rooms

D.1 WIRE COUNT the relevant equipment or circuits to the wiring diagram and connecting leads/cables.

D.2 Remove the relays and check for damage or contamination on or inside the relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, strong smell, silver sulphide, metal flakes, bent or broken contact springs, corroded terminals).

D.3 Check relay plug board for correct pin code, silver migration, damage, spades pushed too far forward or broken contact insulators.

Cables

D.4 CABLE FUNCTION TEST line circuits.

D.5 INSULATION TEST all cables (tail, lineside, rack to rack).

Check cables are totally disconnected for this test as the high voltages involved will damage electronic components.

Lineside connection boxes and wheel detectors

D.6 Test the operation of the system by carrying out a test of the wheel detector at the detection points for the relevant section NR/SMS/PartB/Test/039 (Siemens ACM 100 – In Service Functional Test of Wheel Detector). Observe the indications on the LEDs at the relevant ACM100 during this test.

Miscellaneous

D.7 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Destructive tests.

OTHER CONSIDERATIONS

O.1 Possible remote-control system fault/failure.

O.2 Possible design error.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part08/T033		
Wrong Side Failure Test Guide: Balise		
Issue No. 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Siemens and Alstom Balises (including ETCS, SDO and ATO)
Excludes:	All other type of beacon or balise.

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc).

N.2 Note the nature of any work being done, or persons working in the area.

N.3 Note the time and type of train (including vehicle class or number), event or operation that first caused the reported failure to become apparent and whether the train approach was particularly slow.

N.4 Note the time and type of train or operation last made, prior to the report, which used the affected equipment.

N.5 Note any other train movements in the affected rea.

N.6 Note any significant weather conditions in the area.

NOTE: *Do not use metal measuring tapes when checking the balise position.*

N.7 Check for any signs of damage or missing equipment.

N.8 Check for security or tightness of equipment.

N.9 Check for signs of any recent disturbances (track maintenance or renewals activity, replacement mountings, equipment re-located).

N.10 Check the location of equipment, in conjunction with the Balise Sighting Form.

N.11 Check that equipment is correctly installed and centrally mounted.

N.12 Check the Identification (ID) label is identical on both the balise and the mounting bracket assembly.

Some Testing and Programming Tools generated strong electromagnet fields during their use. These can interfere with cardiac pacemakers and can have long-term detrimental effects on health.

N.13 Test the Balise telegram data through the air gap using the Testing and Programming Tool.

N.14 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

OTHER CONSIDERATIONS

O.1 Possible design error in telegram data.

O.2 Possible design error in specifying balise position.

O.3 Possible failure of train-borne equipment.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part08/T034		
Wrong Side Failure Test Guide: SDO Beacon		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Tracklink II & Tracklink III Beacons (SDO)
Excludes:	All other types of Beacon and Balise

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc).

N.2 Note the nature of any work being done, or persons working in the area.

N.3 Note the time and type of train (including vehicle class or number), event or operation that first caused the reported failure to become apparent and whether the train approach was particularly slow.

N.4 Note the time and type of train or operation last made, prior to the report, which used the affected equipment.

N.5 Note any other train movements in the affected area.

N.6 Note any significant weather conditions in the area.

Beacon

N.7 Check for any signs of damage or missing equipment.

N.8 Check for security or tightness of equipment.

N.9 Check for signs of any recent disturbances (track maintenance or renewals activity, replacement mountings, equipment re-located).

N.10 Check location of equipment in conjunction with the signalling plan or other form of local record.

N.11 Check that equipment is correctly installed and centrally mounted.

N.12 Check the two Beacon labels are correct for beacon type, part number, station CRS code, platform number and approach direction.

N.13 Test the Tag and Beacon.

Miscellaneous

N.14 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

OTHER CONSIDERATIONS

O.1 Possible design error in telegram data.

O.2 Possible design error in specifying balise position.

O.3 Possible failure of train-borne equipment.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part08/T036		
Wrong Side Failure Test Guide: Colour Light Signal – Degraded by Sunlight		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

***** ESCALATION EXEMPT *****

GENERAL

Failures resolved using this Test Guide only require Level 1 sign back.

A separate Investigation Report is not be required unless additional tests or tests not defined in this Test Guide are required to resolve the failure.

NON-DESTRUCTIVE TESTS

Signalbox

N.1 Note the time and type of train or operation that caused the failure to become apparent.

N.2 Note relevant signal box indications.

N.3 Note relevant lever or switch positions.

N.4 Establish from Signaller that the equipment operated normally and responded in the manner expected. Note details.

Signal Equipment

N.5 Note any significant weather conditions in the area (cloud cover, position and strength of sun).

N.6 Note aspects displayed.

N.7 Check background for any possible distractions. Check signal backboard is matt black and not discoloured or faded. Check other lighting factors with potential to contribute to confusion or degradation of aspect.

N.8 Check door is initially closed. Check that the seals on the door(s) are effective and that the door(s) are secured with padlock(s).

N.9 Check for damage. Check interior of signal head for dirt, deterioration, or moisture ingress.

N.10 Check for correct type of signal i.e. ground mounted or elevated.

N.11 Check for correct beam and hot strip alignment. See NR/SMS/PartC/SG00 (Signals: General) - Beam alignment.

N.12 Check condition of interior and exterior lenses (colour, type, clean, not damaged, contaminated or discoloured, etc.). Pay attention to the red aspect.

If the lenses are polycarbonate, check the lens is not beyond renewal date and not opaque with excessive scratching.

N.13 Check condition of any hoods (length, type, etc.).

Miscellaneous

N.14 Note any extraneous conditions or circumstances that could have an effect on the failure.

DESTRUCTIVE TESTS

Signal Equipment

D.1 Test voltages on all aspects and record results.

D.2 Visually check from the sighting distance of the signal that all aspects and indications are clear and visible. Carry out NRSMS/PartB/Test/302 (Signal Visibility Check).

END

GENERAL

A separate Investigation Report is not required unless additional tests or tests not defined in this Test Guide are required to resolve the failure.

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note the time and type of train or operation that caused the failure to become apparent.

Signal Equipment

N.2 Using the Signal Sighting Record, or the process in NR/SMS/PartB/Test/302 (Signal Visibility Check), identify the required reading distance (RRD). Walk towards the signal from the reading distance identified on approach to the signal, checking for obscurations to the driver's visibility of the signal.

N.3 Record findings on NR/SMTH/Part02/Form 21 (Obscuration Diagram).

N.4 Check background for any possible distractions, including street lighting. Check signal backboard (where fitted) is matt black and not discoloured or faded.

N.5 Signals that do not require folding down to access, check condition of lenses (colour, type, clean, not damaged, contaminated or discoloured, etc.). On multi-aperture signals pay particular attention to the red aspect.

If the lenses are polycarbonate, check they are not beyond renewal date and not opaque with excessive scratching.

Miscellaneous

N.6 Note any extraneous conditions or circumstances that could have an effect on the failure.

DESTRUCTIVE TESTS

Signal Equipment

D.1 Signals that require folding down to access, check condition of lenses (colour, type, clean, not damaged, contaminated or discoloured, etc.). On multi-aperture signals pay particular attention to the red aspect.

D.2 Recheck signal visibility after the obstruction has been removed. Carry out NR/SMS/PartB/Test/302 (Signal Visibility Test).

END

GENERAL

A separate Investigation Report is not required unless additional tests or tests not defined in this Test Guide are required to resolve the failure.

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note the time and type of train or operation that caused the failure to become apparent.

Signal Equipment

N.2 Using the Signal Sighting Record, or the process in NR/SMS/PartB/Test/302 (Signal Visibility Check), identify the required reading distance (RRD). Walk towards the signal from the reading distance identified on approach to the signal, checking for obscurations to the driver's visibility of the signal.

Record findings on NR/SMTH/Part02/Form/21 (Obscuration Diagram).

N.3 Check background for any possible distractions, including street lighting.

N.4 Check any signal backboard is effective.

Miscellaneous

N.5 Note any extraneous conditions or circumstances that could have an effect on the failure.

DESTRUCTIVE TESTS

Signal Equipment

D.1 Test voltage on filament lamp or check condition of oil lamp.

D.2 Test by operation of the equipment.

D.3 Recheck signal visibility after the obstruction has been removed. Carry out NR/SMS/PartB/Test/302 (Signal Visibility Test).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part08/T039		
Wrong Side Failure Test Guide: Automatic Train Protection (ATP) (Chilterns)		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Chiltern ATP
Excludes:	Great Western Main Line ATP

GENERAL

All test measurements shall be recorded on ATP (Chilterns) Test NR/SMS record card together with the reason for the test.

NON-DESTRUCTIVE TESTS

N.1 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc).

N.2 Note the nature of any work being done, or persons working in the area.

N.3 Note the time and the type of train or operation which first caused the reported failure to become apparent.

N.4 Note the weather conditions at time of fault or incident.

N.5 Note the time and type of operation last made, prior to the report which used the affected equipment.

Lineside Locations or Equipment Rooms

N.6 Check ATP equipment and signal location or room is correctly locked or padlocked.

N.7 Check and record LEU indications.

N.8 Check for equipment security and tightness.

N.9 Check the insulation of cables and wires at terminations. Check that adjacent terminations are properly isolated from each other.

N.10 Check equipment for possible short circuits (nuts, washers, solder, off-cuts of wire, metallic dust, etc.).

N.11 Check for any unusual amounts of moisture.

Track Equipment

N.12 Check ATP loop is not damaged and correctly positioned.

N.13 Check for any signs of recent disturbances (wiring alterations, track maintenance or renewals activity).

N.14 Check for equipment security and tightness.

N.15 Check equipment for possible short circuits (nuts, washers, solder, off-cuts of wire, metallic dust, etc.).

N.16 Check for any unusual amounts of moisture.

Cables

N.17 Check ATP cables are not damaged (fires, squashed cables, etc).

N.18 Remove covers from trunking and check for safe insulation (chaffing, scorched, rodent damage).

Simulate reported condition, then:

Track Equipment

N.19 Test and record loop telegrams.

N.20 Test and record loop current.

Lineside Locations or Equipment Rooms

N.21 Test ATP power and signal interface voltages, at input terminals of ATP LEU.

N.22 EARTH TEST (DC) or EARTH TEST (AC) 110VAC bus bar.

N.23 WIRE COUNT relevant equipment or circuits to the wiring diagram.

Miscellaneous

N.24 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Non-Destructive tests.

DESTRUCTIVE TESTS

Track Equipment

D.1 WIRE COUNT relevant equipment or circuits to the wiring diagram.

D.2 Test resistance of loop.

Lineside Locations or Equipment Rooms

D.3 WIRE COUNT relevant equipment or circuits to the wiring diagram.

D.4 Simulate reported condition, test loop telegrams.

D.5 Remove TELGEN Card and check EPROM’s (correct data and installation).

Cables

D.6 INSULATION TEST all ATP cables.

D.7 INSULATION TEST signal head tail cable(s).

Miscellaneous

D.8 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI/) for any other relevant Destructive tests.

OTHER CONSIDERATIONS

O.1 Possible right-side failure not noticed by train crew.

O.2 Possible wrong side failure of signal not noticed by train crew.

O.3 Possible that signal to signal distance is different from ATP design details.

O.4 Possible that PSRs/TSRs have changed without ATP modification.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part08/T040		
Wrong Side Failure Test Guide: ATP (Chilterns) Reported WSF of Signal, No Allegation Against ATP Equipment		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Chiltern ATP
Excludes:	Great Western Main Line ATP

GENERAL

All test measurements shall be recorded on ATP (Chilterns) Test NR/SMS record card together with the reason for the test.

Follow normal WSF investigation procedures, those covered by NR/SMTH/Part08/T007 (Wrong Side Failure Test Guide: Lamp – No Light (Any Type)) or NR/SMTH/Part08/T008, (Wrong Side Failure Test Guide: Colour Light Signal) with the addition of the following steps:

NON-DESTRUCTIVE TESTS

N.1 Before any disconnections are made check and record ATP LEU indications.

N.2 If LEU indications are not correct there might be an internal fault and after all relevant conditions have been simulated, SIGANP Card shall be renewed and original sent for investigation.

DESTRUCTIVE TESTS

D.1 Carry out an INSULATION TEST on the ATP cable from signal location to LEU. This can be carried out in the normal way after disconnecting signal interface switches in signal location and disconnecting the cable at the LEU.

D.2 After above tests, reconnect the LEU and signal interface switches. Check that LEU indications are working correctly.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part08/T041		
Wrong Side Failure Test Guide: Automatic Warning System (AWS) **Reduced Testing of Extra-Strength (Green) AWS Magnet following Code 5 failure**		
Issue No: 01	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Extra-Strength (Green) AWS Magnet with a code 5 failure
Excludes:	Suppressor type AWS, Standard (Yellow) AWS, portable/temporary AWS and all other AWS fault codes

GENERAL

Units fitted with Standard-Strength AWS Receivers are known to suffer with Code 5 Failures (Bell Vice Horn) when passing over Extra-Strength permanent magnets.

Prior to using this Reduced Test, the following shall be confirmed:

a) The AWS magnet concerned is Extra-Strength type.

b) The AWS magnet concerned is not a suppressed type.

c) The AWS magnet concerned is not a portable type.

d) The unit concerned is known to have a Standard-Strength Receiver fitted (see Table 1).

e) A subsequent train has reported to have received correct AWS indication with the associated signal displaying a cautionary aspect.

If any of the above pre-checks cannot be confirmed, then authority to use this Test Plan shall be gained from the SFI Level 2.

Units known to have Standard-Strength Receivers		
On-Track-Plant (OTP)	**Locomotives**	**Multiple Units**
ALL	Class 66	Class 313
	Class 67	Class 165
	Class 73	Class 769
	Class 92	Class 319

Table 1 – Units with Standard Strength Receivers

NON-DESTRUCTIVE TESTS

N.1 Note the AWS involved and its location.

N.2 Note the details of the unit involved including Headcode, Unit Number, Unit Class, Unit type.

NOTE: *On gaining authority from SFI Level 2 the AWS may be offered back for normal working and the remaining test plan steps N3 to N5 deferred for up to a maximum 91 days from the initial report. If authorised to defer the remaining tests, a WAIF should be raised in ellipse by the SM(S) responsible for the AWS and the record closed in FMS as 'WSF fault found as per NR/SMTH/Part08/T041".*

N.3 Check and note any signs of recent works or disturbances at the AWS and for 50m in advance of / beyond the AWS.

N.4 Check and record the position of the magnet(s) and associated ramps according to the relevant configuration detailed in Figure 1.

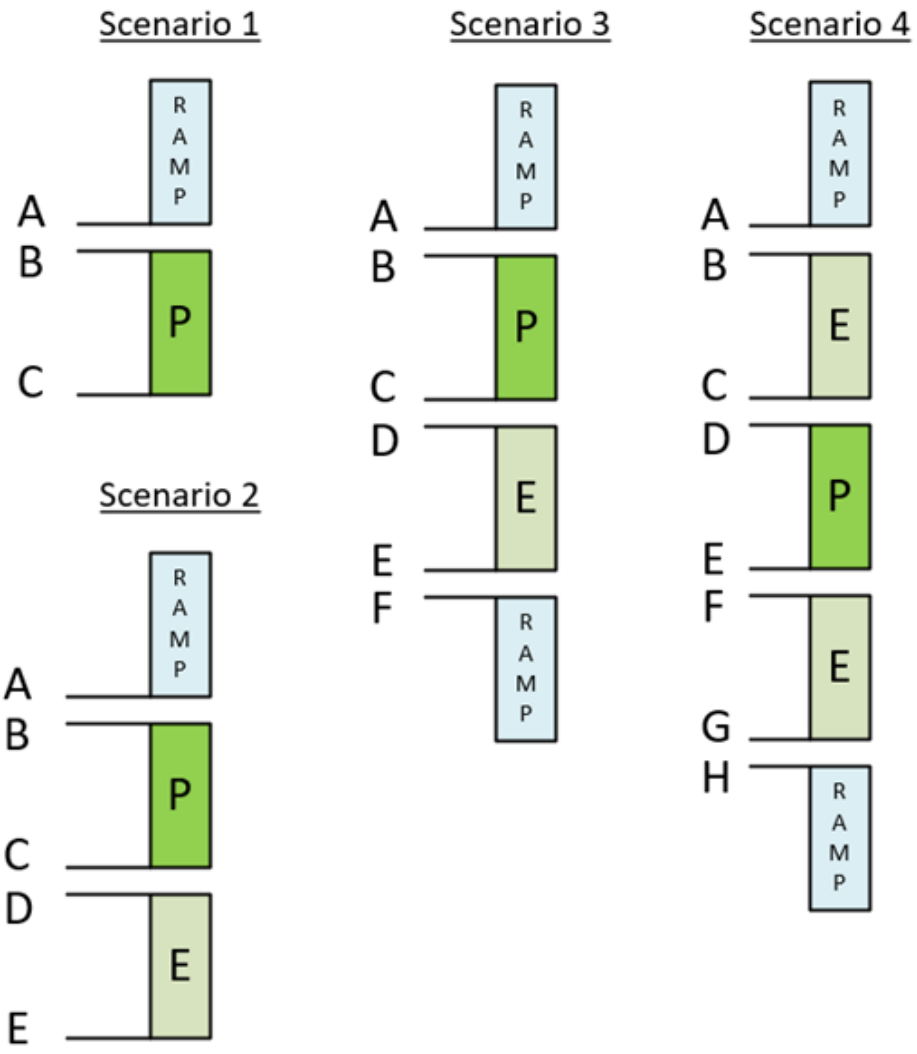

Figure 1 – AWS Configuration Scenarios

N.5 Check that the magnet is centrally located in the 4-foot (+/-10mm from track centre line).

APPENDIX A - Reduced Test Plan form

T011-SR	FMS Report No.	Incident Date	Incident Time	Signal Box
Initial Report Detail				
Pre-Check	Confirmed	Detail / How confirmed		Initials
AWS is Extra-Strength and is not suppressed or portable type	Yes/No			
Unit concerned is known to have Standard Strength Receiver fitted	Yes/No			
Subsequent train has reported correct AWS indication with the associated signal displaying a cautionary aspect	Yes/No			
SFI Level 2 giving authority to use this Reduced Test (if a pre-check not confirmed)				
Name			Date	Time
Reduced Test Plan Part A				
N1	Signal Identity		AWS Identity	Location
N2	Train ID (Headcode)	Unit Number	Class (if not OTP)	Unit Type (Loco / EMU / OTP)
SFI Level 2 giving authority to defer further testing and resume normal working				
Name			Date	Time
SFI Level 1				
Name	Signature		Date	Time

If Part B deferred and AWS offered back for normal working			
SM(S)Responsible for AWS	Ellipse W/O number	W/O Created Date	Required Finish Date (max 91 days from initial report)

Reduced Test Plan Part B				
N3	Check and note any signs of recent works or disturbances at the AWS and for 50m in advance of / beyond the AWS.			
N4 (measurements in mm + is above rail level – is below rail level)	Arrangement Scenario No.		1 / 2 / 3 / 4	
	A	B	C	D
	E	F	G	H
N5	Check AWS is centrally located (+/-10mm from Track Centre)			
	Yes / No			
SFI Level 1				
Name	Signature		Date	Time

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part08/T042		
Wrong Side Failure Test Guide: Temporary Automatic Warning System (AWS) Associated with Speed Restrictions		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Temporary Magnets (e.g. Yardene)
Excludes:	Standard Automatic Warning System (see SMTH/Part08/T011)

GENERAL

All test measurements shall be recorded.

NON-DESTRUCTIVE TESTS

Signal Box

N.1 Note any unusual operating methods in place (hand-signalling, possessions, single line working, etc).

N.2 Note the nature of any work being done, or persons working in the area.

N.3 Note the time and type of train (including vehicle class or number), event or operation that first caused the reported failure to become apparent and whether the train approach was particularly slow.

Class 319 electric multiple units automatically sense the traction system, so will display to the driver if the traction is DC. The AWS setting defaults to standard strength and will remain so until the driver selects the extra-strength setting (for DC traction areas). If the driver does not correctly set the AWS system to the right sensitivity, the AWS might indicate a Code 5 WSF.

On routes operating class 377/2, 377/5, and 376/6 electric multiple units, confirm that the AWS receiver on the rail vehicle is operating in the correct mode of operation (AC or DC).

This is particularly applicable to failures on services that are operating on a route that has traversed an AC & DC electrified boundary.

N.4 Note the time and type of operation last made, prior to the report, which used the affected equipment.

N.5 Note any other train movements in the affected area.

N.6 If practicable, arrange to have the OTMR (On-Train Monitor and Recorder) downloaded and analysed from the train involved in the failure.

On-Track Equipment

N.7 Check the magnet is situated in the correct location (refer to ESR/TSR/PSR design).

N.8 Note the type of magnet fitted (e.g. Single-Rail Yardene Yellow or Green, Two-Rail Vortok, Two-Rail BR Yellow or Green, etc).

N.9 Check if a calibration label is fitted and note the date.

N.10 Check position of magnet (height in relation to the rail head, centre of track).

***NOTE**: Yardene Single-Rail types are not required to be height tested.*

N.11 Check equipment is correct type (Standard - yellow or Extra-Strength - green).

N.12 Check for other potential sources of magnetic field nearby (e.g. impedance bonds, DC traction cables).

N.13 Take several digital photographs of the magnet with at least one showing the complete installation.

N.14 Check for any other magnets within 250m (274 yards) in either direction on the same line as the AWS under investigation. If one is found, measure and note the distance between the two magnets.

N.15 Check for damage.

N.16 Check for rail defects in the area of the magnet.

Miscellaneous

N.17 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI) for any other relevant non-destructive tests.

DESTRUCTIVE TESTS

On-Track Equipment

D.1 Check that the magnet is secured properly to the rail(s) so that it does not move when touched.

D.2 Test for correct strength and polarity (using S&P meter) **(EXCLUDING YARDENE and VORTOK types).**

Miscellaneous

D.3 Check Special Inspection Notices (NR/SIN), Technical Instructions (NR/TI) or Letters of Instruction (NR/BS/LI) for any other relevant destructive tests.

OTHER CONSIDERATIONS

O.1 Possible failure of train borne equipment.

END

Includes:	Siemens Class 717 rolling stock within the NCL ETCS Area
Excludes:	All other rolling stock and ETCS Areas and implementations

GENERAL

NOTE: *Tasks requiring the use of the WESTCAD Technician's Terminal (TT), WESTLOCK Technician's Facility (TF), Radio Block Centre Technician's Facility (RBC TF) and GSM-R Qualitative Analysis & Troubleshooting System (QATS) can be undertaken from locally or remotely (from another site) as listed in Table 1.*

TF System Available	Site	
	YROC	KX Signal Box
WESTCAD Technician's Terminal (TT)	✓	
WESTLOCK Technician's Facility (TF-L)	✓	
GSM-R Qualitative Analysis & Troubleshooting System (QATS)	✓	✓
Radio Block Centre Technician's Facility (RBC TF-L)	✓	
Technician's Facility (TF-R+)		✓
Technician's Facility (TF-R) KX SB	✓	

Table 1

NON-DESTRUCTIVE TESTS

YROC

N.1 Note any other train movements in the affected area.

N.2 Note which Signaller is controlling the affected section of line.

N.3 Note the relevant indications.

N.4 Note the state of any relevant train describer displays.

N.5 Note the time and type of train (including vehicle class and number), event or operation that first caused the reported failure to become apparent.

N.6 Note the operating level and mode of the train (Level 2 / Level NTC, Full Supervision (FS) mode etc.) as shown on the WESTCAD-E(SS) (Service Control Workstation) General Information Display's Train List.

N.7 Note whether the train is at a signal or ETCS block marker and the relevant designation number.

N.8 Check and note if the movement authority was issued and then withdrawn.

N.9 Check and note if there are ESR/TSR's in place

N.10 Note any unusual operating methods in place (hand-signalling, possessions, Single line working etc.)

N.11 Note the nature of any work being carried out on the suspect or associated equipment and any persons working in the area of the allegation.

N.12 Note the time and type of operation made prior to the report using the affected equipment.

N.13 Note any error reports occurring at the time of the allegation on the Westcad-E(SS) TT.

N.14 Note any failure alarms displayed on the Westcad-E(SS) TT that were present at the time of the allegation.

N.15 Using the WESTCAD Technician's Terminal, interrogate the WESTCAD-E(SS) (Service Control Workstation) Event Log to establish if a route request was made by the Signaller or ARS (or equivalent of ARS where provided) and what that route was.

NOTE: *It is also possible to interrogate the WESTLOCK TF log to confirm if a route request was made by the Signaller or ARS (or equivalent of ARS where provided) and what that route was.*

N.16 If a temporary speed restriction was active at the time and is suspected to be incorrect, download the SCS Event Log for retention and review it to determine what was entered by the user.

NOTE: *The RBC Event Log and QATS shows the temporary speed restriction in the movement authority issued to the train.*

N.17 Download electronic copies of the WESTCAD-E(SS) (Service Control Workstation) Status and Event Logs from the TT for retention, the copies shall where possible start when the route against which the allegation is made was last used.

N.18 Download electronic copies of the WESTCAD-E(SS) Trace Logs from the TT for retention and send copies to Siemens for analysis. The file shall, where possible, start when the route against which the allegation is made was last used.

N.19 Review any voice recordings relating to the allegation.

N.20 Obtain a statement if practicable from the Signaller which records the events that they recall of the allegation.

N.21 Contact the Route Control Manager and request a statement from the driver which records the events that they recall of the allegation.

N.22 Obtain a statement if practicable from any other person which records the events that they recall of the allegation.

KX Signal Box

NOTE: *YROC Also has TF equipment available for carrying out steps below.*

N.23 Note any error reports occurring at the time of the allegation on the TF(R).

N.24 Note any failure alarms displayed on the TF(R) that were present at the time of the allegation.

N.25 Interrogate RBC TF(R) History File to establish if and the content of a movement authority sent by the RBC to the train. Print a copy of relevant information.

N.26 Download an electronic copy of the WESTLOCK log pertaining to the allegation via the TF for retention, the copy shall where possible start when the route against which the allegation is made was last used.

N.27 Download an electronic copy of the following logs for retention; RBC Event Log, Interlocking Log, Signalling Model Log, Alarms and Access Control Logs from the TF pertaining to the allegation by running a Test Log, the copies shall where possible start when the route against which the allegation is made was last used.

N.28 Interrogate the RBC Event Log to establish the content of the movement authority sent by the RBC to the train (including any temporary speed restriction if relevant).

N.29 Contact the Route Control Manager and request an annotated download of the on-board Juridical Recording Unit (JRU) data from the train pertaining to the allegation, the annotations shall start at the route prior to the one against which the allegation is made. For comparison, request the same for the last train to have used the route before the incident.

N.30 Interrogate the log of the GSM-R QATS (Qualitative Analysis & Troubleshooting System) to identify any irregularities or errors in the GSM-R system.

N.31 Interrogate the log of the GSM-R QATS (Qualitative Analysis & Troubleshooting System) to identify any irregularities or errors in the messages exchanged between the infrastructure and train.

N.32 Download an electronic copy of the GSM-R QATS data pertaining to the allegation for retention, the copy shall where possible start when the route against which the allegation is made was last used. For comparison, download the same for the last train to have used the route before the incident.

DESTRUCTIVE TESTS

D.1 Download an electronic copy of the Westcad-E SS data from the TT pertaining to the allegation, the copy shall where possible start when the route against which the allegation is made was last used.

OTHER CONSIDERATIONS

O.1 Possible error in Balise position.

O.2 Possible failure of train-borne equipment.

END

Ref:	**NR/SMTH/Part/09**
Issue:	03
Date:	02 December 2023
Compliance date:	02 March 2024

NR/L3/SIG/11231

NR/SMTH/Part/09

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INDEX

END

GENERAL

1. These U series “Intermittent and Obscure Failure Guides” have been introduced in the form of check lists to detail the suggested checks and tests which shall be carried out when investigating:

    a) Intermittent or repetitive failures.

    b) Failures where the root cause is not readily apparent.

    c) Where equipment is found to be working correctly upon arrival at the reported fault location.

2. Wrong Side Failures shall always be investigated using the correctly selected Test Guide(s) from the T series.

3. Further faulting guidance can be found within the documents listed in NR/SMTH/Part/10 (Faulting Guides) and in relevant Manufacturer's Documentation.

Intermittent and Obscure Failure Guides

4. The Faulting Guides are presented in a similar style to the Test Plans, with the guide being used to aid when testing/checking on site to determine the potential cause of any failure.

5. The checks listed are not intended to be a comprehensive test sequence or be in the correct order for every circumstance. Checks and tests considered most relevant to the reported failure shall be carried out first.

6. If no cause is apparent after these checks, advise your SM(S) and seek type specific fault-finding information from available sources.

Records

7. Complete the Signalling Intermittent and Obscure Failure check sheet in NR/SMTH/Part02/Form/14. Any measurement results or test records shall be included or attached.

8. If any item is replaced under NR/SMTH the SMTH logbook sheet shall also be included.

9. If you are investigating a SPAD, write down the results of each test that you complete and send it to your SM(S). Remember to identify any root cause as well as the actual cause of the failure.

10. If operating staff decline access to equipment for test/check purposes record this fact on the SMTH logbook sheet and advise your SM(S)

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part09/U002		
Intermittent/Obscure Failure Guide: Point Machines		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Power Operated Points
Excludes:	Clamp locks and EP points, Suspected WSF

GENERAL

Point failure is a common cause of reported signal failure and reported change of aspects. This Test Guide gives you guidance on the checks and tests required.

Signal box and Signaller Checks

1. Check with the Signaller and/or infrastructure fault control whether the equipment affected has shown a similar failure characteristic prior to this fault.

2. Check that no work has been recently completed in the area (e.g. stagework, S&C tamping, new huck bolts or point heater pads fitted).

Point Operation

3. Remove the point machine covers and ask the Signaller to operate the points to the normal and reverse positions.

   If the point motor does not run, the fault is within the point control circuit or the motor (see Steps 10 to 19).

   If the point motor runs but the points do not move, the fault might lie in the clutch mechanism (see Steps 20 to 22).

   Observe point operation and look for:

   a) Excessive time of operation

   b) Erratic operation

   c) Loose or obstructed fittings

   d) Movement of the point machine

   e) Poor supplementary drive operation, condition and adjustment

   f) Arcing contacts.

   NOTE: *If the points correctly operate, the facing point or detection mechanisms could still be out of adjustment (see Steps 23 to 36).*

General Checks

4. Check security and condition of point machine (was it locked upon arrival at fault location?).

5. Check the security of the point machine on its base / mountings – does it move when points are operated?

6. Check that all internal components are secure and lubricated.

7. Check tail cables, glands and terminations.

8. Check heaters.

9. Examine any snubbing contacts or diodes and check snubbing is effective.

Motor does not operate / weak operation

10. Check the crank handle reset contact (adjustment, condition).

11. Ask the Signaller to operate the points and measure the motor voltage and current (each affected end).

    This might identify a fault in the tail cable or the power supply.

12. Check the clutch slip current.

13. Check the motor brushes and commutator.

    Make sure the brushes are secure, not worn or jammed and that the commutator is not high resistance.

14. Check the motor control contacts (sparks, arcing, adjustment, condition).

15. Check that the point control relays operate when the Signaller controls the points.

    If the relays do not operate, the fault lies in the line-side circuit or interlocking controls. Using the record diagrams, identify the control circuit and trace any fault.

16. Check the point control relays and bases.

17. Measure the line circuit voltages at the incoming links and the relay coils.

18. Check the security of links and terminations in the location, any disconnection box and in the point machine.

19. Check that the point drive bar does not run back after completing its stroke.

Motor operates but the points do not move

20. Is the clutch slipping?

    Look for obstructions within the machine and in the points.

21. Check the clutch assembly and fixings.

22. Check the wiring and clutch control circuit.

Points move but do not lock

23. Carry out NR/SMS/PartB/Test/001 Facing Point Locks Tests (Machine).

    If the FPL has to be adjusted, the route cause for it shall be investigated.

24. Check the lock slide, throw bar and lock rod.

    Check that the lock rod is not damaged, and nuts and lock nuts are tight.

Points are locked but not detected.

25. Carry out NR/SMS/PartB/Test/011 (Detector Tests (Electrical Detectors)).

    If the detection has to be adjusted, the route cause for it shall be investigated.

26. Carry out NR/SMS/PartB/Test/019 (Detection Loop Test).

27. Measure the detection voltage at outgoing and incoming links (each affected end).

28. Check the detection rods, nuts and lock nuts.

    Check that the detector rods are not damaged, and nuts and lock nuts are tight.

    Also check that the rods are not obstructed.

29. Check the detection contacts and detection assembly (high resistance).

    Check that the contacts are clean, correctly aligned and that the required spring pressure is present.

30. Check the wiring, links and terminations in the location, any disconnection box and in the point machine.

31. Check that the detection relays operate when the Signaller controls the points.

    If the relays correctly operate, the fault lies in the line-side circuit or interlocking controls. Using the record diagrams, identify the control circuit and trace any fault.

32. Check the detection relays and bases.

33. Check the relay spades and wiring.

34. Measure the line circuit voltages (or line levels) at the busbar and outgoing links.

35. INSULATION TEST the tail cable.

36. Carry out NR/SMS/PartB/Test/052 Dynamic Earth Tests.

Supplementary Detector

37. Carry out NR/SMS/PartB/Test/016 Detection Test (Supplementary Detectors).

38. Measure the incoming and outgoing detection voltages.

39. Open the detector and check:

    a) The equipment is clear of obstruction or metallic objects.

    b) Internal cables and wiring (including insulation).

    c) Cable terminations are tight.

    d) Detector contacts are correctly adjusted.

    e) Sufficient spring tension and correct alignment.

    f) Contact surfaces are clean and in satisfactory condition.

    g) Tappets, sliders, rocker mechanisms.

    h) Micro-switches and tappets.

Lineside Location or Equipment Room

40. Check whether a data logger is fitted to the affected points – what information is available regarding the current failure?

    (In SSI areas, check Technician's Terminal).

41. Measure voltage and current at points supply battery when under load.

42. EARTH TEST (DC) or EARTH TEST (AC) relevant busbars.

43. Check that fuses and links are secure within clips/holders (and that contact areas are clean).

44. Check for signs of overheating (touch/smell) in supply T/Js, control, indication and proving relays.

45. Check security of other related equipment (e.g. SSI modules, interlocking units/modules).

46. Check condition of control, indication and proving relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

47. Check condition of point contactor relay.

48. Test insulation and continuity of tail & lineside cables.

    If necessary, advice should be obtained from the Section Manager (Track).

Track

49. Where possible, fit a void meter and measure the vertical movement of the track following the passage of a train.

    Report as corrective maintenance if voiding exceeds 5mm.

50. Check for evidence of run through.

51. Is there any obvious damage to the track components and stretcher bars? (loose stretchers, bolts, blocks etc).

52. Note the stock rails and switch rail profiles.

    Are the points fitting up correctly?

    Is there any lipping?

53. Measure the track gauge and switch openings at the switch toes and back-drive positions.

54. Is there anything that could prevent the point blades from correctly operating? Obstructions, kicking ends, rail creep etc.

55. Check the slide chairs and chair (huck) bolts.

    a) All bolts shall be fitted, intact and tight (front slide chair bolt not fouling, sole plate/gauge stops, excessive voiding, kick shoes not binding).

    b) Switch rails shall be properly supported on slide chairs and rollers.

    c) Metal slide chairs shall be lubricated.

    d) Teflon or plastic slide chairs shall not be lubricated.

56. Check switch rollers are properly adjusted NR/SMS/PartC/PF03 (Point Fittings: Switch Rollers).

57. Check the security of external mechanical fittings.

58. Check additional drive adjustment (5 – 8mm clearance).

59. If a supplementary drive is fitted:

    a) Are cranks, fittings and “A” frames secure?

    b) Does the heel of the switch meet the stock rail before the toe?

    c) Does the heel of the switch prevent the toe from fitting up properly?

60. Check that back drive cranks are ‘in action’.

61. Check for excessive wear on the switch rail (if excessive, this can cause the toe to fit under head of stock rail).

62. Check that any point machine or detector box stabilisation plates are secure and undamaged.

63. Check for lost motion/excessive wear in supplementary drives.

64. Check adjacent rail joints are correctly packed and free from excessive vertical movement.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part09/U003		
Intermittent/Obscure Failure Guide: Rail Clamp Point Lock		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Mk 1, Mk 2 and Mk 3 Clamp Locks
Excludes:	Suspected WSF

GENERAL

Point failure is a common cause of reported signal failure and reported change of aspects. This Test Guide gives you guidance on the checks and tests required.

Signal Box and Signaller Checks

1. Check with the Signaller and/or infrastructure fault control whether the equipment affected has shown a similar failure characteristic prior to this fault.

2. Check that no work has been recently completed in the area (e.g. stagework, S&C tamping, new huck bolts or point heater pads fitted).

Point Operation

3. Remove the lock body covers and ask the Signaller to operate the points to the normal and reverse positions.

   Inspect pump unit. Look and listen for:

   a) Hydraulic leaks.

   b) Unusual sounds.

   Observe point operation and look for:

   a) Excessive time of operation.

   b) Erratic operation.

   c) Loose or damaged lock bodies.

   d) Loose or damaged centre thrust bracket.

   e) Hydraulic leaks.

   f) Poor supplementary drive operation, condition and adjustment.

General Checks

4. Check security of points (were detector box and power pack lids locked upon arrival at fault location?).

5. Check security of lock bodies (do they move when points are operating?).

6. Check security of centre thrust bracket (does it move when points are operating?).

7. Check for any obvious hydraulic pipe or cable damage.

8. Check that all internal components are secure and lubricated.

9. Check tail cables, glands and terminations.

Track

If necessary, advice shall be obtained from the Section Manager (Track).

10. Where possible, fit a void meter and measure the vertical movement of the track where a train pass.

    Report as corrective maintenance if voiding exceeds 5mm.

11. Check for evidence of run through.

12. Is there any obvious damage to the track components or stretcher bars? (loose stretchers, bolts, blocks, etc).

13. Measure the track gauge and switch openings at the switch toes and back-drive positions.

14. Is there anything that could prevent the point blades from correctly operating? Obstructions, kicking ends, rail creep etc.

15. Check the slide chairs and chair ('huck') bolts.

    All bolts shall be fitted, intact and tight (front slide chair bolt not fouling, sole plate/gauge stops, excessive voiding, kick shoes not binding). Switch rails shall be properly supported on slide chairs or rollers. Metal slide chairs shall be lubricated.

16. Check the profile of stock rails and switch rails.

    a) Are the points fitting correctly?

    b) Is there any stock rail 'lipping'?

17. Check adjacent rail joints are adequately packed and free from excessive vertical movement.

18. If a supplementary drive is fitted:

    a) Are cranks, 'A' frames and fittings secure?

    b) Does the heel of the switch meet the stock rail before the toe?

    c) Does the heel of the switch prevent the toe from fitting up properly?

    d) Check additional drive adjustment (5 to 8mm clearance).

Tests

19. Facing Point Lock Test NR/SMS/PartB/Test/003 (Facing Point Lock Tests – Clamp Lock).

    If the FPL or detection has to be adjusted, the route cause for it shall be investigated.

20. Detection Test NR/SMS/PartB/Test/013 (Detection Test – Clamp Lock).

21. Supplementary Detection Test NR/SMS/PartB/Test/016 (Detection Test – Supplementary Detectors).

22. Place an obstruction in the open switch and test the operation of the cut-out.

Supplementary Detector

23. Open the detector and check:

    a) The equipment is clear of obstructions or metallic objects.

    b) Internal cables and wiring (including insulation).

    c) Cable terminations are tight.

    d) Detector contacts are correctly adjusted sufficient spring tension and correct alignment.

    e) Contact surfaces are clean and in satisfactory condition.

    f) Tappets, sliders, rocker mechanisms.

    g) Micro-switches and tappets.

24. Measure the incoming and outgoing detection voltages.

Lineside Location or Equipment Room

25. Check whether a data logger or remote condition monitoring is fitted to the affected points – what information is available regarding the current failure?
(In SSI areas, check Technician's Terminal).

26. or EARTH TEST (AC) the relevant busbars.

27. Detection Loop Test NR/SMS/PartB/Test/019.

28. Measure incoming and outgoing line circuit voltages and remote control system levels.

    This might identify a problem in the line circuits. Consider repeating this test at the interlocking end of the circuit.

29. Measure voltage and current at points supply battery when under load.

30. Check condition of control, indication and proving relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

    The relays should be secure and the correct retaining clips should be fitted.
    Look for signs of overheating or burned contacts.

31. Check condition of point contactor relay.

32. Check for signs of overheating (touch / smell) in supply T/Js, control, indication and proving relays.

33. Check security of other related equipment (e.g. SSI modules, interlocking units or modules).

34. Check the wiring and terminations.

    Use the record diagrams and check each wire termination.
    Look particularly for loose terminations, loose back nuts and spade connectors, and high resistance soldered joints.

35. Check that fuses and links are correct rating, secure within clips / holders (and that contact areas are clean).

    Consider replacing the fuses.

36. INSULATION TEST the tail cables.

Pump Unit (see also NR/SMS/PartC/PB11 - Clamp Lock Hydraulic Points)

37. Check the hydraulic fluid level and pressure.

38. Look for leaks in the hydraulic rams and hoses.

39. Test for air NR/SMS/PartB/Test/015 (Clamp Lock: Test for Air in the System) and top up fluid as necessary.

40. Check electrical terminations. Check for signs of weakness in the crimps.

41. Measure the motor voltage during operation.

42. Check the normal and reverse valves are not sticking.

43. Check the motor brushes and commutator (security, condition, wear).

44. Manually operate the pump unit and look for incorrect operation.

Lock and Detector Mechanisms

45. Check terminations and wiring. Check for signs of weakness in the crimps.

46. Measure the incoming and outgoing point detection voltage.

47. Check microswitches and tappet settings. Check microswitches are free to move and have a positive snap action (ITW type excepted).

    The cam follower tappet screws shall protrude no more than 25mm.

48. Check the bodies are secured to the stock rail. Fixing bolts 250Nm, locking piece bolts 60Nm.

49. Check for loose bolts or cracked bodies. Check that the body sideplates are not cracked using an approved method. **(Mk 1s ONLY).**

50. Check for excessive wear on mounting studs **(Mk 1s ONLY).**

51. Lock and Detection Test NR/SMS/PartB/Test/014 (Lock and Detector Full Test – Clamp Lock) as necessary.

52. Check that the drive lock slide travels fully.

53. Check the locking piece is tight.

Clamp Lock Mechanism (open switch)

54. Check the switch rail bracket assembly is tight, refer to NR/SMS/PartZ/Z02 (Points Reference Values) for torque values.

55. Check the lock arm is free on the pivot pin and the pivot pin is free to rotate.

    This proves the 3mm clearance between the lock arm and drive lock slide.

56. Check that the lock arm and detection arm are both free to move independently on the brass bush **(Mk 2 ONLY)** or spherical bearing **(Mk3 ONLY).**

57. Check the lock slide cam is solid.

    If it is loose, check the Allen key on the underside of the drive lock slide.

58. Look for wear on the cam follower and fixed cam.

59. Check the lock slide 'Spirol' pin is flush. **(Mk2 only).**

60. Lubricate as necessary (**NOTE**: Mk3 spherical bearing/bush assemblies are dry joints and do not require lubrication).

Clamp Lock Mechanism (closed switch)

61. Check there is 4 to 12mm clearance between the top of the drive lock coupling and the bottom of the lock arm.

62. Check the drive lock slide is fully locked:

    - Mk 1 lock slide flush with the end of the body.
    - Mk 2 lock slide protrudes 25 to 30mm beyond the body.
    - Mk 3 lock slide protrudes > 71mm beyond the body.

Four Foot Fittings

63. Check the rams and hydraulic connections.

64. Check the tie bar is not fouling the thrust bracket assembly or rams (3mm clearance). **(Mk1 and Mk2 only).**

65. Check clearance between front stretcher bar and rail underside.

66. Check points/ram bay not obstructed by ballast/paper.

67. Check clearance between first P Way bolt and lock arm assembly mounting bolt.

68. Check all fittings are secure.

Final Test

69. Carry out NR/SMS/PartB/Test/003 (Facing Point Lock Test (Clamp Lock)).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part09/U004		
Intermittent/Obscure Failure Guide: Electro-Pneumatic Points		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Electro-Pneumatic Points with Intermittent/Obscure Failures
Excludes:	Suspected WSF

GENERAL

Point failure is a common cause of reported signal failure and reported change of aspects. This Test Guide gives you guidance on the checks and tests required.

Signal Box and Signaller Checks

1. Check with Signaller and/or infrastructure fault control whether the equipment affected has shown a similar failure characteristic prior to this fault.

2. Check that no work has been recently completed in the area (e.g. stagework, S&C tamping, new huck bolts or point heater pads fitted).

Point Operation

3. Remove the machine covers and ask the Signaller to operate the points to the normal and reverse positions.

   Inspect valve chest. Look and listen for:

   a) Air leaks.

   b) Unusual sounds.

   Observe point operation and look for:

   c) Excessive time of operation.

   d) Erratic operation.

   e) Point drive running back after completing its stroke.

   f) Flashes or sparks from electrical contacts.

   g) Movement of the mechanism relative to the bearers.

   h) Poor supplementary drive operation, condition and adjustment.

General Checks

4. Check security and condition of point machine (was it locked upon arrival at fault location?).

5. Check the security of the point machine on its base/mountings – does it move when points are operated?

6. Check that all internal components are secure and lubricated.

7. Check tail cables, glands and terminations.

8. Check heaters.

Track

If necessary, advice shall be obtained from the Section Manager (Track).

9. Where possible, fit a void meter and measure the vertical movement of the track where a train pass.

Report as corrective maintenance if voiding exceeds 5mm.

10. Check for evidence of run through.

11. Is there any obvious damage to the track components or stretcher bars? (loose stretchers, bolts, blocks, etc).

12. Measure the track gauge and switch openings at the switch toes and back-drive positions.

13. Is there anything that could prevent the point blades from correctly operating? obstructions, kicking ends, rail creep etc.

14. Check the slide chairs and chair (huck) bolts.

All bolts shall be fitted, intact and tight (front slide chair bolt not fouling, sole plate/gauge stops, excessive voiding, kick shoes not binding). Switch rails shall be properly supported on slide chairs and rollers. Metal slide chairs shall be lubricated.

15. Check the stock rails and switch rail profiles.

a) Are the points fitting up correctly?

b) Is there any stock rail lipping?

16. Check adjacent rail joints are correctly packed and free from excessive vertical movement.

17. If a supplementary drive is fitted:

    a) Are cranks, '"A' frames and fittings secure?

    b) Does the heel of the switch meet the stock rail before the toe?

    c) Does the heel of the switch prevent the toe from fitting up properly?

    d) Check additional drive adjustment (5 to 8mm clearance).

Tests

18. Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

    If the FPL or detection has to be adjusted, the route cause for it shall be investigated.

19. Carry out NR/SMS/PartB/Test/011 (Detector Tests (Electrical Detectors).

20. Carry out NR/SMS/PartB/Test/016 (Detection Test (Supplementary Detectors)).

21. Place an obstruction in the open switch and test the operation of the cut-out.

Supplementary Detector

22. Open the detector and check:

    a) The equipment is clear of obstructions or metallic objects.

    b) Internal cables and wiring (including insulation).

    c) Cable terminations are tight.

    d) Detector contacts are correctly adjusted for correct alignment and spring tension.

    e) Contact surfaces are clean and in satisfactory condition.

    f) Tappets, sliders, rocker mechanisms.

    g) Micro-switches and tappets.

23. Measure the incoming and outgoing detection voltages.

Lineside Location or Equipment Room

24. Check whether a data logger or remote condition monitoring is fitted to the affected points – what information is available regarding the current failure? (In SSI areas, check Technician's Terminal).

25. Carry out an EARTH TEST (DC) or EARTH TEST (AC) on the busbars.

26. Carry out NR/SMS/PartB/Test/019 (Detection Loop Test).

27. Measure incoming and outgoing line circuit voltages and remote-control system levels.

    This might identify a problem in the line circuits. Consider repeating this test at the interlocking end of the circuit.

28. Check condition of control, indication and proving relays (cracked casing, internal moisture, insects, foreign matter, contact arcing, internal cloudiness, silver sulphide, metal flakes, bent or broken contact springs, or corroded terminals).

    The relays shall be secure and the correct retaining clips shall be fitted.

    Look for signs of overheating or burned contacts.

29. Check for signs of overheating (touch/smell) in supply T/Js, control, indication and proving relays.

30. Check security of other related equipment (e.g. SSI modules, interlocking units or modules).

31. Check the wiring and terminations.

    Use the record diagrams and check each wire termination.

    Look particularly for loose terminations, loose back nuts and spade connectors, and high resistance soldered joints.

32. Check that fuses and links are correct rating, secure within clips/holders (and that contact areas are clean).

    Consider replacing the fuses.

33. Carry out an INSULATION TEST on the tail cables.

Valve Chest

34. Is the air valve turned up too high?

    This can cause air to escape through the relief valve.

35. Check air pipes and fixings.

36. Check electrical terminations.

37. Are the normal and reverse valves sticking?

38. Check detection and valve coupler contacts.

Point Drive and Detector Mechanism

39. Is the piston correctly adjusted?

40. Are all fixings tight?

41. Are the stroke adjusting screws secure?

42. Are point drive and detector rods secure?

43. Do any moving parts require lubricating?

44. Are electrical contacts contaminated with dirt or oil?

45. Check contact springs and contact surfaces.

46. Measure the incoming and outgoing detection voltages.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part09/U005		
Intermittent/Obscure Failure Guide: Track Circuits		
Issue No: 02	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Right Side Failure due to Intermittent/obscure aspect
Excludes:	Suspected WSF

GENERAL

Track circuit failure is a common cause of reported signal failure and reported change of aspects. This Test Guide gives you guidance on the checks and tests required.

Good record keeping is essential to refer to and review later.

For EBI200 and EBI400 type track circuits use of the ETTCM is recommended. Where this is not available, TTM or MTM is acceptable.

It is not acceptable to test EBI Track 200 or 400 without a TTM, MTM or ETTCM.

Signal Box, Signaller and Remote Checks

1. Check with Signaller and/or Infrastructure Control whether the track circuit affected has shown a similar failure characteristic prior to this fault.

2. Check if any work has been recently completed in the area (e.g. stagework, track maintenance or renewals activities).

3. Check data logger, Technician's Terminal, Remote Condition Monitoring – what information is available regarding the current failure to ascertain the failure mode?

   In DC traction areas, ascertain if recent Thermal Imaging camera footage is available for the line and ask for this to be reviewed.

4. Check with Electrification Control Room (if in AC / DC traction area) whether any nearby traction current circuit breakers have tripped and reset. Also check if there are any known intermittent power supply failures that could be affecting the track circuit.

5. Check whether any associated equipment might have caused the track circuit to drop (e.g. Shunting Treadle / Track Circuit Interrupter / Special Feed)?

Track Circuit Tests

6. Carry out Service A of the relevant track circuit type, see NR/SMS/PartC/TC02 - TC17

   In DC traction area, if practicable to do so, monitor track circuit relay/receiver voltage whilst trains are in section and drawing current.

   If DC traction interference or traction return imbalance is suspected, use DMM (Double Millivolt Meter) to identify fault.

7. Carry out Service A of NR/SMS/PartC/TC30 (Track Circuits: Additional Bonding Check).

   In DC traction areas, at impedance bonds, where fitted, check integrity of all bond-rail connections and advance plate connections. Look for signs of arcing, overheating or corrosion indicating water ingress.

   If practicable, monitor connections using a thermal imaging camera or IR phone adapter whilst trains are in section and drawing current.

   For 50Hz AC and FS2600 Impedance Bonds, INSULATION TEST auxiliary coil to the bond casing. A reading of less than 1MΩ is not ideal but >200kΩ (>0.2MΩ) is acceptable to remain in work and not likely to be the cause of the fault.

8. Test and record track circuit rail voltages using the correct meter (e.g. for EBI types use ETTCM), measuring at regular intervals starting at the Feed/Transmitter through to the Relay/Receiver end (look for an even voltage gradient along the length of the track circuit).

   Voltage should fall linearly through the circuit, except where intermediate impedance bonds or intermediate tuning capacitors are fitted.

9. For 50Hz AC, FS2600, EBI200 and EBI400, measure and record track circuit rail current (e.g. by using a Rocoil or Lemflex in conjunction with the correct meter) in each rail. Measure at regular intervals starting at the Feed/Transmitter end through to the Relay/Receiver end (look for loss or unexplained variation). Pay particular attention to rail connections (look for fluctuation when the connection is subject to vibration or movement).

   Current should remain at a constant level throughout the track circuit, except where intermediate impedance bonds or intermediate tuning capacitors are fitted.
   In a double-rail configuration, track circuit current in each rail should be equal (+/- 2%).

10. For DC Track Circuits, carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

11. For 50Hz AC, HVI, EBI, Reed and FS2600 Track Circuits, refer to RIA 021 Issue 4 Section 7 and carry out IBJ Electrical Fault Finding.

12. Check on metal structures, that the signalling rail is insulated from structure that the line passes over (e.g. wheel-timber bridges). Look for loose or misaligned timber straps, tie bars, walkway fittings, etc.

13. Track Circuit Full Test NR/SMS/PartB/Test 251 - 263. Compare results with previous readings and investigate any significant variations.

14. CONTINUITY TEST the tail cables.

15. INSULATION TEST the tail cables.

16. Compare the resistance of duplicate tail cables using a current clamp. For further details see NR/SMS/PartC/TC00 (Track Circuits General) - Section 8.

17. Check relevant TCAIDs and connections for security and damage (if fitted), and that TCAID is switched on and that its battery is working within specification.

18. Check any disconnection boxes for water ingress or contamination and for integrity of connections and terminations.

19. Check the rail clip insulations on concrete and metal sleepers (using the rail clip tester where available).

20. Check other insulations throughout TC length (rail foot, point fittings) for security and damage.

21. Check that rail clip insulations are correctly installed (i.e. right way up) and correct type.

22. Check height and condition of ballast through track circuit length (dirty, damp, other contamination).

23. Check for short circuits through signal wires, point rodding, point heater leads/strips and clamp lock hoses.

24. Check condition and drainage of track (particularly in tunnel areas) for ‘wet spots’, etc.

25. If track circuit is over a Level Crossing, check for salt contamination in Bowmac units.

Lineside Location or Equipment Room

26. EARTH TEST (DC) or EARTH TEST (AC) the busbars.

27. Check terminations on track links, surge arrestors, and fuse-holders.

28. Check main and tail cable terminations, crimps, links and back nuts.

29. Check power supplies, fuses and fuse-holders.

30. Examine the track circuit feed units, relays (TR, TPR, etc.) and bases. Look for signs of overheating or burned contacts. Check that wire terminations and straps are secure.

    The equipment should be secure and the correct retaining clips should be fitted to plug-in units.

31. Check front and rear of relay/receiver base for silver migration.

32. Measure the voltages at the busbar and across the TPR contacts. Look for a volt drop, which might indicate a high resistance contact.

    Whilst monitoring the outgoing TPR voltage, lightly tap the relay which might indicate an intermittently high resistant contact or low contact pressure.

33. Measure incoming and outgoing line circuit voltages and remote control system levels.

    This might identify a problem in the line circuits. Consider repeating this test and checking the equipment at the interlocking end of the circuit.

Follow Up steps if root cause not identified

34. Plot the readings taken in Steps 6 and 7 on a graph to draw a voltage (and current where applicable) vs distance profile of the track circuit, identify areas of concern to investigate further.

35. In DC Traction areas, disassemble, clean and re-make every rail and impedance bond connection.

36. On EBI Single-Rail types, renew any Surge-Protected ETU (SPETU) for ETU.

37. On TI21 / EBI types, change Tuning Units at both ends of the track circuit and any abutting zero-pole TUs at tuned zones.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part09/U006		
Intermittent/Obscure Failure Guide: Colour Light Signals		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	All types and styles of both filament and LED signal
Excludes:	Alleged SPAD or change of aspect, Suspected WSF

GENERAL

This Test Guide gives you guidance on the checks and tests required, in the event of signal failure not associated with point, track circuit or barrier failure.

Signal Box and Signaller Checks

1. Check with the Signaller and / or infrastructure fault control whether the equipment affected has shown a similar failure characteristic prior to this fault.
2. Check that no work has been recently completed in the area (e.g. stagework).
3. Check with Signaller if any other signals were replaced when signal failed.

Signal Head Checks

4. Measure signal lamp / module voltage compare results with last reading on record card.

   For LED Modules this voltage is taken in the location case.

   If the voltage requires adjustment, the reason shall be determined.

5. Check security and condition of signal head (was it locked upon arrival at fault location?).
6. Check security of all electrical terminations (including back nuts, crimps) in signal head.
7. Check any Plug and Play cable connections are secure and locked into position.
8. Check security of filament test crimps (if fitted).
9. Check the lamp is seated correctly in the lamp holder.
10. Check security of filament changeover relays (ERs) and that they are correctly fitted.
11. Check that all ER terminal pins are intact.
12. Check security and condition of lamp holders, contacts, base of lamps.
13. Check security and condition of signal head transformer.
14. Check for signs of overheating in ERs or head transformer.

15. If signal affected is an ‘auto’, check Emergency Replacement Switch for correct operation.

16. Replace lamps and retain for investigation if required.

17. Replace ERs and retain for investigation if required.

18. Test lineside and tail cables for INSULATION / CONTINUITY.

19. Carry out an ASPECT TEST signal.

20. Carry out Full Test to appropriate NR/SMS.

Lineside Location or Equipment Room

21. Check whether a data logger or remote condition monitoring is fitted to the affected signal – what information is available regarding the current failure?
(In SSI areas, check Technician's Terminal).

22. Measure ECR/HR/DR line voltages.

23. Carry out EARTH TEST (DC) or EARTH TEST (AC) on the relevant busbars.

24. Check security of all electrical connections (including back nuts / crimps) of internal wiring, tail and lineside cable connections.

25. Check that relevant fuse and links are secure within clips and holders, and that contact areas are clean.

26. If signal is fitted with flashing aspects, check condition of FECR.

27. Check condition of ECR/ECROJ/HR/DR/TPR and aspect proving relays.

28. Check for overheating (touch / smell) in ECR/ECROJ/HR/DR/TPR and aspect proving relays.

29. Check security of relays and plug-in units and that retaining clips are correctly fitted.

30. Check relay spade connectors are secure.

31. Check security of other related equipment (SSI Modules / Westpac units).

32. Check that ECROJ is correctly adjusted, if fitted.

33. Test Lineside and tail cables for Insulation / Continuity.

34. If signal is operated from a mechanical signal box, check relevant circuit controller bands for security and condition.

35. Consideration shall also be given to checking the signal ahead of the one affected (e.g. for intermittent ECPR fault) and any points in the route to the next signal for bobbing detection.

36. Look for possible read through, signals on adjacent lines or other possible sources of visual interference or distractions, e.g. traffic lights, street lamps or advertising hoardings.

END

GENERAL

This Test Guide sets out the procedure to be adopted for dealing with a reported SPAD where no allegation is made against the signalling system.

If the driver (or other responsible person riding in the cab) admits passing the signal at danger, staff shall attend to the signal and check or determine the following features (within 48 hours of the initial report), but the signal need not be treated as defective. Where remedial actions are taken, these shall be noted on the SMTH logbook sheet.

If the correct operation of any equipment is doubted it shall be treated as defective and fully tested.

Signal Not Alleged Defective

1. Where evidence of the SPAD might have been recorded on a data logger, see NR/SMTH/Part05/Module/S07 (Evidence - Data Loggers and Condition Monitoring Systems), the recording shall be requested regardless of whether an allegation has been made against the signalling system.

2. Using a digital camera, take a photograph of the signal from a position 20m on approach, from the left-hand rail in direction of travel.

3. Check the signal asset is correctly aligned to the information on the Signal Sighting record, or the signal head record card, see NR/SMS/PartC/SG00 (Signals: General) - Signal Visibility and Beam Alignment.

4. Check the Signal Light Modules (SLM) are the correct type (Range / Beam), where specified on the Signal Sighting Record (**DORMAN LED SIGNALS ONLY**).

5. Using a digital camera, take a photograph through the alignment device and where the signal asset is misaligned, make adjustment to correct the alignment to the position stated on the Signal Sighting Record.

6. Check the seal on the lamp holder is intact (where fitted).

7. Check the signal head, lens hoods, backgrounds and anti-vandal guards (where fitted). Check the signal back board is not discoloured or faded (where fitted).

8. Check backlights, where provided. Backlights on elevated position light signals shall be blanked off.

9. Check all lenses/glasses are clean, both inside and out (where applicable), not damaged or discoloured and not obstructed. On multi-aperture signals, pay particular attention to the red aspect.

10. Check the close-up segment is correctly aligned according to the position of the signal.

11. Check if the lenses are polycarbonate. If so, they shall be in good condition i.e. not opaque or excessively scratched.

12. Check the interior of the signal head/indicator for deterioration, moisture ingress or contamination. Check that the seals on the door(s) are effective. Take remedial action if required.

13. Check where fitted the signal/indicator lamp voltage is correct (main and auxiliary) and adjust as necessary.

14. For semaphore signals, check that the arm, spectacle and, if fitted, the sighting board are clean and fit for purpose.

15. Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check) for the signal asset. Note the permissible speed approaching the signal may be required for this task.

16. Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check) for any associated banner repeater or co-acting signals.

17. Check whether any identified obscurations of the driver's visibility of the signal asset or associated banner repeater/co-acting signals are recorded on the signal sighting record.

18. If an obscuration of driver visibility is found, assess if this can be safely removed, e.g. vegetation growth, if safe to do so, remove it, noting any material removed.

19. Check that the signal structure is sound and upright. Measure the height of the red aspect above rail level and its lateral displacement from the running edge.

20. Check all signal identification plates. These shall be secure, correctly aligned, clean, legible, and displaying the correct number.

21. Using a digital camera, take a photograph of:

    a) The signal from the required reading distance on approach to the signal, and

    b) The signal from the minimum reading distance, and

    c) The signal from the AWS, where positioned at less than minimum reading distance, and

    d) The track approaching the signal, from the signal, as near as possible to the most restrictive aspect, and

    e) The track approaching the signal, from the signal through the alignment device.

22. Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check) for the cautionary aspect of the signal in rear of the signal that was passed at danger.

Additional Testing requirements at Signals where TPWS and TPWS+ are Fitted

On the TSS grids

23. To check the grids have not been transposed carry out the following:

a) NR/SMS/PartB/Test/230 (Train Protection and Warning System (TPWS) Tests) Sections 1, 2 & 3.

b) NR/SMS/PartC/TP11 (Train Protection & Warning System (TPWS) Clause 3.2.

c) Measure and record the distance between the signal post and the leading edge of the trigger grid.

d) Check the arming and trigger grids are fitted without a gap between them.

On the OSS grid and OSS+ grid (if fitted)

24. Carry out the following:

a) NR/SMS/PartB/Test/230 (Train Protection and Warning System (TPWS) Tests) Sections 1, 2 & 3.

b) NR/SMS/PartC/TP11 (Train Protection & Warning System (TPWS) Clause 3.2

c) The distance between the signal post and the leading edge of the trigger grid shall be measured and recorded.

d) The distance between the leading edge of the arming grid and the leading edge of the trigger grid shall also be measured and recorded.

Other Considerations

The rail head surface shall be examined from the AWS to the signal for contaminants such as leaf mulch or excessive grease from automatic grease applicators.

Low Sunlight

If the driver alleges aspect degradation by sunlight, then Test Guide NR/SMTH/Part08/T036 (Wrong Side Failure Test Guide: Colour Light Signal – Degraded by Sunlight) shall be followed.

If there is reason to believe that low sun, or any other lighting interference, is a possibility, the following checks shall be performed:

a) As far as possible confirm that interference from the sun, or other light source is in fact the cause of the difficulty to read.

b) Carry out the checks in steps 1 to 22, above.

c) Then adjust the lamp voltage on the red aspect to the maximum level that just prevents 12.1V being exceeded at the time of day when the voltage is highest (when power demand is least). Record the details of the reason for lamp voltage adjustment on the signal record card so the maintainer is aware of the issue **(EXCLUDES LED SIGNALS).**

d) If the signal is one of a group of signals that are adjacent to each other (such as on a gantry) then the red aspect voltage of all signals in the group are to be similarly adjusted. This is to avoid one signal appearing brighter than the others, which in itself can cause misreading.

e) Where applicable, and after consulting with the Signal Sighting Engineer, consider fitting long hoods to the main aspects and any junction indicator which is read in conjunction with the main aspects.

Other Obscuration

If the driver alleges physical obscuration, then Test Guides NR/SMTH/Part08/T037 (Wrong Side Failure Test Guide: Colour Light Signal – Obscured by Obstruction) or NR/SMTH/Part08/T038 (Wrong Side Failure Test Guide: Mechanical Signal – Obscured by Obstruction) shall be followed.

NOTE: *Permitted obscurations between the RRD/MRD and asset position are defined on the Signal Sighting Record*.

If there is other reason to believe that obscuration is a possibility, carry out the checks in steps 1 to 22, above. Under these circumstances, if it can be confirmed that the obstruction is intermittent (as is often the case in vegetation), then the signal need not be treated as defective, but the situation shall still be attended to as quickly as possible.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part09/U008		
Tests Following an Alleged Change of Aspect (COA)		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	SPADs where an allegation is made against the signalling system
Excludes:	SPADs where no allegation is made against the signalling system, Suspected WSF

GENERAL

This Test Guide sets out the procedure to be adopted for dealing with a reported change of signal aspect (COA) or SPAD where a cause is not obvious at the commencement of investigation.

It applies when a colour light signal reverts to a more restrictive aspect, or a COA is observed by a Driver or Signaller, provided it can be confirmed that the signal concerned, or the signal in rear, was displaying the correct aspect prior to the reported incident (either by the Signaller or by a data logger).

If this cannot be confirmed, or the Signaller disputes the driver's alleged aspect sequence, a WRONG SIDE FAILURE shall be assumed, which shall be investigated using the Test Guide(s) in the T series.

Most signalling equipment failures have the potential to cause a COA. A SPAD is dependent on the position of trains at the time of the COA.

A SPAD is classified as Category B if a signal returns to danger in front of a train because of a signalling fault, and the train runs past the signal.

NR/SMTH/Part05/Module/S16 (Signals passed at danger (SPADs)), tells you how SPADs and COA failures are managed.

Records

Where a COA has resulted in a SPAD, you shall record the results of each check and send them to your SM(S). Remember to identify any root cause as well as the actual cause of the failure.

Signal Box and Signaller Checks

1. Check with Signaller and/or infrastructure fault control whether there is a history of COAs or SPADs at this signal.

2. What signal aspect was displayed before the signal returned to danger?

3. Is the expected aspect displayed?

4. What was the aspect sequence leading up to this signal?

   If the signal aspect was less restrictive than expected, you shall report that a wrong side failure has occurred and then apply testing in accordance with NR/SMTH/Part08 (WSF Test Guides).

   If the train driver reported a change of aspect, you shall continue with this Test Guide.

5. Did the Signaller control the signal to danger in front of the train?

6. If yes, the SPAD shall be reported as a Category C or a non-technical Category B SPAD. You do not need to do any more testing.

7. Did the Signaller receive any indication or information that could be the cause of the COA?

8. Check with Signaller if any other signals were replaced when signal failed.

9. Is there any evidence of an irregular train movement, which could have caused an irregular aspect sequence?

10. Check that no work has been recently completed in the area (e.g. stagework).

Signal Location or Equipment Room

Following a SPAD, the signal might have been signed out of use. An unauthorised 'OFF' aspect shall not be displayed to the driver of a train while you are carrying out tests.

11. Check whether a data logger, Technicians Terminal or remote condition monitoring is fitted – what information is available regarding the current failure?

    Where the data logger indicates a momentary failure of a relevant track circuit, or a loss of point detection, then the Test Plan for that equipment shall be used to find the cause of the intermittent failure.

12. Appendix 1 provides a defined list of failure modes. Select the failure mode and then apply relevant checks.

13. EARTH TEST (DC) or EARTH TEST (AC) relevant busbars.

14. Using the signalling record diagrams, identify the signal control circuit.

15. Check relays and bases (secure spades, retaining clips in place). Look for damaged or burned contacts.

16. What is the position of the signal aspect controlling relay, i.e. DR (2 aspect), HR, GR, or UR, if reverting to red (HHR or DR, if reverting to yellow or double yellow)?

a) If the relay is energised and the signal is displaying more restrictive aspect, look for a fault in the signal aspect circuit (go to Step l).

b) If the controlling relay is energised and the signal is showing the correct OFF aspect, there might be an intermittent fault in the relay control circuitry.

This might include:

c) Low voltage in the line circuits.

d) Transmission system levels out of specification (FDM, TDM).

e) Loose wire termination (including back nuts).

f) High resistance termination point.

g) High resistance contact or spade.

Intermittent failure of:

h) Point detection.

i) Track circuit.

j) Level crossing barrier detection.

k) Any other controlling function.

l) If the aspect controlling relay is de-energised, when it ought to be energised, trace the circuit through to find the cause.

This might include:

m) Fuse failure (blown, loose, dirty).

n) Power supply failure (main, battery).

o) Lamp out in the signal ahead.

p) Disconnected cable core or wire.

q) High resistance or disconnected cable termination point.

r) High resistance or disconnected contact spade.

s) Relay or plug-in unit failure.

t) Failure of a controlling function (relay position).

In this case the cause of the failure might be indicated to the Signaller (point detection, track circuit failure etc).

Signal Head

17. Carry out NR/SMS/PartB/Test/054 (Cable insulation Test) on the signal tail cable.

18. Are the signal lamps intact (both filaments) and correctly fitted to their lamp holders?

19. Are there any loose or disconnected wires or cable terminations? (internal and tail cables).

20. Is there anything that could have caused a short circuit?

21. Are there any signs of vandalism?

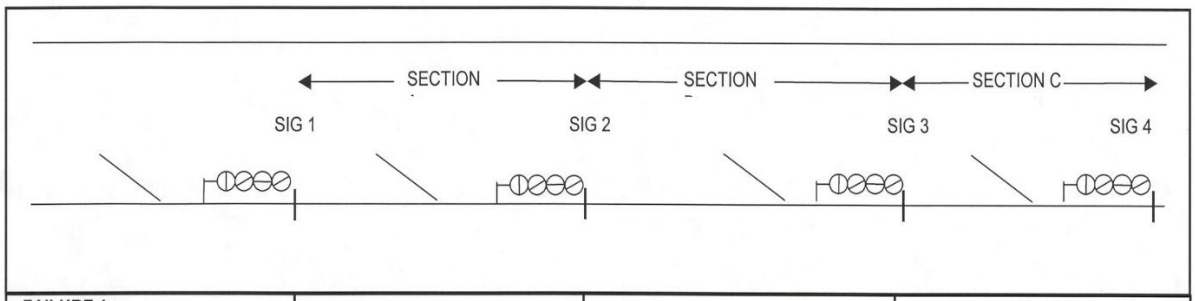
22. ASPECT TEST this signal and any related signals.

23. Carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests). Including standing voltages on unlit aspects.

24. Carry out NR/SMS/PartB/Test/022 (Signal Lamp and Light module Proving Tests).

25. Check the lamp filament proving relays (condition, security).

APPENDIX A - Defined Failure Modes



FAILURE 1: SIG 1 CHANGES G to YY CHECK: • SIG 1 DR LINE	CHECK: • SIG 2 HHR LINE	CHECK: • SIG 3 HR LINE	CHECK: • POINTS IN SECTION C • TRACK CIRCUITS IN SECTION C • SIG 4 FOR BLACK ASPECT
FAILURE 2. SIG 1 CHANGES G to Y: CHECK • TOP Y IF BLACK FOLLOW 1 • SIG 1 HHR LINE	CHECK: • SIG 2 HR. LINE	CHECK: • POINTS IN SECTION B • TRACK CIRCUITS IN SECTI0N B • SIG 3 FOR BLACK ASPECT	
FAILURE 3 SIG 1 CHANGES G to R CHECK: • SIG 1 HR LINE	CHECK: • POINTS IN SECTION A • TRACK CIRCUITS IN SECTI0N A • SIG 2 FOR BLACK ASPECT		

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part09/U009		
Right Side Failure Test Guide: Automatic Warning System (AWS)		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	AWS Right Side Failures
Excludes:	Suspected WSF

GENERAL

AWS equipment shall be repaired as quickly as possible. AWS is a primary safety system.

Whilst AWS is repaired, signal aspects shall be restricted for a maximum of 48 hours if authorised by a Level 3 SFI Engineer.

If the apparatus cannot be restored to normal working within 48 hours, the issue shall be escalated to the Signal & Telecoms Maintenance Engineer.

The Signal & Telecoms Maintenance Engineer shall arrange that resources necessary to rectify the defect are given a high priority.

If AWS is unable to be repaired within 48 hours and cannot be fully functional for a period of time, the aspect shall be returned to normal operation and train drivers advised about the defective AWS by means of a published notice.

1. Introduction

Table 1 summarises the AWS Failure Codes that can be reported to Signalling Technicians.

Required Audible Indication	Actual Audible Indication	Fault Code
CLEAR	HORN AND BELL	1
CLEAR	HORN INSTEAD OF BELL	2
CLEAR	NONE	3
WARNING	BELL AND HORN	4
WARNING	BELL INSTEAD OF HORN	5
WARNING	BRAKE WITHOUT HORN	6
WARNING	NONE	7
WARNING	INDICATOR DID NOT CHANGE TO YELLOW & BLACK (this is not a fault if it occurs after cancelling the AWS indication received when setting a driving cab into service)	7A
NONE	HORN	8
NONE	BELL	9
UNABLE TO CANCEL		10
INDICATOR NOT CHANGING TO ALL BLACK		11
AWS FAILS TO ARM		12
AWS FAILS TO DISARM		13

Table 1 – AWS Faults

Codes 5 and 7 could be infrastructure related and are Wrong Side Failures. Testing required after report of Code 5 or 7 failure is covered in NR/SMTH/Part08/T011 (Wrong Side Failure Test Guide: Automatic Warning System (AWS)).

2. Testing after Code 1 AWS Failure

This is likely to be a trainborne equipment fault. A train passing over an AWS magnet that is supposed to be present at very slow speed can cause the failure, but that is due to operating the AWS outside its design criteria.

When an AWS Code 1 is reported, determine from the Signaller/Driver where the train was and how fast it was going.

a) Train travelling at more than 5mph, fault occurred at AWS magnet. Trainborne problem, no further action necessary. Advise Signaller fault is not an infrastructure related issue.

b) Train travelling at less than 5mph or speed unknown, fault occurred at AWS magnet. Advise the Signaller that the fault is likely to be trainborne. No further action is necessary other than to advise your SM(S) that a code 1 AWS fault has occurred.

3. Testing after Code 2 AWS Failure

This could be an infrastructure failure or a trainborne equipment fault. This failure shall necessitate fault finding on site unless it is proven to be a trainborne fault (i.e. unit reports a string of code 2 failures at ‘clear’ signals (colour lights showing green or semaphore distant signals showing ‘off’).

If it is decided not to go to site because the same unit has reported several AWS failures, advise the Signaller that it is unlikely to be an infrastructure fault and request advice of further incidents.

If a site visit is required, undertake right side failure testing of the AWS installation, paying particular attention to the positioning, height and field strength (S&P meter) of the electro-magnet.

4. Testing after Code 3 AWS Failure

This could be infrastructure failure or a trainborne equipment fault. This failure shall necessitate fault finding on site unless it is proven to be a trainborne fault (i.e. unit reports a string of code 3 and 7 failures at ‘clear’ signals and signals displaying a caution/red aspect).

When an AWS Code 3 is reported, it could be a Code 7 failure waiting to happen. On arrival at site, concentrate on the permanent magnet.

Determine whether the Permanent magnet is effective by undertaking NR/SMTH/Part08/T011 (Wrong Side Failure Test Guide: Automatic Warning System (AWS)) - tests N01 to N05; N20 to N24. Test the Signal's permanent magnet for correct strength and polarity using an S&P meter.

If satisfied that everything is correct, this is likely to be a trainborne fault.

If the permanent magnet is a suppressor, and appears to be producing correct magnetic fields, undertake the remaining parts of NR/SMTH/Part08/T011 (Wrong Side Failure Test Guide: Automatic Warning System (AWS)). If nothing is found, check that the electro magnet is correctly operating, then advise the Signaller and offer the equipment back for service.

5. Testing after Code 4 AWS Failure

This is likely to be a trainborne equipment fault. It may be reported as either a bell and horn together or as a horn after bell – both are Code 4.

A train passing over an AWS magnet that is supposed to be present at very slow speed can cause the failure, but that is due to operating the AWS outside its design criteria.

When an AWS Code 4 is reported, determine from the Signaller/driver where the train was and how fast it was going.

a) Train travelling at more than 5mph, fault occurred at AWS magnet. Trainborne problem, no further action necessary. Advise Signaller fault is not an infrastructure related issue.

b) Train travelling at less than 5mph or speed unknown, fault occurred at AWS magnet. Advise the Signaller that the fault is likely to be trainborne. No further action is necessary other than to advise your SM(S) that a code 4 AWS fault has occurred.

6. Testing after Code 5 AWS Failure

Refer to NR/SMTH/Part08/T011 (Wrong Side Failure Test Guide: Automatic Warning System (AWS)).

7. Testing after Code 6 AWS Failure

This is likely to be a trainborne equipment fault. No further action necessary. Advise Signaller fault is not the infrastructure.

8. Testing after Code 7 AWS Failure

Refer to NR/SMTH/Part08/T011 (Wrong Side Failure Test Guide: Automatic Warning System (AWS)).

9. Testing after Code 7A AWS Failure

This is likely to be a trainborne equipment fault. A train passing over an AWS magnet that is supposed to be present at very slow speed can cause the failure, but that is due to operating the AWS outside its design criteria. There is also a very remote chance that another magnet too close or an extraneous strong magnetic field might lead to this failure.

When an AWS Code 7A is reported, determine from the Signaller/driver where the train was and how fast it was going.

Train travelling at any speed, fault occurred at AWS magnet. Determine from Signaller if any other trains have reported similar AWS problems.

If not, advise the Signaller that the fault is likely to be trainborne and request to be advised of any further occurrences in the area.

If Signaller reports further instances, go to site and examine the line seeking for extraneous magnets or sources of strong magnetic field.

10. Testing after Code 8 or Code 9 AWS Failure

This could be an infrastructure failure or a trainborne equipment fault. The only conceivable infrastructure causes are a right side failed suppressor or the train passing over a strong magnetic field that is not supposed to be present.

When an AWS Code 8 or 9 is reported, determine from the Signaller/driver where the train was and if other reports of code 8 or code 9 AWS failures have been received.

If the site is of a suppressor, go to site and test the suppressor for a right side failure.

If the site is away from an AWS installation, and the report is a one off, request the Signaller to advise you of any further instances of Code 8 or Code 9 failures in the area.

If Signaller reports further instances, go to site and examine the line for extraneous magnets or sources of strong magnetic field.

11. Testing after Code 10 AWS Failure

This can only be a trainborne equipment fault, a traction unit stopped with its receiver over an AWS magnet, or passing extremely slowly over a source of strong magnetic field.

When an AWS Code 10 is reported, determine from the Signaller/driver where the train was. If the train was over an AWS magnet, the AWS is operating outside its parameters and there is no fault. An extremely slow train could have the same symptom.

If the site is away from an AWS installation, and the report is a one off, request the Signaller to advise you of any further instances of Code 10 failure in the area. If Signaller reports further instances, go to site and examine the line seeking for extraneous magnets or sources of strong magnetic field.

12. Testing after Code 11 AWS Failure

This is can only be a trainborne equipment fault. Advise the Signaller that this is not an infrastructure fault.

13. Testing after Codes 12 and 13 AWS Failures

These can only be trainborne equipment faults. Advise the Signaller that they are not infrastructure faults.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part09/U011		
Intermittent/Obscure Failure Guide: Automatic Half Barrier Crossings		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Automatic Half Barriers
Excludes:	MCBs, ABCLs, Suspected WSF

GENERAL

This Test Guide gives you guidance on the checks and tests required in the event of one or more barriers lowering without a train or failing to rise after the passage of a train.

Signals are not required to protect an AHBC.

If one or more barriers fail to lower with a train approaching within the strike-in point (unless an intervening signal is at red), the failure is regarded as a WRONG SIDE FAILURE and shall be investigated using the Test Guide(s) in the T series.

Signal Box and Signaller checks

1. Check with the Signaller and/or infrastructure fault control whether the equipment affected has shown a similar failure characteristic prior to this fault.

2. Check that no work has been recently completed in the area (e.g. stagework).

GENERAL

Much can be learned from observing the barriers during their normal operation.

3. Observe the operation of the crossing on ‘auto’:

    a) Time taken for the barriers to fall and raise (any particular barrier slower than the others).

    b) Any moving parts snagging or falling off.

    c) Any signs of loose pedestal mountings.

    d) The 24V battery supply is recovering after each operation.

    e) Test the battery under load with the power off.

    f) The boom damping is effective (approx. 10° from horizontal).

    g) The above observations might lead you to an intermittent or potential barrier failure.

4. Check whether a data logger or remote condition monitoring is fitted – what information is available regarding the current failure? (in SSI areas, check Technician's Terminal).

Power Supply

5. Measure the battery voltage during the lower and raise cycle. Confirm that the battery charger power is on.

   The voltage during operation should not dip below 20V to 24V, depending on the battery type.

   When the barrier has raised, the battery charger should bring the battery voltage back up to 26V to 29V.

6. Test the battery under load with the power off.

7. Check electrolyte condition and levels of 24V standby battery.

8. Check electrolyte condition and levels of 24V standby battery.

9. Check 'Power Off' circuit works correctly.

On-Track checks

10. Check correct operation of treadles, including damper timing and gauging (maintenance instruction/specification).

11. Check security of treadle electrical terminations including tail cable and internal wiring.

12. Check security/condition of treadle tail cables.

13. INSULATION TEST and CONTINUITY TEST of tail cables to treadles.

14. Carry out a track circuit Full Test (NR/SMS/PartB/Test/251 to 263) on relevant up and down line.

For each Barrier Pedestal and Boom

15. Measure voltage and current at pump unit motor when under load.

16. Check booms are free from obstruction.

17. Check the security of electrical terminations (including internal and tail cable connections).

18. Check that circuit controller contacts are clean, free from excessive wear and correctly adjusted.

19. Check that the circuit controller is free from metallic dust and moisture.

20. Check the circuit controller linkage is free from excessive mechanical wear.

21. Check hydraulic fluid levels are correct.

22. Check for evidence of fluid leakage around hoses, unions and rams.

23. Check the motor brushes and commutators are in good order and free from dust.

24. Check all the pedestal mountings and fixings are intact and secure.

25. Check that boom counterweights are correctly adjusted and secure.

26. Check 'Local Control Switch' position and connections.

Hand Pump (BR843)

27. Hand pump each barrier to the raised position.

    The barriers should not drop between each pump.

28. Lift the pump handle and check that the barrier lowers.

    When you release the handle, the barrier should stop.

29. Check the shock absorber cannot be depressed by more than 3mm by finger pressure.

30. Check the operator's door micro-switch, wiring and terminations.

    Confirm that when you turn the key, the Yale lock is fully operated.

Barrier Location or Equipment Room

31. Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests).

32. Carry out NR/SMS/PartB/Test/019 (Detection Loop Test).

33. Check the security of electrical terminations (including internal and tail cable connections).

34. Check the security of back nuts on terminal blocks.

35. Check that fuses and links are clean and secure within their holders.

36. Measure incoming and outgoing line circuit voltages and remote-control system levels.

    This might identify a problem in the line circuits. Consider repeating this test at the interlocking end of the circuit.

37. Examine the control and detection relays and bases.

    Confirm the relays and spades are secure and the correct retaining clips are fitted.

38. Measure current in control circuit when under load.

39. Check condition of control, timer, indication and proving relays (for burnt contacts, condensation, silver migration, etc.).

40. Check for signs of overheating (touch/smell) in supply T/Js, control, timer, indication and proving relays.

41. Check relay base spade connectors are secure.

42. Check treadle stick and proving circuits operate correctly.

43. Check that relevant up/down road TPRs operate correctly.

44. Check ‘Another Train Coming’ circuit operates correctly.

45. Check RECR circuit is operating correctly.

46. Test insulation and continuity of tail and lineside cables.

47. Observe the passage of a train on both the up and down lines and confirm that the crossing functions correctly.

48. If no cause is apparent after these checks, advise your SM(S) and seek type specific fault-finding information from available sources. Also consider the fitting of a data logger.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part09/U012		
Intermittent/Obscure Failure Guide: Manually Controlled Barriers (including CCTV)		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Manually Controlled Barriers
Excludes:	AHBCs, ABCLs, Suspected WSF

GENERAL

Barrier failure is a common cause of reported signal failures. This Test Guide gives you guidance on the checks and tests required in the event of one or more barriers failing to lower/raise.

If one or more barriers fail to lower and the crossing protecting signals can be cleared, the failure shall be regarded as a WRONG SIDE FAILURE and shall be investigated using the correct Test Guide(s) from the T series.

Signal Box and Signaller Checks

1. Check with the Signaller and/or infrastructure fault control whether the equipment affected has shown a similar failure characteristic prior to this fault.

2. Check that no work has been recently completed in the area (e.g. stagework).

Barrier Operation

3. Ask the Signaller to operate the barriers.

If the crossing equipment operates correctly, observe the following:

a) The time taken for barriers to raise and lower (any particular barrier slower than the others).

b) Erratic operation of a barrier.

c) Loose or obstructed barrier fittings.

d) Movement of the level crossing pedestal or base.

e) Correct damping of the boom during the last 10 degrees.

f) Arcing contacts.

If the crossing equipment fails to operate correctly, the fault is within the level crossing control circuit.

4. Check whether a data logger or remote condition monitoring is fitted. If it is, check what information is available regarding the current failure? (In SSI areas, check Technician's Terminal).

Power Supply

5. Measure the battery voltage during the lower and rise cycle.

   Is the battery charger power on?

   The Voltage during operation should be in the region of 20V to 24V, depending on the type of battery.

   When the barrier has raised, the battery charger should bring the battery voltage back up to 26V to 29V.

6. Test the battery under load with the power off.

7. Check the 24V standby battery for both electrolyte level and condition.

For each Barrier Pedestal and boom

8. Check that nothing is obstructing the operation of the boom, skirt, side arm or counterweights.

9. Check the boom counterweights are correctly adjusted and secure.

10. Examine internal wiring and terminations.

    NOTE: *Look particularly for loose terminations and connectors.*

11. Test the continuity of the (BOOM)CR circuit wiring and its connectors.

    If this is the cause, you may temporarily strap out the faulty section. You shall report this to you SM(S).

12. Check Local Control Unit for signs of tampering or forced entry.

13. Test the operation and continuity of the pedestal door micro-switches.

14. Check the circuit controller linkage is correctly fitted and has not excessively worn.

15. Examine the circuit controller contacts. Look for the following:

    a) Out of adjustment contacts.

    b) Loose or worn contacts and springs.

    c) Metallic dust.

    d) Moisture or contamination.

    e) Damaged wiring or loose terminations.

16. Measure the resistance of the contacts in the closed position.

17. Check the pump unit. Look for signs of:

    a) Low hydraulic fluid.

    b) Fluid leakage around hoses, joints and rams.

18. Check the pedestal mounting bolts and fixings.

19. Check the motor brushes and commutators are in good order and free from dust.

20. Measure the voltage and current at the motor during operation.

Hand Pump (BR843)

21. Hand pump each barrier to the raised position.

    NOTE: *The barriers should not drop between each pump.*

22. Lift the pump handle and check that the barrier lowers. When you release the handle, check that the barrier motion stops.

23. Check the shock absorber cannot be depressed by more than 3mm by finger pressure.

24. Check the operator's door micro-switch, wiring and terminations.

    Make sure that when you turn the key, the Yale lock is fully operated.

Barrier Location or Equipment Room

25. Carry out, NR/SMS/Test/PartB/052 (Dynamic Earth Tests).

26. Carry out, NR/SMS/Test/PartB/019 (Detection Loop Test).

27. Check the security of electrical terminations (including internal and tail cable connections).

28. Check the security of back nuts on terminal blocks.

29. Check that fuses and links are clean and secure within their holders.

30. Measure incoming and outgoing line circuit voltages and remote-control system levels.

    NOTE: *This might identify a problem in the line circuits. Consider repeating this test at the interlocking end of the circuit.*

31. Examine the control and detection relays and their bases.

    Confirm that the relay retaining clip is fitted and that the relay spades are secure.

32. Check the condition of control, timer, indication and proving relays (for burnt contacts, condensation, silver migration, etc.).

33. Check for signs of overheating (touch/smell) in supply T/Js, control, timer, indication and proving relays.

34. Check that the RECR circuit is operating correctly.

35. Test the insulation and continuity of tail and lineside cables.

36. Observe the passage of the train and check the crossing functions correctly.

37. If no cause is apparent after these checks, advise your SM(S) and seek type specific fault-finding information from available sources; also consider the fitting of a data logger.

END

Ref:	**NR/SMTH/Part/10**
Issue:	02
Date:	04 June 2022
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NR/L3/SIG/11231

NR/SMTH/Part/10

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INDEX

END

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 the above items that 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.

This guide assumes that the track relay is not energised and testing is started at the relay end. If testing is started at any other point the order of the steps will have to be altered.

FAULT FINDING GUIDE

1.1 Check the record card for voltages when the TC is working.

1.2 Measure the voltage across the rails at the relay end. If the voltage is low, or there is no voltage go to 1.4. If it is within the specified limits, continue.

1.3 Check tail cables, disconnection boxes, wiring, connections, relay coil, links and (if provided) the relay end adjustable resistor for loose or open circuit connections.

1.4 Measure the voltage at the feed end. If it is within the specified limits go to 1.5. If it is low, go to 1.6. If there is no voltage, go to 1.7.

1.5 Check throughout the length of the track circuit for the following:

a) Broken or high resistance bonding.

b) Broken rails.

1.6 Check throughout the length of the track circuit for partial or full short circuits. These could be caused by faulty IRJs, especially in S&C, insulations on points and rail fastenings and poor ballast conditions.

1.7 Check (as provided) tail cables, disconnection boxes, wiring, connections, links, fuses, feed sets, TJs, batteries and adjustable resistors for loose/open circuit connections or short circuits.

APPENDIX A - Track Circuit Adjustments

Systems fitted with feed sets are set up on commissioning and shall not be altered during maintenance.

If a satisfactory drop shunt cannot be obtained on a track circuit using these feed sets, report immediately as corrective maintenance.

Some systems with feed sets have adjustable resistors at the relay end. These shall not be adjusted.

Systems that do not use a feed set (primary cell and TJ/secondary cell fed) are usually fitted with a separate adjustable resistor block at the feed end that can be adjusted by using the input/output leads and straps to obtain the resistance necessary to obtain a satisfactory drop shunt.

Increasing the resistance will decrease the voltage and increase the drop shunt; conversely decreasing the resistance will increase the voltage and decrease the drop shunt.

Drop shunt values are detailed in NR/SMS/PartZ/Z03.

END

NR/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part10/FF04		
Faulting Guide: EBI Track 200 Track Circuit		
Issue No. 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

GENERAL

For the Fault Finding Guide please use Section 2 of NRSMS/Appendix08.

END

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 shall be tested as such. Record cards shall be kept for each part.

Cut Section Track Circuits: Each cut section shall be treated as an individual track circuit and record cards kept accordingly.

Where the Receiver Is Adjacent to a Pair of Insulated Rail Joints:

Report situations where track circuit track tail cables are not terminated within 1m of an IRJ.

Drop shunt test at three positions approximately 15m apart, within 50m of transmitter and its terminations.

For end fed TC, the test shall be outside the tuned zone. Results are listed in Appendix B.

These guidelines start at the feed (Tx) end but fault finding can start at either end.

To quickly localise a fault:

a) Check cables and connections.

b) Compare voltage readings with values with record card.

c) Always check correct frequency apparatus is fitted.

NOTE: *applying a shunt to an adjoining track circuit causes it to show occupied.*

FAULT FINDING GUIDE

1. Feed (Transmitter) End

1.1 Check the transmitter is emitting its characteristic ‘singing’ note (that is, loud and steady). If this is correct move to step 1.5, if not continue.

1.2 Measure the DC input voltage to the transmitter unit between terminals + and – (between 22.5V and 29.5V).

1.3 If this is correct change the transmitter unit check that the correct frequency unit is selected by observing the colour coding on the units.

1.4 If it is incorrect investigate the power supply and restore. When the power supply feeds other units, it might be necessary to disconnect them one at a time to find the faulty one.

1.5 Measure the AC feedback voltage to the tuning unit between terminals T1 and T2. If this voltage is within approximately 33% of its previously recorded value proceed to step 1.8. If it has fallen by more than 33% of its previously recorded value continue.

1.6 Connect a train shunt set at 10Ω across the transmitter side of the track circuit feed links, then connect a meter set to read AC across the train shunt. If terminals 3 and C are connected, disconnect at terminal C.

Open the track feed links and measure the voltage. The voltage should not be less than given in Table 1.

Close the track feed links and reconnect the link to terminal C before disconnecting the meter and train shunt. If the voltage is lower than given in Table 1 change the transmitter unit. If the voltage is above the minimum go to step 1.8.

Track Circuit Frequency (Hz)	Minimum Voltage
1700	3.5V
2000	3.8V
2300	4.9V
2600	5.3V

Table 1 – Minimum Voltages

1.7 If a train shunt is not available measure the current from the power supply. Typical values for the transmitter end are given Table 2. If the current is lower than 33% of the value given change the transmitter unit. If the current is correct move to step 1.8.

Track Circuit Frequency (Hz)	Maximum Current
1700	1.6A
2000	1.7A
2300	1.8A
2600	1.9A

Table 2 – Maximum Currents

1.8 Check the tuning unit and change if necessary. Check the wires are connected to the correct terminals.

1.9 Examine the surge diverter and change if necessary.

1.10 Examine the track circuit connections to the tuning unit and track transformer.

1.11 Where two Aster tracks adjoin, measure the AC voltage on the tuning unit between terminals T1 and T2 with a short circuit across the adjoining track circuit tuning units between terminals T1 and T2. If there is an increase in the voltage reading when the short circuit is applied replace the adjoining track circuits tuning unit.

1.12 Apply a short circuit across the rails at the adjacent TTU (this causes the adjacent track circuit to fail). If the short circuit causes the failed track circuit to clear, replace the adjacent TTU.

1.13 If after changing the transmitter, track transformer or tuning unit and the measurements are correct the feed end apparatus is operating normally.

2. Track Circuit: General

2.1 Examine the track circuit NR/SMS/PartC/TC10 (Track Circuits: Aster SF15 / U Type) - Service A.

3. Relay (Receiver) End

3.1 Check the track relay, if energised check the line circuits.

3.2 If the relay is de-energised measure the AC input voltage on the tuning unit between terminals T1 and T2.

3.3 If the voltage has fallen by less than 33% of its last recorded value go to step 3.4 If it fallen by more than 33% of its last recorded value go to step 3.5.

3.4 Attention shall be given to a track circuit examination NR/SMS/PartC/TC10 (Track Circuits: Aster SF15 / U Type) - Service A, and testing at the transmitter end of the track circuit.

3.5 Check the tuning unit, track transformer and receiver unit connections. Re-terminate any poor connections.

3.6 If the voltage in measured in 16 is still low and two Aster tracks adjoin, measure the AC voltage on the tuning unit between terminals T1 and T2 with a short circuit across the adjoining track circuit tuning units between terminals T1 and T2. If the voltage is now correct replace the adjoining track circuits tuning unit.

3.7 Measure the DC input voltage to the receiver unit between terminals + and – (between 22.5V and 29.5V).

3.8 If it is incorrect investigate the power supply and restore. When the power supply feeds other units, it might be necessary to disconnect them one at a time to find the faulty one.

3.9 Examine the surge diverter and change if necessary.

3.10 Check the relay voltage on the terminals R1 and R2 of the receiver. If this is greater than 19V with the relay de-energised, then relay or the wiring to it is faulty.

3.11 Measure the AC voltage on the receiver unit between terminals T1 and T2. If the voltage is more than 66% of its last recorded value change the receiver unit. If the voltage is less than 66% of its last recorded value examine the track transformer, tuning units and receiver unit. Replace if necessary.

3.12 Apply a short circuit across the rails at the adjacent TTU (this causes the adjacent track circuit to fail). If the short circuit causes the failed track circuit to clear, replace the adjacent TTU.

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
	A	H	BD 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	-	-	-

The receiver gain connections listed above are to be used as a guide. Adjustment might be required to suit local conditions.

END

1. HVI Track Circuit Faulting Check List

The questions can be answered in any order.

1.1 Contact Fault Control and review whether this is a repeat failure; has the TC shown a similar fault characteristic prior to this fault?

TX End

1.2 Test the supply voltage 95V-121V and current load test 0.3A-0.5A. Are the measurements within expected values? (Record results).

1.3 Carry out TX power test (T7) (Connect a short circuit between terminals C- and t6).

Disconnect any strapping between t1 and t6 and measure the TX power between t1(+ve) and t3(-ve).

The minimum expected value is 120V.

1.4 Are the TX Voltages higher or lower than expected?

1.5 Relay end voltages/tests measure and record.

Compare to previous results on record card.

a) Min 20V - Max 50V

b) V1+toV1- =

RX End

1.6 Relay end load test (T5) (Apply 0.5Ω shunt on rails @ RX end).

Compare to previous results on record card.

a) Min 30V - Max 100V

b) V2+toV2- =

1.7 Are the RX Voltages higher or lower than expected?

1.8 Carry out drop shunt test.

a) Min 0.5Ω - Max 2.5Ω.

TC voltages near min & low drop shunt value will indicate a developing fault in the receiver that should be replaced.

TC voltages near max and high drop shunt value will indicate the transmitter is not providing the required waveform and should be changed.

1.9 Check security of tail cable entry points and terminations within TX and RX.

1.10 Check all rail terminations.

1.11 Examine the length of all tail cables at both the TX and RX end. Check for no joints or cuts. If any damage found. Replace immediately.

1.12 Hand trace to verify cables are free from mechanical trapping and they are cleated down. If any damage found. Replace immediately.

1.13 Check and test the TC bonding, including any jumper cables, and TC interrupters (use the current clamp meter for jumpers).

1.14 Is the track circuit bonding correct, intact and free from short circuit causing objects? (Rectify any defects) Including any Pin Brazing.

2. Examining the P-way

2.1 Check the following:

a) All rails are intact?

b) Rails, insulations and IRJ's are free from contamination?

c) Remove any metallic debris from around IBJ's and point insulations.

d) Is the track free of wet beds and contamination?

e) Test the IRJs, do they pass all tests? Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Tests).

NOTE: *Disconnection of track circuits will be required for this test.*

3. Additional Fault-Finding Notes

A full description is contained within NR/L2/SIG/11756 HVI Track Circuits.

No adjustment can be made to the HVI track circuit during maintenance visits. Service B is therefore restricted to testing those components whose performance can be expected to change.

Transmitters and power supply units shall not be plugged in or unplugged, or straps changed whilst they are powered up.

In 3rd Rail DC traction areas, and in dual electrified areas, HVI track circuit transformer/terminal boxes (known as 'bread bins') can experience a catastrophic arcing across the terminals when the traction supply is short circuited to the "Signalling" rail.

As such traction short circuits are unpredictable (and can be caused by trains, rubbish falling across the rails or other reasons) it is undesirable to work inside the 'bread bin' with the traction current energised. The main reasons for opening the 'bread bin' are maintenance to carry out NR/SMS/PartB/Test/255 (HVI TC Test) and fault finding.

Work shall not be attempted inside the 'bread bin' on 3rd rail DC and dual electrified areas unless the DC traction current is isolated for the entire length of the track circuit(s) concerned. Non-electrified and AC or DC overhead electrified areas are not affected.

Fault finding shall use test points other than inside the box. If the fault finding requires entry to the 'bread bin', the traction current shall be isolated first. NR/SMS/PartB/Test/255 (HVI TC Test) shall be undertaken on the rails as described in Appendix A.

Access to the track in some areas is very restricted. It is permissible for the local Area Signal Engineer to authorise installation of permanent test 'leads', wired from the rails to a special test box positioned in a place of safety.

This box shall have the leads terminated in the box as far apart as physically possible.

It is recommended such a test box is non-metallic.

An ideal termination arrangement for each test lead would be one terminated at the top and the other at the bottom of a 6-way 2BA terminal block. (After installation, the loop resistance of the leads should be measured, and the value recorded in the box so that allowances can be made when applying shunts at the test box.)

4. Track Relay Voltage

The track relay voltages V1 and V2 will indicate the correct functioning of the receiver and will vary inversely proportional to the drop shunt value (i.e. as the track voltage rises, the drop shunt will fall).

Track relay voltages that are near the minimum, while the drop shunt remains low, indicates a developing fault in the receiver, which should be changed.

Track voltages which are near the maximum, while the drop shunt remains high, indicates that the transmitter is not providing the required waveform and should be changed.

5. Relay End Voltage

The 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.

Values of relay voltage towards the maximum should be accompanied by higher limit values of track relay voltage and a lower limit of drop shunt.

Values of relay voltage towards the minimum should be accompanied by lower limit values of track relay voltage and a higher limit of drop shunt.

If the rail voltage is high and the drop shunt is high, it indicates that the transmitter is providing an unsatisfactory waveform and should be changed.

6. Current Provided by Equipment

The ability of the transmitter to provide power can be checked by measuring the current at the relay end. As the instrument for measuring the waveform will only measure voltages, it is necessary to pass current through a 0.5□ resistor to measure a representative voltage.

The value of this voltage is individual to each track circuit, being affected by length, length of tail cables and complexity of S&C. The measurement is important as a basis for comparison rather than an absolute value. The voltage measured should not differ by more than +/- 3V from the commissioning result.

If the test voltage is satisfactory but the rail and track relay voltages are low, then it is likely that the track circuit is being shunted by poor ballast or debris.

If the test voltage is low but the rail voltage is satisfactory, it is likely that the track circuit bonding or tail cables are becoming defective.

END

FAULTING GUIDE

SR = Single Rail Installations Only.

DR = Double Rail Installations Only.

Relay End

1. Check the position of the relay vane.

   If the vane is up (delay unit for VT1(SP) also up) check the status of the track with the Signaller.

   If it is showing occupied at the signal box end investigate for an indication fault.

   If the vane is down, proceed to Step 2.

   For VT1(SP) only, if the vane is up and the delay unit is down, go to the Delay Unit Tests(15).

2. Measure the voltage on the relay local coil.

   If the voltage is within spec (99V to 121V) go to Step 3.

   If the voltage is below spec or at zero check the BX110 supply and fuse.

3. Measure the voltage on the relay control coil.

   If the voltage is within spec (approximately 25% above the relay nominal value) visually inspect the relay for signs of damage.

   Check for a tendency to drive in the opposite direction, if found a Full Test shall be required.

   Check the control coil resistor (DR). If the voltage is low, check the stabiliser (SR). If a transient suppressor (GDT or Spark Gap) is fitted, remove it from its base then recheck the voltage. If the voltage increases, check the rating of the suppressor noting that long track circuits with Type 3 bonds might require a 1000V type at the feed and first intermediate bonds.

4. If there is no voltage check the track fuse. Check the control coil resistance is at least 3Ω. Check the control coil resistor (DR).

5. Check for any DC voltage across the relay control coil with a multimeter whilst trains are in vicinity (SR).

   If none found proceed to Step 6.

   If more than 0.5V DC is found at any instant and the relay chatters, check all negative bonding in area.

   If all present and functioning correctly, refer to the Route Engineer [Signalling], Principal Route Engineer [Signalling] or equivalent for possible fitment of interference suppressor unit.

6. Measure phase angle and voltage and compare with the NR/SMS record card (DR).

   If the phase angle is higher and the control voltage lower, check the relay capacitor,

   Check for impedance bond faults.

   If the phase angle is the same and the control voltage is lower, check for a high resistance connection, rail to rail fault etc.

7. Measure the AC voltage across the rails at the relay end and compare with the record card.

8. If the voltage is approximately 45V AC (SR), check for high resistance at the relay end.

   If the voltage is within the specified limits or higher, check track leads to relay.

   Check the phase angle of control and local voltages (DR). Check the relay end impedance bond (DR).

   If the voltage is low, check the relay end and intermediate impedance bonds (DR).

   If there is no voltage, check for voltage across rails proceeding towards the feed end.

9. Measure the rail end current to the rails (SR). If it is over 0.5A AC replace the stabilising rectifier.

   Measure the AC voltage across the rails and compare with the NR/SMS record card.

   If the voltage is higher than the specified limits, check for a high resistance fault in the bonding and relay end circuitry, also check for a possible increase in the ballast resistance.

   Check feed end and intermediate impedance bonds (DR).

If the voltage is within the specified limits, check again the rails at relay end. Check for high resistance bonding fault. Check feed end and intermediate impedance bonds (DR).

If the voltage is low, check the track feed transformer outputs, step 10. Check bonding and cables for possible short circuit. Check IRJ's and other insulations for possible breakdown.

If there is no voltage check the 10A fuse.

If OK proceed to Step 11.

10. Measure the voltage across the 110v supply fuse (SR).

If the voltage is between 150V & 180V AC check for high resistance at the feed end.

Feed End

11. Measure the output voltage of the track feed transformer.

If the voltage is within the specified limits, go to Step 12.

99V to 121V for the standard type, 85V to 90V or 90V to 99V if the former is not achievable for the VT1(SP) type.

If the voltage is outside the specified limits, check the feed end supply. (Step12), check the 110V feed fuse. Replace or adjust feed transformer.

12. Measure the output voltage at the feed end with the track feed fuse removed.

If the voltage is within the specified limits, replace the fuse and re-check.

If the voltage is low or at zero, check the 110V supply and fuse. Test the capacitor by setting a value using alternative switch settings or replace, and then re-check the voltage.

13. Remove the surge arrestor and re-check, if it is now correct replace surge arrestor and carry out a Full Test (DR).

14. Measure the current to rails at the feed end and compare against the NR/SMS record card.

If the current has increased, check the stabilising rectifier (SR), check for a short circuit bonding fault, check for impedance bond short circuit (DR).

If the current has decreased, check for a high resistance in feed cable connections or track circuit bonding, or a fault in feed or relay equipment.

If the feed end current is significantly greater than the relay end current (SR), check for a rail-to-rail fault.

VT1 (SP) Delay Unit Tests

15. Check the delay unit after the VT1(SP) relay has been energised for more than 2 seconds.

If the unit is not completely energised, (e.g. one or more relays in the unit not energised) go to step 16.

If the unit is completely energised, go to step 17.

16. With the VT1(SP) relay energised, remove the interconnecting cable between the relay and the delay unit. At the fixed connector on the delay unit connect a multimeter (set to 100V DC.) between pin A (+ve) and pin B (-ve).

If the voltage is not between 55V to 60V DC, replace the VT1(SP) relay

If the voltage is between 55V to 60V DC, go to step 17.

17. Reconnect the cable at the relay end and check for a voltage of 55V to 60V DC. on pins A and B at free end of cable.

If the voltage is not present, replace the connecting cable.

If the voltage is present, replace the delay unit.

18. Check the sequence of operation of delay unit as follows:

Observe that relay R1 (on right hand side of delay unit when viewed from front) energises, de-energises and re-energises and that relay R2a energises followed by relay R2b.

If the delay unit does not operate in this manner, replace the delay unit.

If the delay unit does operate in this manner, check for possible high resistance output contacts between pins 23 & 24 and 13 & 14 of the VT1(SP) relay.

END

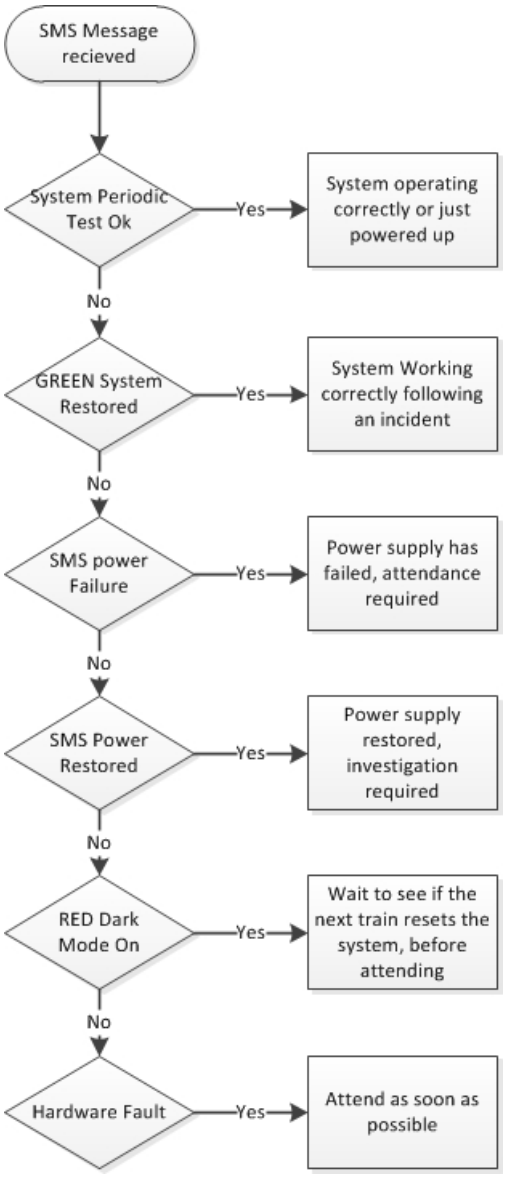
NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part10/FF08		
Faulting Guide: EBI Gate 200 Level Crossing System		
Issue No. 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	EBI Gate 200
Excludes:	All other Overlay MSL crossings

SMS Text Notifications

Message received	**Meaning**
"System Periodic Test Ok"	Sent on Power up and Mid-day
"GREEN System Restored"	System has been restored
"RED Dark Mode On"	Dark Mode On. This could be caused by engineering works, irregular train movements or a fault with the system.
"SMS Power Failure"	Input power failure to the system.
"SMS Power Restored"	Power restored.
"Hardware Fault"	Irrecoverable Fault

SMS Message Sequence :



Site Arrival Checklist

Note the following:

1. Is the “On Demand” button (Where fitted) illuminated?

2. Push button (where fitted) on the crossing to check status on the master and slave post.

3. Inspect Master Post.

    a) Is there a power supply to the post?

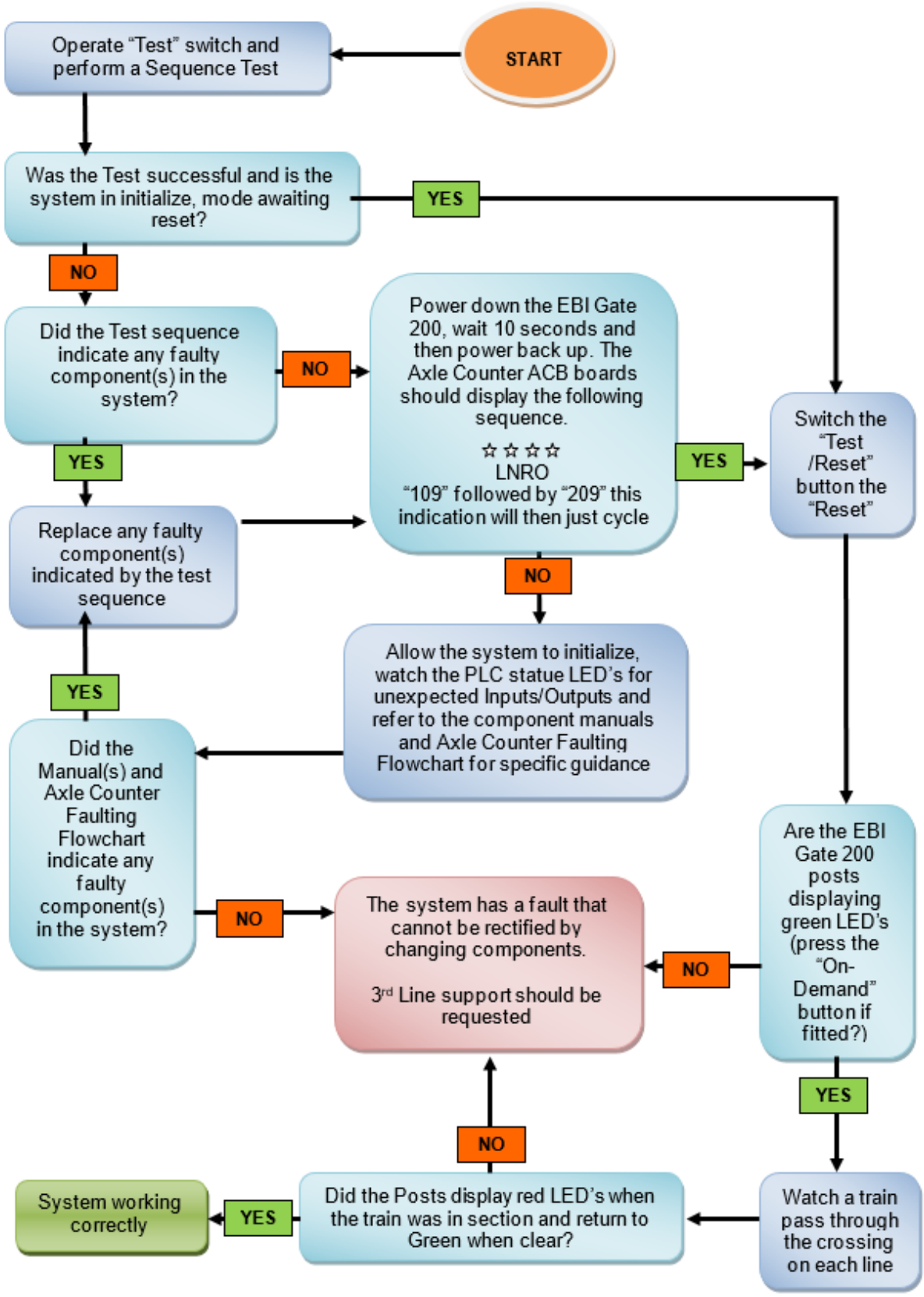
    b) Are error codes present on the axle counter system?

    c) Are the Programmable Logic Controller (PLC’s) active?

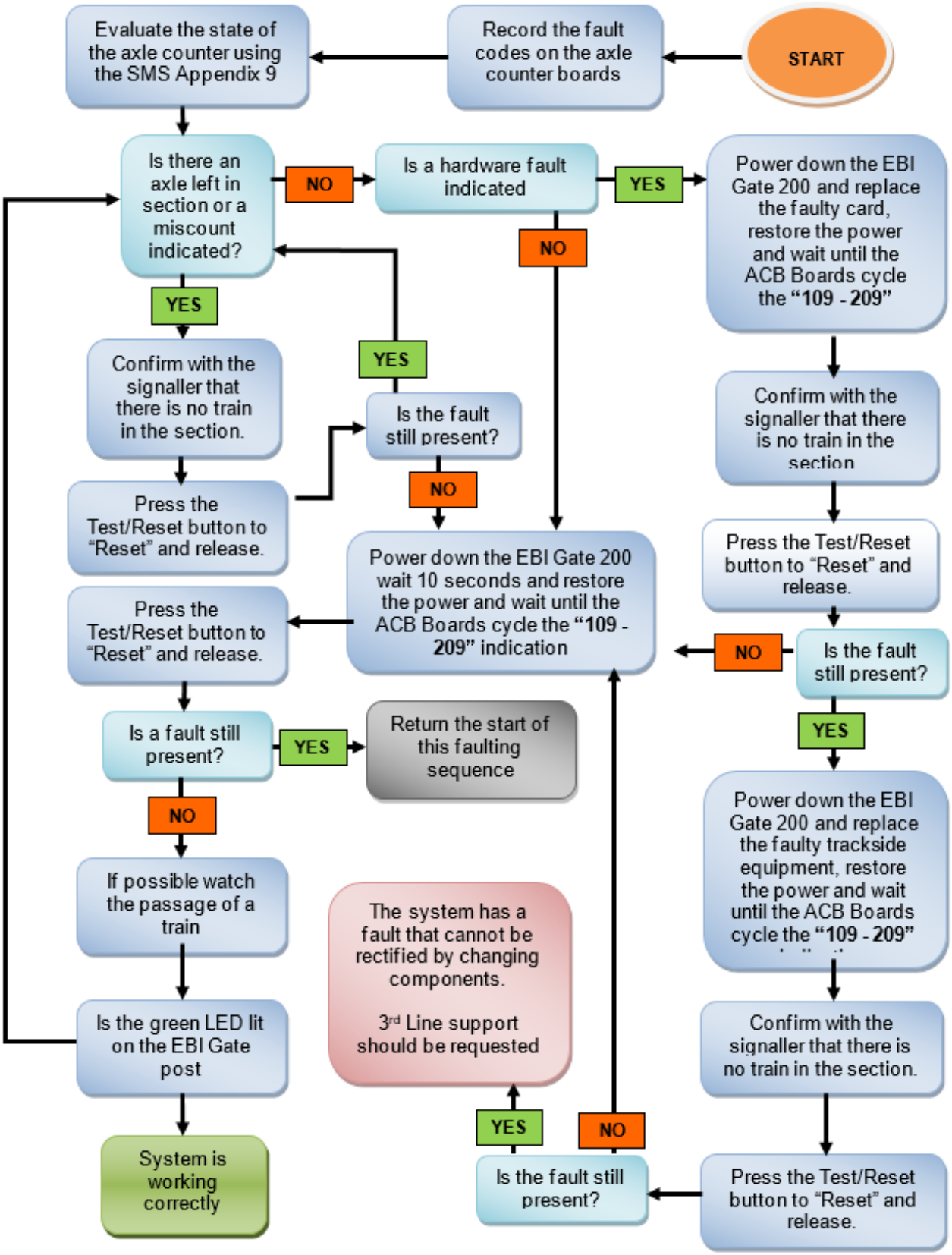
    d) Is the Auto dialler flashing?

4. Inspect Slave Post

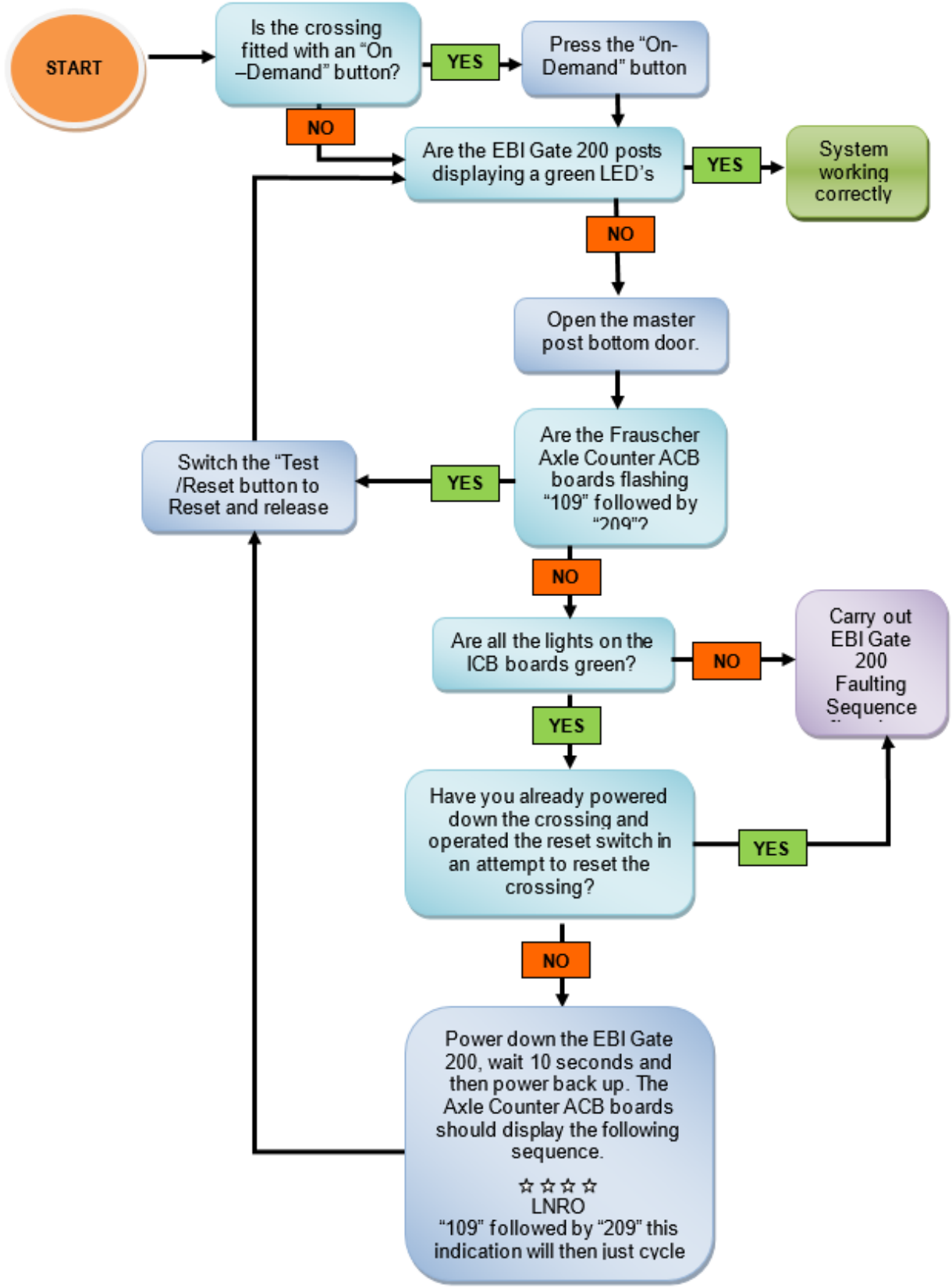
Faulting Sequence



Axle Counter Faulting Sequence



Reset Sequence



EBI Gate 200 Power Supply

5. Go to the **Master Post** and check the following.

    a) Is the Blue collar around the "On Demand" Button illuminated? (where fitted).

    b) Is there power to the axle counter system? i.e. Are the ACB displays lit? Are the LED's on IMC boards lit or flashing?

    c) Is there power to the Auto-Dialer? i.e. Are any of the LED's on the front of the Auto-Dialer illuminated or flashing?

    d) Is there power to the PLC? ie. Are any of the LED's on the front of the PLC illuminated or flashing?

    e) Are any of the PSU Controller LEDs Illuminated?

    f) Is there power to the DC power supply? ie. Are any of the LED's on the front of the PSU/UPS illuminated or flashing?

6. Go to the Slave Post and check the following.

    g) Is the Blue "On Demand" Button illuminated? (where fitted).

7. If the answers to questions A to G are all YES then the fault is not related to the power supply and you should re-evaluate the symptoms.

8. If the answers to questions A to G are all NO then the fault is in the AC power supply and the EBI Gate system should be disconnected while this is investigated.

9. If some of the questions have been answered NO, then the power is failing to reach that particular component. Using the test points in Table 1 you can trace the voltage supply through the system. Comparison of actual readings with the limits indicated allows the faulty component to be traced.

Test Point	Expected voltage	Fault
AC Input : Bottom of fuse 1(L) – Neutral (N)	110 or 230v AC	Supply Issue
AC Input : Top of fuse 1(L) – Neutral (N)	110 or 230v AC	Fuse 1 Faulty
AC side of the PSU : Live (L) – Neutral (N)	110 or 230v AC	Wiring fault between F1 and PSU
DC side of the PSU : +ve (+) to negative (-)	24v DC +/- *	Faulty PSU
Fuse 2 bottom – negative (-) TB1 Terminal 10	24v DC +/- *	Wiring fault between PSU and F2
Fuse 2 top – negative (-) TB1 Terminal 10	24v DC +/- *	Fuse 2 Faulty
Fuse 3 bottom – negative (-) TB1 Terminal 10	24v DC +/- *	Wiring fault between PSU and F3
Fuse 3 top – negative (-) TB1 Terminal 10	24v DC +/- *	Fuse 3 Faulty
UPS Battery FuseTB2 Fuse 4 top – negative (-) TB2 Terminal 22	24v DC +/- *	TB2 Fuse 4 Faulty

Table 1

* The expected DC voltage is a non-adjustable value: if it is not achieved the backplane should be replaced.

If a replaced fuse blows again during power up, then the relevant backplane should be replaced.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part10/FF09		
Faulting Guide: Power Operated Gate Opener (POGO)		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	GateCare Power Operated Gate Opener (POGO)
Excludes:	All other types of Power Operated Gates

Figure 1 - NR2 - Power Operated Gate Opener (POGO)

Do not enter 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.

FAULT FINDING GUIDE

The NR control board is equipped with three unique features to assist in troubleshooting a gate system.

1. LED indications.
2. Current sensor beeper.
3. The “Open / Close” command push button.

1. LED Indications

1.1 A series of LED indicators lights are located on the main control board which is mounted inside the crossing control box.

These LED’s help to identify problems with the actuator limit switches and all control circuits.

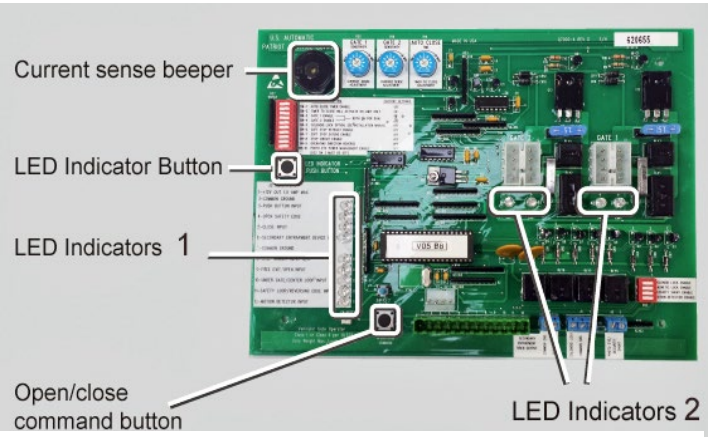


Figure 2 – Control Board

1.2 These LEDs are normally unlit; to illuminate them you should press the LED Indicator Push Button on the left-hand side of the board as shown in Figure 2.

1.3 The tables below assist in identifying which equipment is active:

No	Function	Indication "lit" means
1	+12vdc output 1.5amps max	No LED fitted
2	Common Ground	No LED fitted
3	Push button Input	A green push button is depressed
4	Not used	Not used in NR 2 If lit replace control board
5	Close input	Not used in NR 2 If lit replace control board
6	Not used	Not used in NR 2 If lit replace control board
7	Common Ground	No LED fitted
8	Green Signal Light input	POGO Only (N/C input) - Always lit *POGO/MSL Link (Lit when MSL is Green /Unlit when MSL is Red) If this LED is "out" confirm the green 12 way terminal block connector is full pressed home. If it is, check the cables in terminals 7 & 8, 13 & 14, and MSL connections (where linked) are intact.
9	Not used	Not used in NR 2 If lit replace control board
10	Under Gate / Centre Loop	Not used in NR 2 If lit replace control board
11	Safety Input (Photo eye N/O)	Not used in NR 2 If lit replace control board
12	Emergency Open Button Input	A red emergency push button is depressed

Table 1 – LED Indicators

LED Position	Function	Indication "lit" means
Left	Retract Limit	Limit switch depressed (Gate Open)
Right	Extend Limit	Limit switch depressed (Gate Closed)

Table 2 – LED Indicators Gate 2 (Left Side)

LED Position	Function	Indication "lit" means
Left	Retract Limit	Limit switch depressed (Gate Open)
Right	Extend Limit	Limit switch depressed (Gate Closed)

Table 3 – LED Indicators Gate 1 (Right Side)

For more details related to the LED Indicators refer to section 7.

2. Current Sensing Beeper

2.1 The second feature to assist in troubleshooting is the current sense beeper. The beeper sounds anytime the current sense circuit is activated. This is useful in detecting a false reverse due to an improper or too sensitive current reverse setting, or a gate that needs excessive force to move it.

3. The "Open / Close" command push button

3.1 The third feature to assist in troubleshooting is the control board "Open / Close Command" push button. This button makes it possible to operate the gates with the twelve terminal wiring plug removed. The removal of this plug disables the red / green buttons, solenoids and N/C contact from a green aspect.

Before disconnecting the green 12-way terminal plug on the control board you shall remove the latch pins for both gates in both open and closed positions, because the removal of the terminal block disables the solenoids and push buttons, however the actuators still try to drive the gates, damaging the equipment.

4. On arrival at the site

4.1 Before your testing commences check that the gate actuators are not unpinned.

4.2 If the actuators are unpinned, you should assume that during the time they have been disconnected someone has pressed one of the gates operating buttons.

4.3 The pushing of a button with an actuator unpinned causes the limit switches to move out of adjustment. Therefore, before starting to diagnose / investigate any fault you should check / reset the limit switches.

5. A Gate or Gates do not open

5.1 Remove the main control box cover, press and hold the "LED Indicator" push button and observe all the red LED's (see the table in clause 1.3).

5.2 Identify the blue internal "Reset" push button located above the "Open / Close Command" button (Figure 3) or external reset button mounted on the control box exterior. (Figure 4).

Figure 4 – External reset

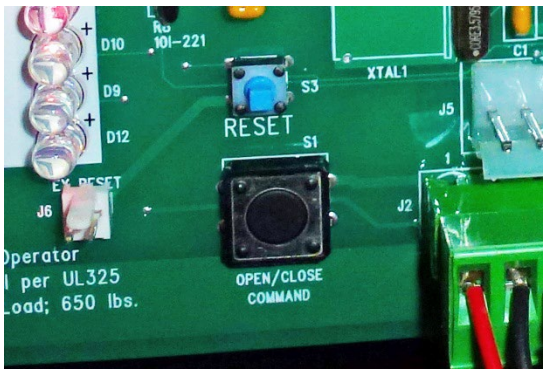


Figure 3 – Internal reset

5.3 Press the reset button.

5.4 Locate and press the LED indicator button.

5.5 Check LED 8 (Green Signal Light input (N/C input)) is lit, if the LED is “out” check the green 12-way terminal plug is full pressed home.

5.6 If the terminal block is correctly pressed home, check the jumper between terminals 7 and 8 on the block is intact.

5.7 Pressing the “Open / Close Command” push button, and listen for a clicking sound, if click is heard and the gates do not open then check that dipswitches SW-3 and SW-4 are set to the on position (Gate enabled) Figure 3.

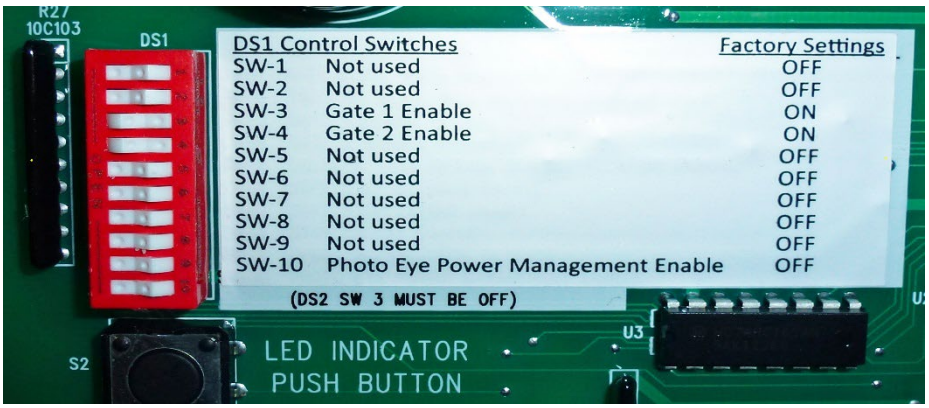


Figure 5 – DS1 Control switches

5.8 If the clicking is not heard examine and test the two 15-amp fuses mounted above 8-way X1 and X2 actuator plug sockets (Figure 6).

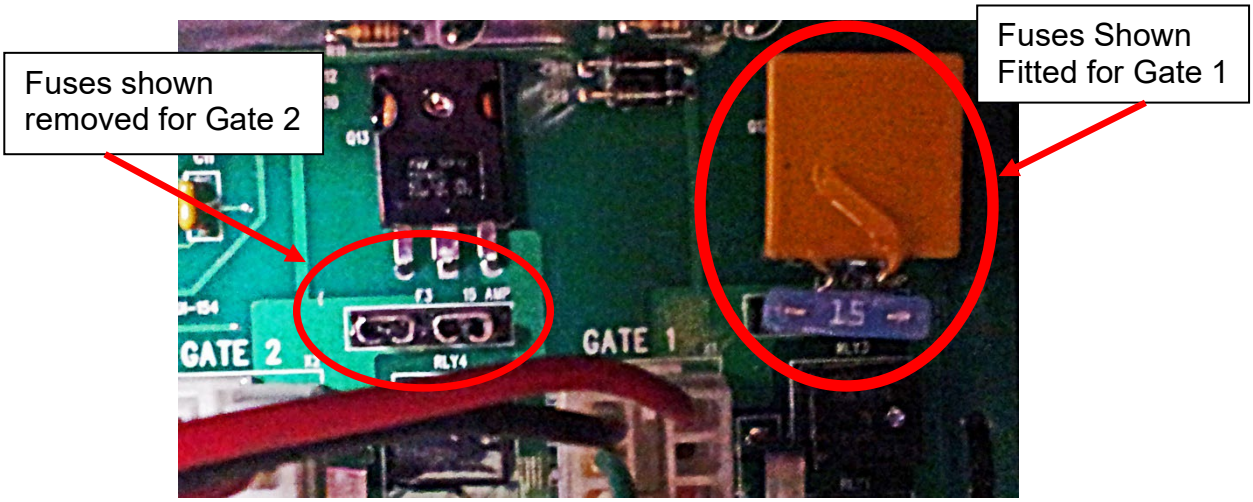


Figure 6 - Location of the Actuator Fuses

Each gate has two fuses fitted in series, the first is a 15-amp spade style fuse (Figure 7, left side) and the second is an automatically resetting thermal fuse (Figure7, right side).

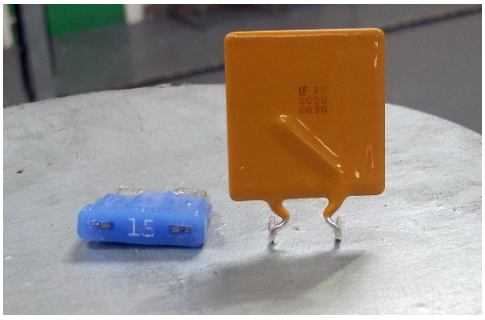


Figure 7 - Actuator Fuses

To fit these fuses, insert the thermal fuse legs into the two female spade holders mounted on the board and then push the 15-amp spade fuse gently into position. The thermal fuse is held in place by the tight fit of the spade fuse.

5.9 If a clicking sound is heard the battery needs to be load tested to determine its condition. Check the battery voltage with the solar panel disconnected is above 12.7 volts.

Battery condition	Voltage range
100%	12.7 (or greater)
75%	12.5
50%	12.2
25%	12.0

Table 4 – Battery Condition

5.10 If the voltage is less than 11.5V it should be replaced.

NOTE: *This type of battery, if allowed to completely discharge, never regains its full capacity. This type of damage is cumulative. This loss of capacity shows up as a quicker than expected discharge rate. (ie the gates shall start to slow after fewer moves).*

Locate and press the LED indicator button.

5.11 Both the retract limit and extend limit LEDs beneath the same Actuator plug should never be on simultaneously.

a) If they are with the gate in the open position and the actuator connected the actuator shall not operate. You should adjust the closed limit switch until its LED goes off.

By adjusting this switch, you are setting the point at which the gate shall stop, so from time to time you should operate the gate towards the closed position and adjust the limit switch to stop the gate at the desired point. As shown in NR/SMS/PartB/Test/084 (Power Operated Gate Opener Adjustment / Test).

b) If they are with the gate in the closed position and the actuator connected the actuator shall not operate. You should adjust the closed limit switch until its LED goes off.

By adjusting this switch, you are setting the point at which the gate stops, so from time to time you should operate the gate towards the open position and adjust the limit switch to stop the gate at the desired point. As shown in NR/SMS/PartB/Test/084 (Power Operated Gate Opener Adjustment / Test).

Gate 2 fails to operate

5.12 Press the “Open / Close Command” button and verify that the Gate 1 operates to the open position.

5.13 Gate 1 operates correctly, and Gate 2 fails to respond, remove the plug in X1 and mark it for identification then remove plug X2 and plug it into the vacant X1 socket (Figure 8).

5.14 If the Gate 2 operates as soon as the X2 plug is fitted into socket X1 this proves that the actuator and tail cables are working for Gate 2 and the NR Control Board is faulty

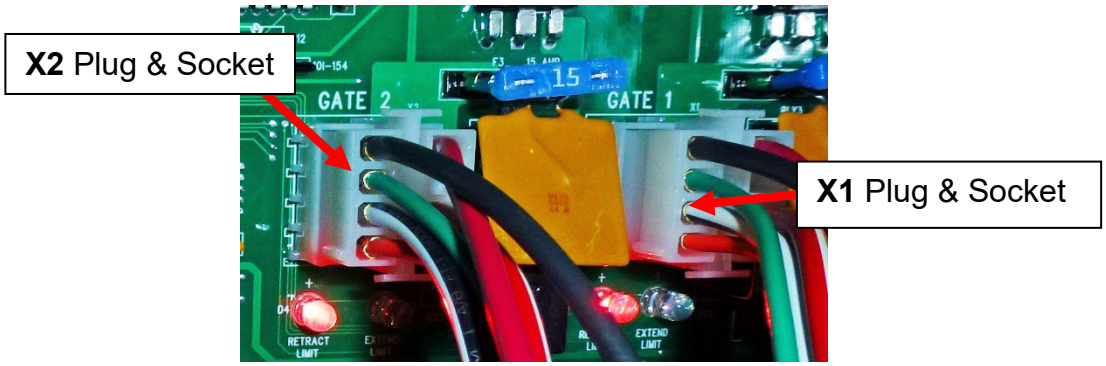


Figure 8 - Location of the X1 and X2 Plugs and Sockets

5.15 Should Gate 2 still fail to operate then the tail cable and disconnection box should be investigated. The DC supply to the actuators should be checked on the terminal blocks inside the disconnection box close to the actuator, and voltage of 13vDC should be expected when a call is placed on the actuator to move the gate (Figure 9).

The polarity of this voltage depends on the direction of movement.

Figure 9 – Actuator Voltage Readings

5.16 Remember to reinstate both X1 and X2 plugs to their respective sockets when testing is completed.

Gate 1 fails to operate.

5.17 Gate 2 operates correctly, and Gate 1 fails to respond, remove the plug in X2 and mark it for identification then remove plug X1 and plug it into the vacant X2 socket (Figure 9).

5.18 If the Gate 1 operates as soon as the X1 plug is fitted into socket X2 this proves that the actuator and tail cables are working for Gate 1 and the NR Control Board is faulty.

5.19 Should Gate 1 still fail to operate then the tail cable and disconnection box should be investigated. The DC supply to the actuators should be checked on the terminal blocks inside the disconnection box close the actuator, and voltage of 13vDC should be expected when a call is placed on the actuator to move the gate (Figure 9).

The polarity of this voltage depends on the direction of movement.

5.20 Remember to reinstate both X1 and X2 plugs to their respective sockets when testing is completed.

6. The Gates open / close slowly

6.1 The usual cause of slow running is low battery voltage. Two things need to be considered.

a) Battery condition (replace or charge)

b) What caused the battery to become discharged?

NOTE: *The battery is charged only from the solar panel.*

6.2 Check the panel is facing in a southerly direction and is not located in a completely shaded area.

6.3 Inspect solar panel surface for contamination and cable for damage.

Should it be necessary for the Solar panel to be disconnected you shall disconnect and insulate the exposed conductors one at a time as the short circuit caused by the cable cores touching damages or destroy the power generation capabilities of the solar panel.

6.4 To test the solar panel for correct voltage, disconnect the incoming supply links from the Solar panel in the disconnection box mounted with the Main Control Box.

6.5 Using a DC voltmeter, measure the dc voltage. It should measure between 17 & 22vDC volts on a sunny day. If this reading is incorrect the panel might be defective.

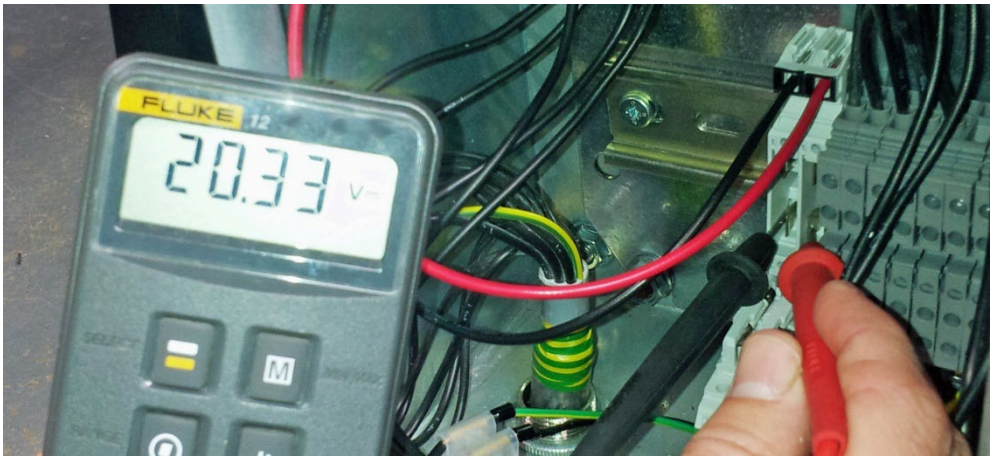


Figure 10 - Solar Panel Voltage measurement

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

Table 5 – Expected voltages

6.6 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.

6.7 Do not reconnect the solar panel at this point.

Do not take any readings using the current setting of your meter on this type of battery

6.8 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

Table 6 – Battery Condition

6.9 Check the correct deep cycle battery is installed.

6.10 If the voltage is less than 11.5V it should be replaced.

NOTE: *This type of battery, if allowed to completely discharge, shall never regain its full capacity. This type of damage is cumulative. This loss of capacity shows up as a quicker than expected discharge rate. (I.e. the gates shall start to slow after fewer moves).*

6.11 Check that solar panel leads are connected to the battery correctly.

6.12 Reinstate the disconnected links for the Solar Panel.

7. The gate begins to open or close but stops and reverses after a couple of seconds.

7.1 Remove the main control box cover and locate the NR control board.

7.2 Locate the sensitivity adjustment potentiometer located on the control board (Figure 11).

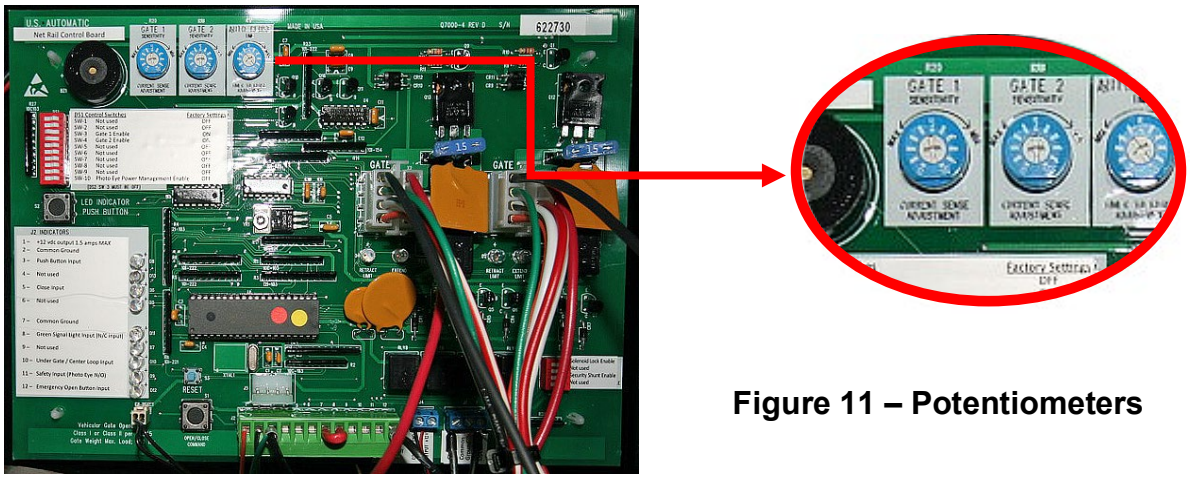


Figure 11 – Potentiometers

The white centre potentiometer is adjustable, and normally a setting of 5 operates most gates.

If the gate requires a setting above 8 to open and close the gate there is a good chance the gate has a problem that should be corrected.

Possible causes are incorrect hinges / lubrication; gate touching the ground, gate not level or the actuator arm connected to the gate is bent or incorrectly installed.

8. Gate opens correctly, then immediately reverses direction.

8.1 The most likely cause is an incorrectly adjusted retract limit switch. Firstly, determine which gate needs adjustment.

8.2 Operate the gates to the open position, while the gate is in motion press the LED Indications button and observe the retract LED indications for the limit switches that are directly below the X1 and X2 sockets.

8.3 When the Gates reach the fully open position the overload bleep sounds, the gates both move away from the latch posts and stop.

8.4 With the gate's closed neither of the retract limit switch LED's should be lit. A lit LED indicates that the gate is incorrectly adjusted.

8.5 Once the gate, or gates, that need adjustment are identified you should carry out the adjustment as shown in NR/SMS/PartB/Test/084 (Power Operated Gate Opener Adjustment / Test). And retest.

9. Gate closes correctly, then immediately reverses direction and fully opens.

9.1 The most likely cause is an incorrectly adjusted extend limit switch. Firstly, determine which gate is in need of adjustment.

9.2 Operate the gates to the closed position, while the gate is in motion press the LED Indications button and observe the extend LED indications for the limit switches that are directly below the X1 and X2 sockets.

9.3 When the Gates reach the fully closed position the overload bleep sounds, the gates return to the fully open position.

9.4 At the point the gate was closed and one or both of the extend limit switch LED shall not have been lit. The unlit LED indicates that the gate is incorrectly adjusted.

9.5 Once the gate, or gates, that need adjustment are identified you should carry out the adjustment as shown in NR/SMS/PartB/Test/084 (Power Operated Gate Opener Adjustment / Test) and retest.

10. The Gates or Gate fails to complete it travel before stopping.

10.1 The most likely cause is an incorrect limit switch adjustment.

10.2 Carry out the adjustment on the limit switch of the gate which is not closing fully as shown in NR/SMS/PartB/Test/084 (Power Operated Gate Opener Adjustment / Test). And retest.

11. Control board 15-amp fuse blows when Open/Close command is given.

11.1 A blown fuse means the gates shall not operate in power mode. Possible causes are an obstruction that prevents the gate from moving, the gate is attempting to 'over close' or 'over open' due to incorrect limit switch setting or there might be a wiring problem because of a faulty connection.

11.2 Before commencing any testing, you should remove the latch pins and manually operate both gates to check they are not binding or catching at any point across their full range of movement.

11.3 Open the main control box cover and locate the NR control board. Locate the 2 LED's under the X1 and X2 actuator connectors on the control board.

11.4 Press the "LED Indicator" push button and hold it in, observe the LED's and determine if the retract limit or extend limit LED is on.

11.5 Check if the correct LED is on for the gate position. For example, if the left LED is on that is the retract limit and the gate should be in the open position. The right LED represents the extend position.

11.6 If the retract limit LED is on and the gate is closed, a command to operate the gate shall try to force the gate beyond the closed position which could blow a fuse.

11.7 If the extend limit LED is on and the gate is open a command to operate the gate shall try to force the gate beyond the open position.

Again, this could blow a fuse. In either case, the actuator limit switches need to be adjusted as shown in NR/SMS/PartB/Test/084 (Power Operated Gate Opener Adjustment / Test) and then the cause for them becoming misadjusted needs to be determined.

The cause is likely to be incorrect wiring, a poor actuator plug connection at the NR control board or excessive sensitivity adjustment applied during installation.

11.8 Check all wiring and verify actuator connector is connected at the control board.

12. The Gate only operates when the "LED INDICATOR" is pressed.

12.1 Advise you SM(S) or on call Supervisor immediately.

13. Solenoid Lock Issues

13.1 Before commencing any testing, you should check that the solenoids are not binding or catching. If the solenoids are binding the current sensing bleeper sounds.

The solenoid lock is a 12vDC device with a nominal current consumption of 350mA when energized. The solenoid lock consists of a spring-loaded latch pin and a strike pin.

13.2 The control board is designed to energize the lock (releasing it) whenever the gate is in the fully open or fully closed position and then receives a command to operate.

13.3 The control shall output 12 vdc ½ second before gate begins to move (allowing time for lock to release) for duration of about 3 seconds.

13.4 The 12 vdc is protected by an auto-resettable fuse that shuts off the output voltage if a short or bind is detected in the lock or its wiring.

13.5 The Solenoid's are connected to the NR Control Board at the bottom right corner of the board. For illustration purposes the cables have been removed from Figure 12.

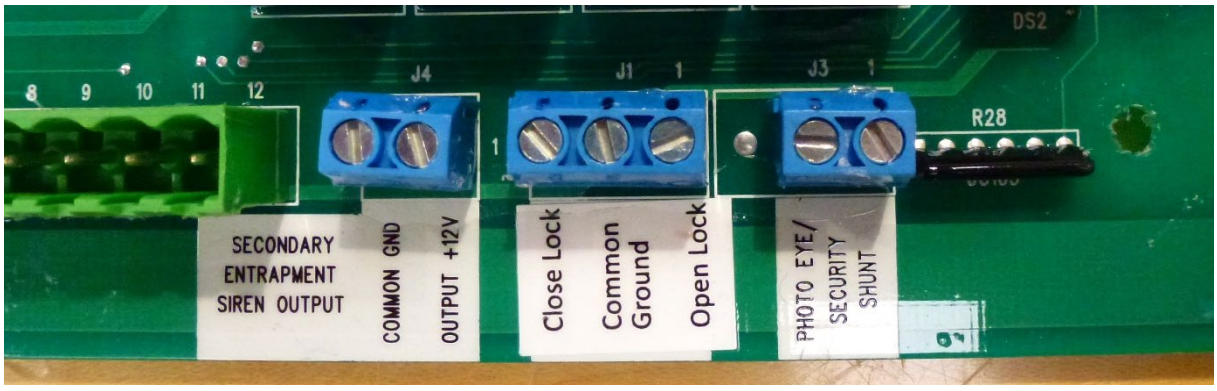


Figure 12 – The J1, J3 and J4 terminations

14. The lock does not pull the latching pin or shall not unlock the gate in the open or closed position

14.1 Remove the strike pin from the lock.

14.2 Using a voltmeter, connect the meter leads to J1 pin 1 (Open Lock) and the Common Ground J1 pin 2.

14.3 Operate the gate to the fully open or closed position.

14.4 Observe the voltmeter press the open / close command button. The meter should read 12vDC – for about 3 seconds on start up.

14.5 If 12vDC is present then the problem is in the wiring, lock or binding of the lock.

Verify wiring.

14.6 Open or close the gate fully.

14.7 Disconnect the green and blue wire from the lock (at the gate lock).

14.8 Using voltmeter connect to the red and black wire which are now disconnected from the lock.

14.9 Operate the gate, the meter should read 12vDC (for about 3 seconds) on start up.

Verify the lock

14.10 Reconnect the green and blue wires to the lock (at the gate lock).

14.11 Verify the strike pin is removed (eliminates the possibility of binding).

14.12 Open or close the gate fully.

14.13 Operate the gate and verify the latch pin is pulled (for about 3 seconds) on start-up.

Verify binding of the latch pin

14.14 Open or close the gate fully.

14.15 Install the strike into the lock (gate should be In the locked position once strike pin is installed).

14.16 Operate the gate to see if gate lock releases.

14.17 If not, then the latch pin is binding up because of too much pressure on the strike pin.

14.18 This is a mechanical issue, caused by incorrect gate stop position or the lock is not aligned correctly.

14.19 Identify which is causing the bind and correct.

The lock does not pull the latch pin (unlock) from the open gate position.

14.20 Verify gate is on the retract limit. Lock pin shall only pull if the retract limit is activated.

14.21 Adjust retract if limit is not activated.

The lock does not pull the latch pin (unlock) from the closed gate position

14.22 Verify the gate is on the closed limit. Lock only activates if the closed limit is activated.

14.23 Adjust closed limit if limit is not activated.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part10/FF10		
Faulting Guide: Frauscher Advanced Axle Counter		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Frauscher Advanced Axle Counter equipment
Excludes:	All other types of axle counters and equipment

1. Wheel Sensor RSR123

1.1 Examine the wheel sensor mounting plates and bolts for heavy soiling, security and external damage. If necessary, remove heavy soiling or replace wheel sensor as described in NR/SMTH/Part04/AX40 (Replace a Frauscher Wheel Sensor RSR123).

1.2 Check the area around the rail contacts (within 2 m); should be free of the following items:

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.

2. Voltage Measurements

2.1 Measure voltage at test sockets for Sys1 and/or Sys2 the reference value should be = 500 mV DC ± 5 %.

2.2 The measured voltage complies with the wheel sensor system current via a 100 Ohm shunt (100 mV therefore complies with 1 mA wheel sensor system current).

The voltage shall be measured in the unoccupied status of the RSR123.

If the voltage is < 475 mV and > 525 mV, then:

a) Do not adjust the RSR123.

b) Check wheel sensor mounting.

c) Check if the RSR123 is occupied (traversed).

If the voltage is alternating < 375 mV and > 550 mV, then:

d) RSR123 fallen off the rail (results in error code output from RSR123).

If the voltage is > 600 mV then:

e) Check for a short-circuit of wire 1 with 2 or wire 3 with 4.

f) RSR123 incorrectly connected.

If the voltage is 0 mV, then:

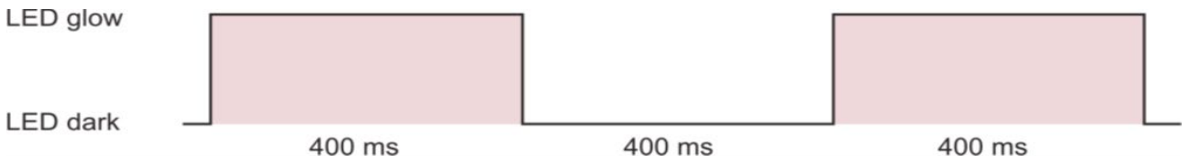
g) Check for a wire break wire 1, 2, 3 or 4.

h) Is the RSR123 connected.

3. AEB

3.1 LED indicators on the AEB

Slow flashing of the Sys1 or Sys2 LED.



Possible causes:

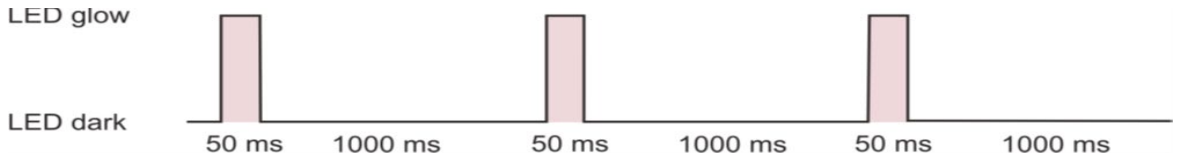
a) RSR123/AEB not adjusted.

b) Wire break or wire short circuit in wheel sensor cable.

c) An overcurrent.

d) Wheel sensor current level overlaid with harmonics.

Short flashing of the Sys1 or Sys2 LED

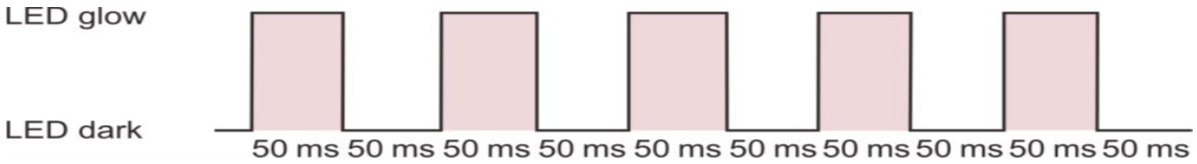


Possible causes:

e) No Life-signal from RSR123 (displayed after 1 minute).

f) Wheel sensor current drift of the RSR180/RSR123 (displayed after 1 minute)

Fast flashing of the Sys1 and Sys2 LED



Possible causes:

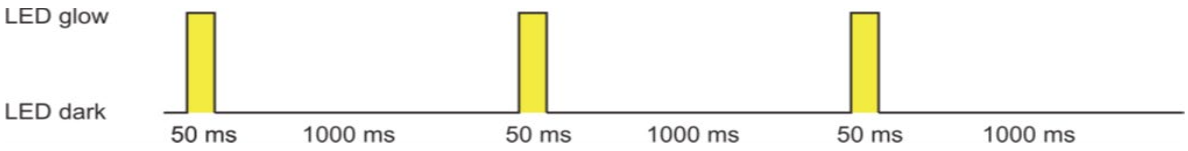
g) Adjustment process terminated (flash duration 2 seconds).

h) Invalid activation sequence instigated for adjustment (flash duration 2 seconds).

i) Internal AEB fault. In this case the power supply must be briefly disconnected.

If the problem continues, the AEB has to be replaced and/or the configuration of the AEB has to be checked.

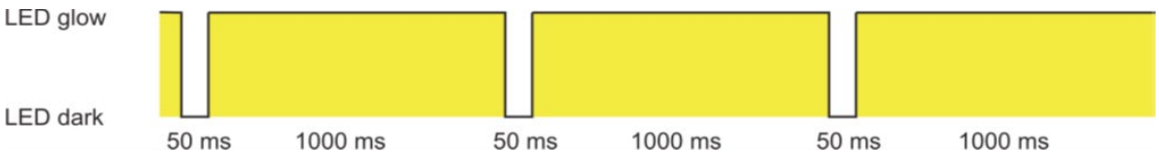
Short flashing of A1 and A2 LED



Possible cause:

j) The AEB is desensitised and the track section (FMA) is clear (in the case of counting head control).

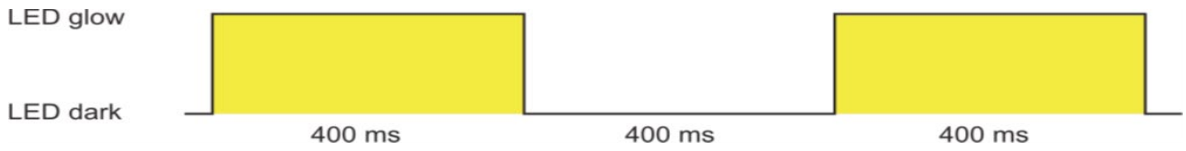
LED A1 and A2 shortly out



Possible cause:

k) The AEB is desensitised and the track section (FMA) is occupied (in the case of counting head control).

Slow flashing of A1 or A2 LED



Possible cause:

l) Track section FMA1 or FMA2 faulty.

B1 and/or B2 LED illuminated

Possible cause:

m) Not yet received a valid configuration file or data transfer interfered.

4. Error codes of the AEB

In the event of a fault and/or of an invalid configuration the AEB issues error codes. The output of the error codes can take place via an IO-EXB which is connected to the respective AEB.

The error codes can also be readout via the ASD or via diagnostic system.

If these error codes occur the configuration should be corrected by the person who designed the configuration.

If an error code occurs which is not described in the table below, please consult Frauscher and if necessary, send the AEB back to Frauscher.

Error code	Possible cause(s) / description
10	DIP-switches counting head outputs on the AEB are set different for channel 1 and channel 2.
12	Adjacent channel is faulty (only one channel of the AEB is faulty).
23	Automatic positioning was selected but bit-position is not configured with “0” (configuration word “data transmission output”).
24	Configuration word “assignment” is not set on each CO-EXB.
25	Configuration word “assignment” is configured several times per CO-EXB.
109	In case of hardware configuration IO-EXB boards are located in the system but no CO-EXB.
112	With the DIP-switches ID on the AEB “0” is set as ID of the AEB (for one channel ore for both channels).
115	Too many CO-EXB boards are located in the system.

Error code	Possible cause(s) / description
116	In case of software configuration CO-EXB boards are located in the system.
120	The maximum number of permitted counting heads per track section (FMA) is exceeded.
121	The maximum number of permitted counting head control sections is exceeded (configuration word “counting head control ID”).
122	The maximum number of permitted synchronisation or supervisor sections is exceeded (configuration word “synchronisation ID”).
123	Multiple configuration of track section FMA (e.g. 2 x FMA 1 or 2 x FMA 2).
124	Multiple configuration of reset.
125	Multiple configuration of counting head.
127	Configuration word “data transmission input” does not directly follow “data transmission output”.
128	No configuration of track section FMA (mandatory) for FMA 1.
129	No configuration of track section FMA (mandatory) for FMA 2.
130	Track section FMA 2 configured without FMA 1.
131	Track section FMA 1 is configured with supervisor section FMA 2 but FMA 2 is not configured.
132	Bits with indicator “AUX1_OUT”, “AUX2_OUT” and/or “MAIN_OUT“ were set to a ”not defined“ value (configuration word “track section (FMA)”).
133	Error if track section FMA 1 is to be output to a half, but track section FMA 2 is not output to a half IO-EXB (configuration word “track section (FMA)”)
134	Error if track section FMA 2 is to be output to a half, but track section FMA 1 is not output to a half IO-EXB (configuration word “track section (FMA)”)
135	No IDs configured for track section FMA 1 but own counting head is not counted.
136	No IDs configured for track section FMA 2 but own counting head is not counted.
137	Direction inversion is set for track section FMA 1, but own counting head is not counted.
138	Direction inversion is set for track section FMA 2, but own counting head is not counted.
139	Configuration of an auxiliary output for track section FMA 1, output however only via software.
140	Configuration of an auxiliary output for track section FMA 2, output however only via software.
141	Configuration of auxiliary output 2 for track section FMA 1, output however only to a half IO-EXB.

Error code	Possible cause(s) / description
142	Configuration of auxiliary output 2 for track section FMA 2, output however only to a half IO-EXB.
143	Configuration of the counting head control input for track section FMA 1, output however only via software.
144	Configuration of the counting head control input for track section FMA 2 (per AEB only one counting head control input is possible).
145	Wrong number of IO-EXB boards (e.g. one IO-EXB was configured and de facto there are two IO-EXB boards).
146	The maximum number of communication partners per AEB is exceeded.
147	Invalid ID (configured ID complies with the own ID.
148	Invalid ID (configured ID is zero).
149	Track section FMA 1 reset type configured with an invalid value (bits with indicator “RESET_IN” and/or “RESET_OUT” were set to a “not defined” value).
150	Track section FMA 2 reset type configured with an invalid value (bits with indicator “RESET_IN” and/or “RESET_OUT” were set to a “not defined” value).
151	The maximum number of permitted IO-EXB boards is exceeded.
152	In case of deactivated outputs, the automatic positioning was activated, a position was set, not the ID of the own ID is entered (configuration word “data transmission output”) or the configuration word “data transmission input” was not configured immediately.
153	Safety level of the data transmission input invalid (bits with indicator “SAFETY_LEVEL” were set to a “not defined” value).
154	Counting head ID configured several times.
155	Counting head control ID configured several times.
156	Synchronisation ID configured several times.
157	Invalid position of the output information (outside of 24 bit).
158	Data transmission configuration before the track section (FMA) configuration.
159	Automatic and manual positioning is combined for the data transmission.
172	Project number configured several times.
173	Project number configured with zero.
174	Configuration word “assignment” is used with software configuration.
175	Incorrect configuration of configuration word “assignment” (ID of AEB is wrong).

Error code	Possible cause(s) / description
176	No configuration of the configuration word “assignment” in the case of the hardware configuration.
177	Incompatible protocol-version-number between several AEB boards (old and new AEB boards were mixed).
178	No correspondence of the project numbers between the communication partners.
179 180	DIP-switches ID of AEB were set different for channel 1 and channel 2.
181 182	Different number of configuration words.
183 184 185	Different configuration.
186	All configuration requests unsuccessful (No CF-Card for configuration of AEB, wrong ID in the configuration file or wrong ID set on the AEB).
187	Invalid position of the input information (outside of 24 bit).

Table 1 – AEB Error Codes

5. Power Supply

5.1 LED Indications

Check the green PWR LED on the front panel of the PSC.

If the green LED is not illuminated, the possible causes are:

a) No voltage input .

b) SMD-fuse is blown (in this case replace the PSC and send the defective PSC back to Frauscher).

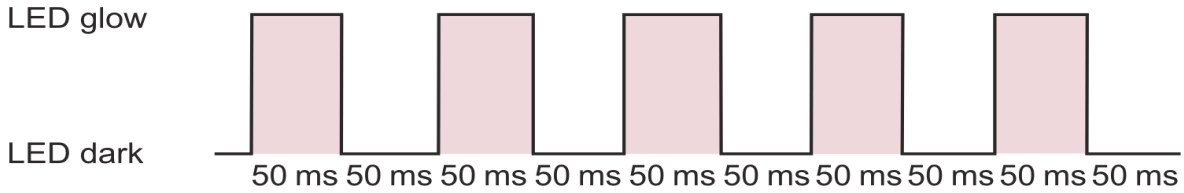
6. Communication Boards

6.1 LED Indications

Description of Error	Possible Cause(s)
LED ”PWR" not lit	No supply voltage
LED “CAN“ lit after Power-up	Board not yet ready for operation
LED ”CAN“ flashing or lit during operation	Error on CAN bus
LED “Ethernet 1” and/or “Ethernet 2”, top not lit	No connection to network 1 and/or 2
LED “Ethernet 1” and/or. “Ethernet 2”, bottom not lit	No data transfer
LED “Card” not lit	No CF-Card, no configuration on CF-Card or faulty CF-Card

Table 2 - Communication Board Error Codes

7. Fast flashing of Status LED



Possible cause:

a) Internal COM-AdC / COM-xxx fault

8. Error codes of the COM-AdC / COM-xxx

In the event of a fault and / or of an invalid configuration the COM-AdC / COM-xxx issues error codes (see Table 3). The error codes can be readout via the ASD or via diagnostic system.

If these error codes occur the configuration shall be corrected by the person who designed the configuration.

The error codes 18-48 (own channel) or 146-176 (other channel) affect the configuration with configuration words. If an error code occurs which is not described in Table 3, please consult Frauscher and if necessary, send the COM-AdC / COM-xxx back to Frauscher.

Error Codes		Possible Cause(S) / Description
Own Channel	**Other Channel**	
0	128	no error
15	143	error protocol-version does not correspond with AEB
16	144	error project-number does not correspond with AEB
17	145	DIP-switch setting of channel 1 and channel 2 not identical
18	146	number of possible configuration requests obtained, no answer
19	147	number of possible configuration requests obtained, faulty answers COMPONENT, CRC,...) received
20	148	comparison VERSION/VERIFY with the other channel failed
21	149	CFG_MY_IP_ADDR may only be configured once
22	150	CFG_MY_MASK may only be configured once
23	151	CFG_UDP_PORT_INT may only be configured once
24	152	CFG_ARP_TIMING may only be configured once
25	153	CFG_GTWY_IP, Gateway 1 (GTWY) may only be configured once
2	154	CFG_GTWY_IP, Gateway 2 (GTWY) may only be configured once
627	155	CFG_GTWY_DEST, Gateway 1 (GTWY) may only be configured once
28	156	CFG_GTWY_DEST, Gateway 2 (GTWY) may only be configured once
29	157	CFG_GTWY_MASK may only be configured once
30	158	CFG_DFLT_GTWY_IP may only be configured once
31	159	CFG_DEST_IP_ADDR with the same ID configured several times
32	160	CFG_UDP_PORT_DEST may only be configured once
33	161	CFG_FWRD_ACD, the same CAN sender-ID (CAN_TX_ID) appears in the configuration words CFG_FWRD_ACD and CFG_FWRD_TS
34	162	CFG_FWRD_TS configured too often
35	163	CFG_FWRD_ACD configured too often
36	164	CFG_FWRD_TS, the same CAN sender-ID (CAN_TX_ID) appears in the configuration words CFG_FWRD_ACD and CFG_FWRD_TS
37	165	CFG_FWRD_DIAG configured too often
38	166	CFG_FILTER_DIAG may only be configured once
39	167	CFG_MY_IP_ADDR or CFG_MY_MASK configured without the other configuration word
40	168	CFG_GTWY_IP, gateway 1 (GTWY) without CFG_GTWY_DEST, gateway 1 (GTWY) configured
41	169	CFG_GTWY_DEST, gateway 1 (GTWY) without CFG_GTWY_IP, gateway 1(GTWY) configured
42	170	CFG_GTWY_IP, gateway 2 (GTWY) without CFG_GTWY_DEST, gateway 2 (GTWY) configured

Error Codes		Possible Cause(S) / Description
Own Channel	Other Channel	
43	171	CFG_GTWY_DEST, gateway 2 (GTWY) without CFG_GTWY_IP, gateway 2 (GTWY) configured
44	172	CFG_DEST_IP_ADDR without CFG_MY_IP_ADDR and CFG_MY_MASK configured
45	173	CFG_UDP_PORT_DEST without CFG_DEST_IP_ADDR configured
46	174	external CFG_DEST_IP_ADDR without CFG_DFLT_GTWY_IP configured or CFG_GTWY_DEST gateway 1 and 2 (GTWY) not configured
47	175	external CFG_DEST_IP_ADDR without CFG_DFLT_GTWY_IP configured, CFG_GTWY_DEST gateway 1 (GTWY) wrong or CFG_GTWY_DEST gateway 2 (GTWY) not configured
48	176	external CFG_DEST_IP_ADDR without CFG_DFLT_GTWY_IP configured or CFG_GTWY_DEST gateway 1 and 2 (GTWY) configured wrong

Table 3 - COM-AdC / COM-xxx Error Codes

9. Error codes of CF-card

9.1 The error codes of the CF-card can be readout e.g. via the ASD.

Error Code	Possible Cause(S) / Description
0	no error
1	CF-card not formatted
2	boot record is bad / partition damaged
3	file system type unsupported
8	could not find the file on the device (error relates only to the respective request)
9	could not find the directory (CONFIG),
16	unsupported sector size / wrong formatting
17	access to CF-card not finished yet (no error, only information)

Table 4 - CF- Card Error Codes

10. Input / Output Extension Board IO-EXB

10.1 Troubleshooting Operating Status.

Operating Status	Display		
	1st Position	2nd Position	3rd Position
Partial traversing (Selection of the track section (FMA) with display-button on the front panel)	**P.**	**Code for determining the RSR causing the issue (see table 6)**	
Waiting for clearing of track (Selection of the track section (FMA) with display-button on the front panel)	**F.**	**Axle number, display to maximum 99 axles**	
Error (Selection of the track section (FMA) with display-button on the front panel)	**E**	**Dezimaler Fehlercode (01 to 99) (see table 6)**	
Communication error during axle counting (Selection of the track section (FMA) with display-button on the front panel)	**C.**	**Decimal error code (01 to 99) (see table 6)**	
Communication error during synchronisation (Selection of the track section (FMA) with display-button on the front panel)	**S.**	**Code for determining the AEB causing the issue (see table 6)**	

Table 5 – IO-EXB Operating Status

Error Code	Possible Cause(S)
0	Error number in case of problem on the own RSR
1 to 15	Error number in case of fault on the 1st to 15th external RSR of the track section (FMA)
16	Error number in case of negative counting
17	Error number in case of communication failure > 30 days
18	Error number during failed channel comparison
21-35	Unusable transfer quality of the counting head (for 1st to 15th external RSR of the track section (FMA))
41-43	Unusable transfer quality of the synchronisation (for 1st to 3rd track section (FMA))
- - -	Display during power up (during power-up the ASD shows the error code 99 (until Reset))

Table 6 - IO-EXB Error Codes

11. Data Transmission

11.1 Troubleshooting Operating Status.

Operating Status	Display		
	1st Position	2nd Position	3rd Position
Communication error	**C.**		**1**
Transfer quality for actuation of the outputs is unusable	**E.**	**2**	**1**
Different signals at own input (relevant to QUAD- and DUAL-inputs)	**E.**		**0**
Different signals at the other input (relevant to QUAD and DUAL-inputs)	**E.**		**1**

Table 7 – Data Transmission Operating Status

12. Error codes of AEB (displayed on the IO-EXB)

The error codes of AEB are described in Table 1.

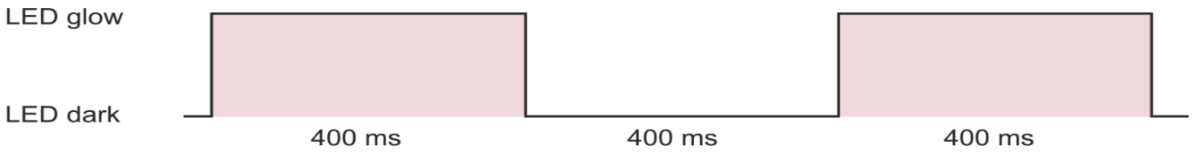
If using an AEB in combination with an IO-EXB, the IO-EXB can output error codes of the AEB.

If several IO-EXB boards have been connected to an AEB, the AEB error codes are displayed on the first IO-EXB.

The display of the IO-EXB shows alternately “Er1” – error code of AEB channel 1 – “Er2” – error code of AEB channel 2. The indication of AEB error codes takes precedence over the indication of axle counting error codes and data transmission error codes.

13. LED indicator on the IO-EXB

Slow flashing of the left Status LED on the IO-EXB



Possible causes:

a) Error during data transmission.

b) Track section (FMA) faulty.

14. Overvoltage Protection Board BSI005

Consider that the clamps of the BSI005 may be subject to transient over voltages.

In case of replacement of an AEB (by reason of an unknown failure) the BSI005 shall also be replaced.

14.1 Measure the voltage between clamps E1 and E2 it should be 28 to 31 V DC.

14.2 Measure the voltage between clamps E3 and E4 it should be 28 to 31 V DC.

If either of the voltages between clamps are not in the range stated, the overvoltage protection board shall be replaced as described in NR/SMTH/Part04/AX44 (Replace an Overvoltage Protection Unit BSI00).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part10/FF11		
Faulting Guide: Platform Identification Beacon		
Issue No. 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Platform Identification Beacons (PIBS)
Excludes:	All other track mounted Beacons

GENERAL

On being notified that there may be a fault with the trackside equipment, there are two distinct areas of activity, locating or diagnosing a fault within the trackside equipment and then rectifying the fault.

Diagnosing a Fault

The PIBS trackside equipment monitors for a variety of faults at start-up (power on) and then during operation it continuously monitors pre-selected conditions.

All malfunctions of the trackside equipment result in the transmission to trains being stopped; at the same time the healthy blue LED on the outside of the control panel is extinguished, i.e. upon pressing the LED button the lamp will not illuminate.

In addition, In the event of a fault with the PIBS trackside equipment, the 7-Segment display on the transmitter control unit within the control panel will display a code. This code will help to locate the cause of the problem by reference to Table 1.

Fault codes which display the decimal point are associated with IC1 and coding plug CP01; fault codes which do not display the decimal point are associated with IC2 and coding plug CP02.

Once the failed component has been replaced and the unit powered up again, PIBS will perform a system self-check and, assuming the fault has been cleared, the system will automatically reset itself into an active state. In the case of a hardware fault and the transmitter unit (LRU) needs replacing, it is essential that the coding plugs are left in the transmitter pane and returned with the unit for repair.

After any repair and before placing the system back into operation, use the Tracklink 2 Beacon Test Unit to check the output from the beacon to confirm for correct station and platform length.

There are no repairable components or adjustments which can be made within the transmitter control unit (LRU No.9). This unit has been sealed at manufacture and has to be replaced as a whole. Breakage of the seals on this unit will invalidate any warranty or guarantee.

Rectifying a Fault

PIBS is a modular system; all components are Line Replaceable Units, (LRUs). This means that there are no user serviceable parts contained within the PIBS system.

In the event of a failure of any module, reference should be made to Table 2. The item in question shall be replaced with a spare and the faulty item returned to the manufacturer for repair. You shall also notify IFC and your SM (S).

Tracklink 2 Beacon Test Unit (Track Loop Tester)

It is possible for maintenance personnel to confirm the correct operation and identification of the location of the station and platform length, etc., by use of the Test Unit. The top panel is shown in Figure 1.

Figure 1 – Tracklink 2 Beacon Test Unit Panel

IC1/CP01	IC2/CP02	Status Description	Suggested Action
	0	Healthy	None
	1	Transmitter Output Signal Level High	1) Check All Track Loop Connections (short-circuit) 2) Hardware Fault — Replace Transmitter Unit (LRU)
	2	Transmitter Output Signal Level Error	Hardware Fault — Replace Transmitter Unit (LRU)
	3	No Track Data after 2 Seconds	Hardware Fault — Replace Transmitter Unit (LRU)
	4	Transmitter Output Signal Level Low	1) Check All Track Loop Connections (disconnected) 2) Hardware Fault — Replace Transmitter Unit
5.	5	RAM Data Register Fault	Hardware Fault — Replace Transmitter Unit (LRU)
6.	6	Initialisation Fault (at Power On)	Hardware Fault — Replace Transmitter Unit (LRU)
7.	7	Brown-out Reset Fault	1) Check Power Supply to Transmitter Unit 2) Hardware Fault — Replace Transmitter Unit (LRU)
8.	8	CPU Data Transfer Fault	1) Check Feeder cable is not near sources of interference 2) Hardware Fault — Replace Transmitter Unit (LRU)
9.	9	Watchdog Reset Fault	Hardware Fault — Replace Transmitter Unit (LRU)
	A	5V Logic Supply High	Hardware Fault — Replace Transmitter Unit (LRU)
b.	b	Coding Plug Parity Fault	1) Check Coding Plug installed correctly 2) Faulty Coding Plug 3) Hardware Fault — Replace Transmitter Unit (LRU)
C.	C	Coding Plug Not Present	1) Check Coding Plug installed correctly 2) Faulty Coding Plug. 3) Hardware Fault — Replace Transmitter Unit (LRU)
	d	Track Data Check Fault	1) Check Coding Plugs installed Correctly 2) Check Coding Plug Numbers Match
	E	Feedback Coil Connection Fault	Hardware Fault — Replace Transmitter Unit (LRU)
	F	Track Data Receive Fault	1) Check All Track Loop Connections 2) Check Feeder cable is not near sources of interference
-.		Operation Stopped	Hardware Fault — Replace Transmitter Unit (LRU)

Table 1 – Transmitter Control Unit Fault Code Table

LRI Item No.	HSD 2000 Part No.	Description	Quantity per System	PADS Cat. No.
1	2000/066/00	Tracklink 2 Beacon (complete)	1 off	3492/098996
2	2000/066/01	Tracklink 2 Support Beams (specify fixings)	5 off	
3	2000/066/02	5m Track Cable Type C3, 2 core, 2.5mm2 c/w 3 pin moulded socket	1 off	006/160086
4	2000/066/03	10m Track Cable Type C3, 2 core, 2.5mm2 c/w 3 pin moulded socket		
5	2000/066/04	60m Tail Cable Type C3, 2 core, 2.5mm2	1 off	006/160086
6	2000/016/00	3 way Disconnection Box (complete)	1 off	3492/098997
7	2000/016/01	Dis. Box Support Stake	1 off	
8	2000/046/00	Tracklink 2 Transmitter S/S Enclosure	1 off	3492/098995
9	2000/046/01	Transmitter Control Unit	1 off	
10	2000/046/02	Transmitter Control Unit Power Supply Unit	1 off	
11	2000/046/03	Matched Coding Plug Set	2 off	
12	2000/046/04	Replacement LED Switch Indicator Complete (White)	1 off	
13	2000/046/05	Replacement LED Switch Indicator Complete (Blue)	1 off	
14	2000/046/06	Panel Condensation Heater	1 off	
15	2000/046/07	Condensation Heater Thermostat	1 off	
16	2000/046/08	Complete Termination Rail	1 off	
17	2000/046/09	Complete Set of Panel Identification Labels	1 set	
	Alter. to type C3 cable	5m Track Cable, ZHLS Type E3, 2 core, 2.5mm2 c/w 3 pin moulded socket	1 off	006/160090
		10m Track Cable, ZHLS Type E3, 2 core, 2.5mm2 c/w 3 pin moulded socket		
		60m Tail Cable, ZHLS Type E3, 2 core, 2.5mm2	1 off	006/160090

Table 2 – Line Replaceable Units (LRUs)

To operate the test unit, place it centrally onto the Tracklink 2 beacon so it is in a stable position, as shown in Figure 2.

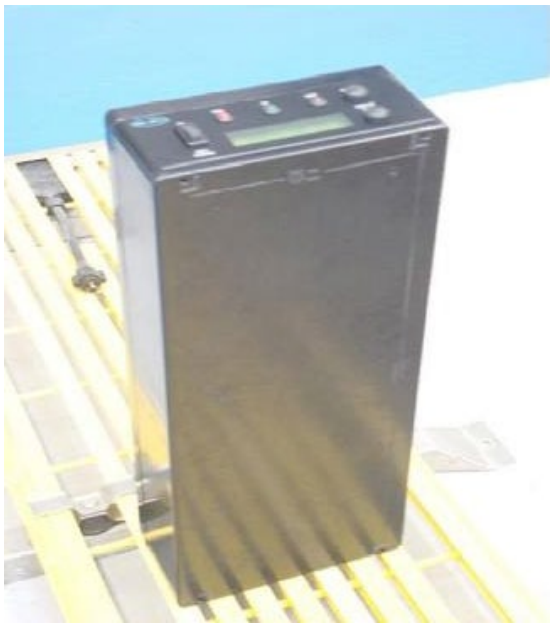


Figure 2 Test Unit Position on Beacon

With the test unit centrally positioned and stable on the beacon switch S1 to “ON” position. The test unit will automatically perform a self-checking procedure during its initialisation process, the sequence of which is as follows:

1. Indicators, L1- L3 externally mounted on the tester will illuminate for 2 seconds to show the LEDs are operational.

2. The 2 x 16-character display will display the following sequence:

TRACKLINK II TRACKLOOP TESTER

TRACKLINK II BATTERY LEVEL: 1-5	(1 = LOW, 5 = FULLY CHARGED)

TRACKLINK II CODE: 000000

In addition, the display backlight will be illuminated.

3. Providing the initialisation process is successful the test unit will go into normal operation. In addition, the Tracklink 2 beacon has to be active for the following to occur.

4. One of the 3 indicators L1 – L3 will illuminate to indicate field strength of the beacon.

   a) L1 “LOW” illuminated means field strength is below the acceptable transmission level.

   b) L2 “OK” illuminated means field strength is within acceptable transmission levels.

   c) L3 “HIGH” illuminated means field strength is greater than acceptable transmission level.

5. Only when L2 is illuminated a new code will be shown on the display as follows:

TRACKLINK II CODE: A1B2C3

The exact code will be determined by the coding plug in the trackside Tracklink 2 transmitter panel which is driving the beacon. The code represents the Location (station) and the Platform (length) data being transmitted from the beacon. This code can be cross referenced with the master listing to confirm it relates to the correct station and platform data.

6. Once the code is displayed press the “display hold” button (S3) which locks the current display. The test unit can be removed from beacon to view/read the data and should match that of the Tracklink 2 Transmitter panel driving the beacon.

7. To reset display and remove the locked data press the “reset” button (S2) which resets the code to 000000 and the LOW RED LED (L1) will illuminate if away from a beacon.

8. To deactivate test unit switch “S1” to the off/charge position.

With a fully charged battery the test unit should last approximately 8 hours in continuous use.

In the event that battery level reaches BATT LEVEL 1 on the display, the test unit will fail to operate. Place the test unit on charge via the charging socket (Figure 1) until a green light is shown on the charger unit which indicates test unit fully charged. While test unit is charging the charger unit shows a red light.

Maintenance of the Tracklink 2 Test Unit

Visual Checks:

a) Check external charging connector for damage.

b) Check external of tester for physical damage.

c) Check main label for secure fixing.

d) Yearly: Return to Hima-Sella Limited for calibration.

END

1. TPWS Failure Indications

The TPWS trackside equipment has two methods of detecting and indicating faults; an internal proving relay, which is generally connected to a signalling indication circuit (signal lamp proving relay circuit, SSI proving input or dedicated FIU circuit); and a 'Fault' LED.

The internal proving relay is energised whenever TPWS is transmitting and the internal circuits of the TPWS modules are not detecting a fault. It is de-energised whenever TPWS is not transmitting, even if it is not required to be transmitting. The status of the relay is indicated by the 'Loops Active' LED on the SIM.

The 'Fault' LED on the TPWS OSM/TSM module is a latched indication. Once a fault occurs the LED continues to be illuminated until reset (achieved by removing the power to the SIM) even if the signal is at a proceed aspect or the fault has cleared. However, this indicator is purely a visual indication to the maintainer and does not cause a TPWS failure to be reported to the Signaller.

Further information on 'Fault' LED indications is given in sections 2 and 4.

For signals, failure of TPWS to transmit when required, is generally reported in the lamp lit indication of the signal fitted. For buffer stops TPWS failure is reported in the platform starter signal's first filament failure proving circuit.

TPWS at PSRs do not normally have any remote fault reporting.

In relay areas and some SSI areas (non-data change TPWS installation), the VCR relay is incorporated into the lamp proving circuit of the fitted signal, and hence needs to be conditioned with contacts of signal operation relays in order that no TPWS fault is reported when the signal is off and TPWS is de-energised.

In other SSI areas (data change TPWS installations), the TPWS internal proving relay contact is used to operate an input to an SSI TFM, and any conditioning of fault reporting is done within the SSI data.

In mechanically signalled areas and the most recent re-signalling schemes using new NX panels or VDUs, TPWS failures are reported using a dedicated proving circuit and indication (an FIU indication in mechanically signalled areas and dedicated TPWS indications on new panels / VDU operated signalling systems).

TPWS failure in these areas might still result in the signal in rear being automatically replaced to danger.

As a result of the above circuit arrangements, the TPWS internal proving relay contact is included in the lamp proving circuit only when the signal is at danger, and failures of TPWS have no effect on the signalling system when a proceed aspect is being displayed.

When the signal is at danger TPWS failures have the same effect as a red lamp failure, causing the signal in rear to be held at or replaced to danger, and the Signaller's panel to display a lamp out indication (or a TPWS failed indication if a dedicated indication is provided).

2. Actions to be Taken if TPWS Fault LED is Illuminated

The 'Fault' LED on the TPWS OSMs / TSMs is a latched indication to help the maintainer identify and rectify faults. However, as explained in sections 14 and 16, it might register a fault due to external causes, such as Class 314/315 trains running over energised loops or short duration power supply outages.

This means that a lit 'Fault' LED does not necessarily indicate the ongoing presence of a TPWS fault.

Where a TPWS installation has fault reporting to the Signaller, and latched fault indications are frequently found in an area where such power supply outages or Class 314/315 problems are known, these fault indications may be ignored providing there is no other evidence of ongoing TPWS failure (e.g. 'blank on panel' or 'Loops Active' LEDs not lit with signal at danger).

In this case there is neither a requirement to report a latched fault indication to the Signaller, nor to enter it into FRAME.

Where there is no remote fault reporting, if a 'Fault' LED is found lit during three monthly and annual maintenance visits, the TPWS fault indication shall be reset and, as a minimum, voltages checked at the output terminals (see Section 19).

To re-set a latched 'Fault' LED indication, the associated BX 110 250mA fuse holder shall be pulled out or MCB switched off for 5 seconds and then replaced (see Section 20).

This reset procedure is intrusive, so set up a safe system of work with the Signaller. When the power supply to TPWS is disconnected, a fault alarm is generated every time the signal displays a red aspect, this can cause replacement of the signal in rear to danger.

3. Failure Identification

Once a failure has been isolated to the TPWS trackside equipment, carry out the fault-finding process outlined in the flowcharts in NR/SMTH/Part10/FF13.

Isolate the TPWS trackside equipment using the BX110 250mA fuse on the terminal rail of the baseplate, the MCB on the racking or trackside enclosure backplane, before any modules are removed or replaced. Remember that the main and subsidiary 110V AC. Inputs to the SIM might still be live.

Record all the test results on NR/SMTH/Part02/Form/12 (Train Protection Warning System (TPWS) Failure Report Form). All equipment that is removed from site and returned to the manufacturer shall be accompanied by a completed TPWS Fault Report Form to aid further failure diagnosis of any returned equipment.

This form can also be used to aid the process of escalating the fault to a second or third-line faulting team.

If any item of equipment is changed then testing shall be carried out using the relevant maintenance test plans, as detailed in NR/SMTH/Part04

All faults, whether rectified or cleared with no fault found (tested OK), shall be recorded in the Fault Management System (FMS).

NOTE: *Cases of 'Fault' LEDs being lit with no other evidence of failure (e.g. blank on panel, or change of aspect), do not count as faults to be recorded in FMS.*

Any failure within the internal wiring of a baseplate or trackside enclosure plugboard panel (including the module plugboard and/or spade connections) shall require the entire unit to be changed. The units are not to be repaired on site.

Where baseplates have not been provided then plugboard wiring shall be checked or replaced.

4. 'No Cause Found' (NCF) or 'No Fault Found' (NFF) - Failure Procedure

There are a number of possible failure modes of TPWS trackside equipment that lead to intermittent faults that are difficult to identify other than the presence of a latched 'Fault' LED.

The method of fault finding in the flowcharts identifies many, but not necessarily all, of these failures.

With the exception of failures in areas known to be susceptible to Class 315 and Power Supply faults, if having completed all procedures outlined in the fault-finding flowcharts in NR/SMTH/Part10/FF13, there is still no cause found for an intermittent fault, proceed as follows:

a) On first failure, replace any phosphor bronze contact modules with gold contact modules, and test as per the fault-finding flowchart.

b) On second failure repeat all tests, if still NCF, replace all TPWS modules.

c) On third failure repeat all tests, if still NCF, replace the baseplate or backplane or plugboard and wiring where no baseplate is provided.

d) On fourth failure repeat all tests, if still NCF, replace the tail cables and loops.

Repeat failures will be kept to a minimum by following this procedure.

It may be advisable to perform items b), c) and d) on the second failure in certain high-risk locations.

5. Loose Terminals

The TPWS transmitter loop output circuit is particularly prone to high resistances, as would be caused by loose connections on terminals and links.

It is hence important that all connections to the loops (i.e. the terminals at the trackside enclosure or baseplate terminal rails or plugboards where baseplates are not provided and outgoing links in apparatus cases and disconnection boxes) are thoroughly checked for tightness.

6. Contamination of Spring Contacts

High resistance contacts between the TPWS modules and the BR829 relay base are a known cause of failures with TPWS equipment with un-plated phosphor bronze contacts.

Although the action of removal and replacement of the TPWS modules can sometimes, in itself, clean the contacts and remove the source of the failure, it is recommended that all such modules are replaced with the equivalent modules with gold plated contacts.

7. Coil Resistance Check

Before performing this test, undertake a continuity check of your meter and leads, by shorting the meter leads together and making a note of the resistance of the leads. This value should be deducted from the results obtained in the following tests.

From the rear of the module, preferably held by a colleague on a solid surface, take the reading in Ohms with a Fluke 187 / 287 using only light pressure at the base of terminals D3/D4 as shown in Figure 1.

Apply light pressure so as not to deform the contact tension. Take care not to press the contacts together otherwise you will simply read a short across the pair.

The coil resistance should be between 320Ω - 400Ω (with an ambient temperature range of - 20°C to +30°C).

If the reading is outside this range, then the module shall be deemed defective and suitably quarantined.

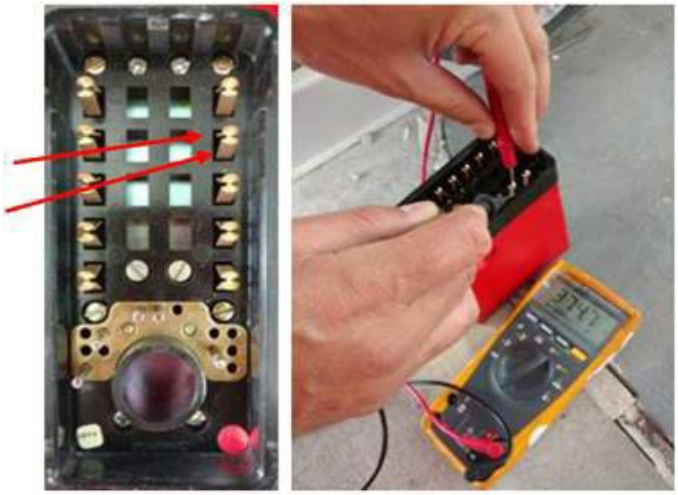


Figure 1 - Coil Resistance Check

8. Contact Resistance Check

Before performing this test, undertake a continuity check of your meter and leads, by shorting the meter leads together and making a note of the resistance of the leads. This value should be deducted from the results obtained in the following tests.

This test checks the proving contacts in the PS & SI (Red Module).

With the signal displaying a Red Aspect, (energising the proving relay coil of the TPWS module) take possession of the signal from the Signaller and slip links 7 and 8 on the TPWS baseplate, measure the resistance across the terminals 7 and 8 as shown in Figure 2.

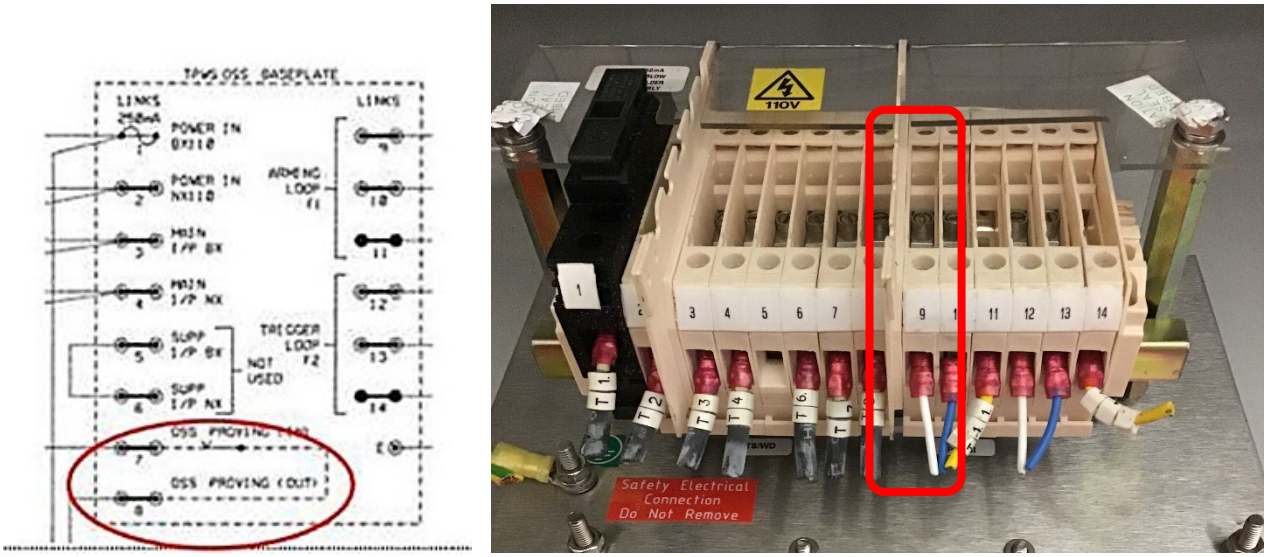


Figure 2 - Contact Resistance Check

Check that the contact resistance is ≤0.50Ω.

If the contact resistance is greater than 0.5Ω, then the module shall be deemed defective and suitably quarantined.

9. Thales Trackside Enclosures Door Seals

Some isolated cases of trackside enclosures have been found with moisture inside. Two causes have been established by Thales; the first due to the rubber door seal having been damaged during installation.

This damage is normally visible, and if found, the entire door shall be changed as individual seals are not available.

The second cause established is failure to correctly install the sealing washer for the cabinet support fixing holes as shown in NR/L3/SIG/11303 (Signalling Installation Handbook).

10. Ceramic capacitors in OSM/TSM

Ceramic capacitors in OSM and TSM modules can fail due to cracking, resulting in SIM failure due to excessive current draw.

In this case a failure within the OSM/TSM would only be identified by either the corresponding SIM overheating or by the SIM 250mA fuse blowing or MCB tripping.

When a TPWS failure occurs and the SIM is found to be overheated, indicating a capacitor failure, replacing only the SIM does not resolve this fault because the cause of the fault is in the OSM or TSM.

In this case, both the SIM and the OSM/TSM shall be changed.

11. Transmitter Loop Related Failures

A fault in TPWS transmitter loop windings can be identified by testing the DC resistance of the transmitter loop across the tail cable connections, using the Fluke 187/TPWS digital multi-meter, with the loop isolated.

A healthy loop should give an indicated DC resistance reading in the area of 0.5 to 1.5 Ohms, when measured across the two smaller pins of the loop plug coupler.

A faulty loop would give a much greater reading.

The meter shall be used in the ‘ΔRel’ mode for this test to compensate for the resistance of the test leads (i.e. normalise the reading first by shorting the two leads, then repeat the test with the Transmitter loop plug coupler in circuit).

During insulation resistance (Megger) testing of TPWS transmitter loop feeder cables and tail cables, damage might be caused to the loop tuning circuit if the cables are tested with the cable still connected to the loop.

All insulation resistance testing of TPWS transmitter loop feeder cables and tail cables shall be performed with the transmitter loop disconnected at the plug coupler.

The transmitter loop tuning unit can become detached from the loop itself if the tail cable is pulled to disconnect the tail cable from the loop.

The end caps of the transmitter loops, if they become detached from the Loop, can be glued back on if the transmitter loop is still working correctly, as described in NR/L3/SIG/11303 (Signalling Installation Handbook).

12. Plug Coupler Related Failures

TPWS cables are susceptible to damage at the point where the cable enters the plug coupler, caused by axial rotation or lateral flexing / twisting of the plug coupler.

This could lead to high resistance readings during insulation resistance testing or a short circuit between cores and the drain wire.

The plug coupler itself has an Ingress Protection (IP) rating of 67, which would allow it to maintain its internal electrical integrity when totally submerged in water.

This also has the effect that any dirt or moisture appearing on the mating halves of the plug coupler prior to installation remains when the plug coupler is mated, leading to failure possibility.

13. Differential Loop Readings

Voltage readings taken from the TSS / OSS module outputs measured at the baseplate where provided or trackside enclosure terminal rail (as per Section 19), for a pair of loops comprising one OSS or TSS function, should be roughly the same for the arming and trigger loop.

For a TSS loop pair, a difference between the two readings of more than 0.3V AC might indicate the possible presence of a fault in the loop feeder cable circuit for the higher of the two readings, as the length of the two loop feeder cables is generally equal.

For an OSS loop pair (other than buffer stop mini-loops), it is expected that the voltage on the arming loop output should be slightly higher than the trigger loop output as the loop feeder cable circuit is generally longer due to the relative distances of the two loops from the controlling apparatus case.

If the reading from the trigger loops is higher than the arming loop, or if the reading from the arming loop is significantly higher than the trigger loop, then this can also indicate the possible presence of a fault in the circuit giving the higher voltage reading.

14. Trends in Loop Voltage or Frequency

The record card should be available on site (if not inform the SM (S). Maintenance readings should be compared to those previously noted to observe any ongoing system deterioration.

Any continuing or sudden drift ft in the voltage or frequency readings for any particular loop, taken either from the OSS / TSS outputs to the transmitter loops or from the loops themselves, indicates the presence of a possible fault within either the OSS / TSS module, the loop feeder cable circuit, or the signalling power supply.

This depends on correct use of the maintenance jig and calibrated test equipment.

It is required that readings taken with the commissioning jig are recorded on the maintenance record card.

These readings are significantly lower than the readings taken with the maintenance jig and should not be confused with the downward drift in maintenance readings referred to above.

15. SSI Method 3 Timing Feature

For SSI interlockings installed using method 3, there is a potential timing feature such that, upon the signal returning to danger and energising TPWS, the fault reporting circuit, due to the slow to drop RECR, might not complete the lamp proving circuit within the settling time allowed by a TFM.

In this case, a loss of proving is reported to the central interlocking, which might immediately result in a blank signal aspect being displayed to the Signaller for 2 to 3 seconds (two or three major interlocking cycles).

If the signal in rear is showing a proceed aspect when the above situation occurs, then the signal in rear could revert to danger and then clear again when TPWS proving is correctly established.

This normally only becomes evident when a signal is replaced to danger by the Signaller (or by a track circuit failure), as during the normal passage of a train the signal in rear is already being held at danger.

The Technicians Terminal should filter out any interruptions lasting less than one major interlocking cycle and it is possible that a fault might be reported by the Signaller that is not actually recorded by the Technicians Terminal.

The above situation normally only occurs with TFMs with software to version SSI4311-C3 or earlier, which have a settling time of about 90ms. Later TFMs with software to SSI4311-C4/D1 or later have a settling time of around 250ms.

If a similar failure occurs with these TFMs, this generates an indication that either the signal lamp voltage is out of specification, or that the signal main filament has blown.

Persistent failures of TFMs with software to SSI4311-C4/D1 or later may be cured by installing SL35 8000-hour lamps and increasing the signal lamp voltage to 12 Volts.

16. Failures Related to A.C. Traction Units (Class 314/315)

Certain 25kV AC Electrical Multiple Units (EMUS), when pulling away under power, induce interference that might cause TPWS faults to be indicated, both by the TSM / OSM 'Fault' LED and to the Signaller.

The units that are known to cause such faults are Class 315 units.

It is also possible that Class 314 EMUs operating in the Glasgow area might cause TPWS faults.

The interference is caused by a magnetic field radiated from the traction equipment on the Driving Motor Cars, which is always mounted further back than the TPWS aerial, hence it is not likely that this would prevent TPWS from being operational when required, however it might cause a large amount of spurious fault indications.

Confirmation that spurious fault indications of the TPWS track sub-system are being caused by interference from traction units, can be obtained by observing the passage of trains accelerating over the energised TPWS transmitter loops (note no faults occur if the loops are not transmitting).

The effect is most consistent at locations where the units accelerate hard past a TPWS fitted signal that is replaced to danger before the traction unit of the train has passed over the transmitter loops.

The interference causes the 'Fault' LED on the TSM / OSM to illuminate and the 'Loops Active' LED on the associated SIM to be extinguished, and possibly cause a brief loss of lamp proving (or TPWS proving if a dedicated indication circuit is used) for approximately one second or less, as each driving motor car passes over an energised transmitter loop.

The TPWS System Authority is currently pursuing a solution to this problem.

17. Baseplate Fuses

The 250 mA fuses used in TPWS trackside enclosures and baseplates are fitted with indicating devices in one of the end caps.

These are a yellow disk attached to a spring, which when visible, show that the fuse has ruptured.

In some instances, the indicator device might become activated without the fuse having blown. This is a known defect with the fuses, and does not require the fuse to be replaced, provided that the 'Power On' indications on the TPWS equipment are still lit.

Do not drop the fuses when the fuse holder is pulled out.

Some installations where baseplates are not provided may be protected by 250mA MCB.

18. Power Supply Interruptions

Signalling power supply interruptions of between 70msec and 700msec can result in short duration TPWS faults, and hence a latched fault appearing on any TPWS module that is transmitting at the time of the power supply interruption. Normally this would occur on a number of the TPWS installations in an area and would almost certainly affect both the OSS and TSS on a signal installation that has both functions.

The presence of multiple latched fault indications in an area is indicative of a power supply interruption and not genuine TPWS faults.

Due to the short duration of the power supply fault the TPWS failure are not usually seen by the Signaller or by the remote fault reporting system.

Longer power supply faults can lead to any TPWS latched failures being reset. However, this would be seen by the Signaller and be recorded on any remote fault reporting system (e.g. Technicians' Terminal).

Following a reset of TPWS after a power supply interruption (see Section 2), it is still advisable to take a full set of voltage and frequency readings to identify any other latent failures.

A voltage reading on the TSS / OSS module output to the transmitter loops that is higher than expected (see Sections 13 and 14) would make the function more susceptible to failures caused by any fluctuations in the signalling power supply.

19. Voltage Testing and Dummy Load Testing

The expected voltage on the TSS / OSS module output to the transmitter loops when driving a nominal 75 Ohm load, should be approximately 4.2V. When connected to a TPWS Transmitter Loop circuit this can vary between 3.9 V and 5.1 V AC.

If there is a failure somewhere in the transmitter loop circuit that is causing the 'Fault' LED to remain lit when the TPWS equipment is reset, then a 75ohm 0.5 W resistor can be used to aid identification of the exact location of the failure.

This test method requires an electrical disconnection and appropriate protection of the operational railway, as the testing is intrusive and the signal in rear will be replaced to danger during the investigation process.

The TPWS BX 110 V AC supply shall be isolated using the 250mA fuse or MCB. The arming transmitter loop for the failed function shall be disconnected from the module outputs using the sliding links on the terminal rail of the baseplate in the trackside enclosure or the outgoing links where no baseplate provided.

The 75 Ohm load shall then be placed across the two legs of the output and the module output voltage recorded.

When the fuse to the module is replaced or the MCB switched back on, and the TPWS equipment is required to transmit, the 'Fault' LED should no longer light, indicating that the fault is in the loop feeder cable circuit or the transmitter loop itself. If the failure still does not clear then the failure is likely to be in either the trigger loop circuit (the above process shall then be followed for that circuit), or in the module / baseplate itself.

If the failure does clear then the module shall once again be isolated and this process repeated at various points in the loop feeder cable circuit (i.e. any disconnection boxes and the plug coupler) with the circuit disconnected downstream from the point at which the dummy load is inserted.

The voltage at the module output to the transmitted loop shall be recorded and the 'Fault' LED monitored in each case, to identify the failure point.

Once the component causing the failure has been identified using the above process, it shall be replaced, TPWS re-energised, and the testing of the equipment carried out.

It is essential that the 75 Ohm resistor is not left in circuit, as this prevents TPWS from working correctly. A final check shall be made for this, before leaving the site.

20. Resetting TPWS Equipment

To reset any lit 'Fault' LEDs on the TPWS equipment, isolate the BX110 supply to the TPWS equipment for at least five seconds by pulling out the 250mA power supply fuse holder or switching off the MCB to the SIM (position I on the baseplate, where provided or trackside enclosure terminal rail), and then replacing it.

Removing the 250mA fuse or switching off the MCB when TPWS is transmitting causes a TPWS fault to be reported and the signal in rear replaced to danger (with the exception of PSR installations), hence all resetting of TPWS shall be done with the full co-operation of the Signaller and when no trains are affected.

It is best to reset TPWS when the controlling signal is showing a proceed aspect, as this does not cause a TPWS fault to be reported and not lead to a reversion of the signal in rear to danger.

After re-applying the power, the green 'Power on' LEDs on all modules associated with the supply fuse/ MCB should be lit and all red 'Fault' LEDs should be unlit.

If they are not, then the fault-finding processes outlined in the flowcharts can be used to assist in identifying the cause of the fault.

When all other testing is completed, before a fault can be considered as rectified, it is necessary to wait for the TPWS to be required to transmit (signal at danger) to confirm that the 'Fault' LED does not relight, and that the 'Loops Active' LEDs and appropriate 'Main I/P' and 'Supp I/P' LEDs do light.

21. TPWS Failure Identification Flowcharts

The processes described in the flowcharts shown in NR/SMTH/Part10/FF13 detail methods of identification of faults likely to be found on installed TPWS equipment.

Before any of the following tests are carried out, a check should be made for obvious causes of failures such as loose connections on terminal rails or loose sliding links in apparatus cases.

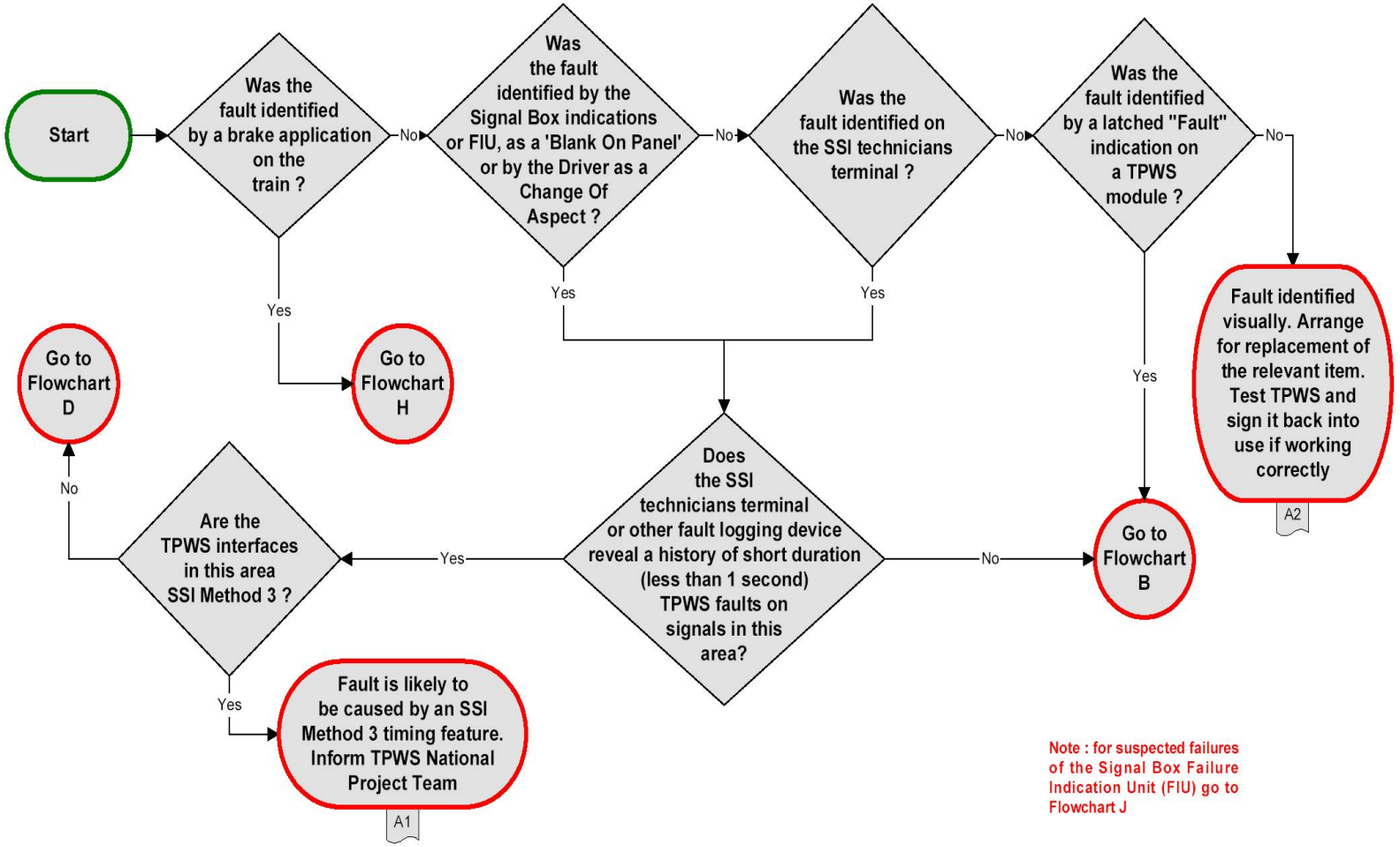
22. Failure Identification Codes

The outcome codes on the above flowcharts represent the TPWS fault finding fault codes shown in Table 1.

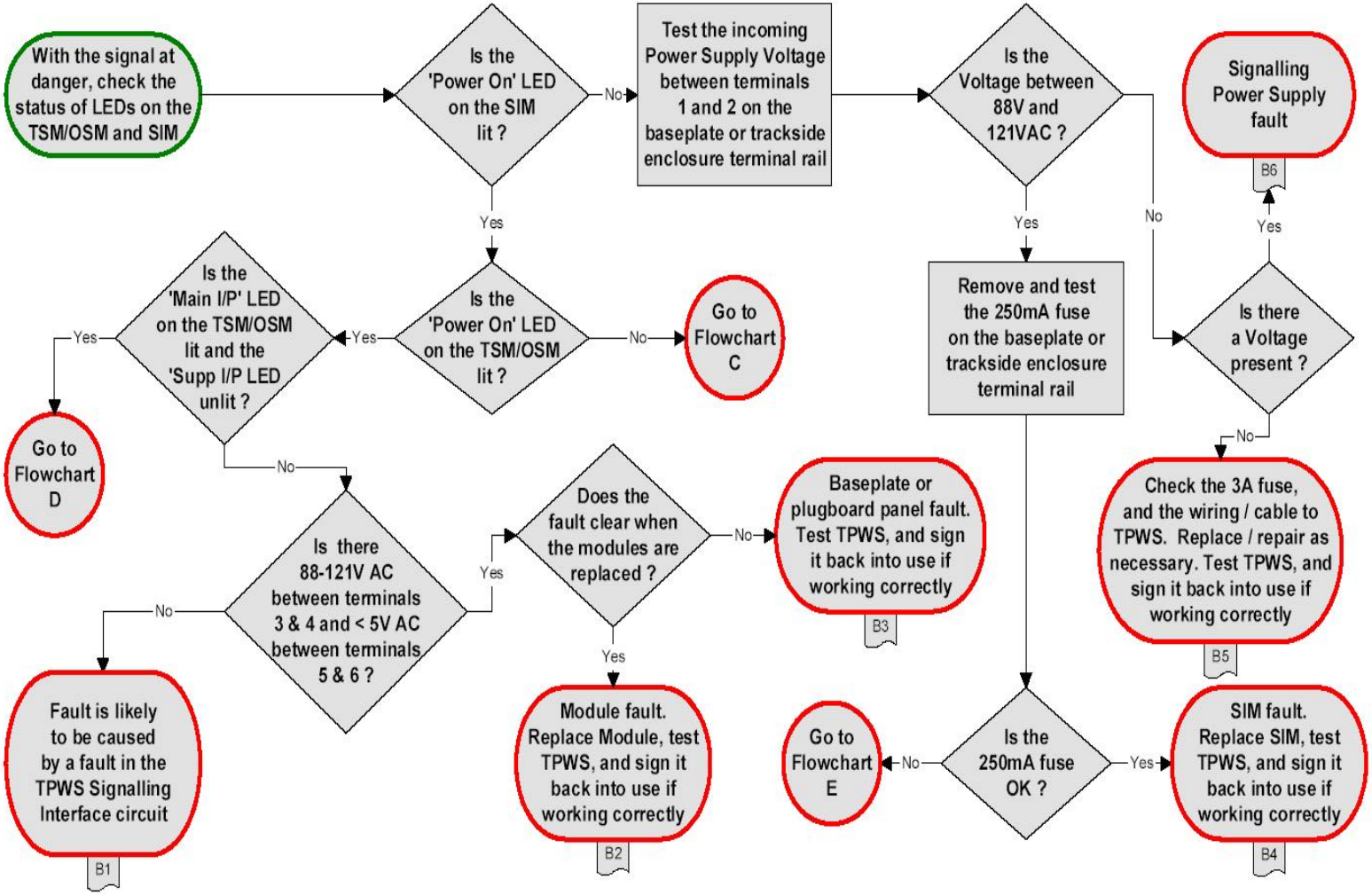
Fault Code	Meaning
A1	SSI Method 3 timing feature.
A2	Other item of equipment / fault identified visually.
B1	Signalling interface circuit fault.
B2	TSM / OSM module fault.
B3	Baseplate or plugboard panel fault.
B4	SIM module fault.

Fault Code	Meaning
B5	Fuse, MCB or cable fault to TPWS.
B6	Signalling power supply fault.
C1	SIM module fault.
C2	TSM / OSM module fault.
C3	Baseplate or plugboard panel fault.
C4	Fault cause not known - contact SM(S).
D1	Fault cause not known / not a TPWS fault - contact SM(S).
D2	Class 314/315 related fault.
D3	TSM / OSM / SIM module fault.
E1	OSM module ceramic capacitor fault.
E2	TSM module ceramic capacitor fault.
E3	Fault cause not known - contact SM(S).
E4	TSM / OSM module ceramic capacitor fault.
E5	250mA fuse of MCB fault.
F1	Module spring contact fault.
F2	Signalling power supply fault.
F3	Link or terminal connection fault.
F4	Module spring contact / baseplate or plugboard panel fault.
F5	Transmitter loop or tail cable fault.
F6	Fault cause not known - contact SM(S).
G1	TSM / OSM module fault.
G2	Baseplate or plugboard panel internal wiring fault.
G3	Transmitter loop cable fault.
G4	Tail cable fault or plug coupler.
G5	Transmitter loop fault.
G6	Fault cause not known - contact SM(S).
H1	OSS loop separation error or genuine over-speeding event.
H2	TPWS loops transposed or signalling interface circuit fault.
H3	Fault cause not known - contact SM(S).
H4	Intermittent signalling interface circuit fault or design error.
H5	TSM / OSM module fault.
H6	Intermittent signalling interface (suppression) circuit fault.
J1	Master FIU fault.
J2	Slave FIU fault.
J3	UPS fault or line termination plug fault.
J4	Signalling power supply fault.
J5	Master FIU fault.
J6	Master / Slave FIU fault.
J7	Fault cause not known - contact SM(S).

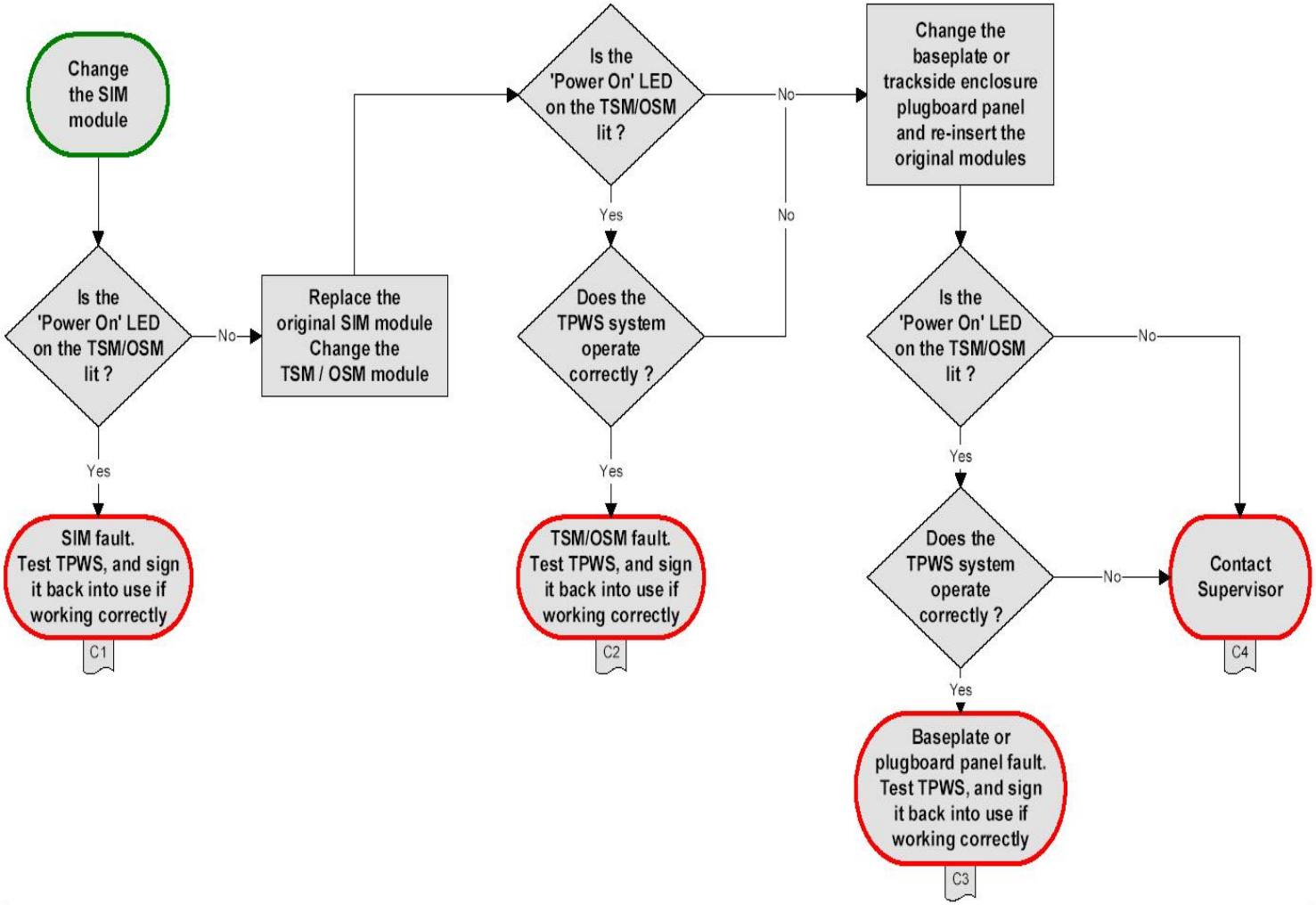
END



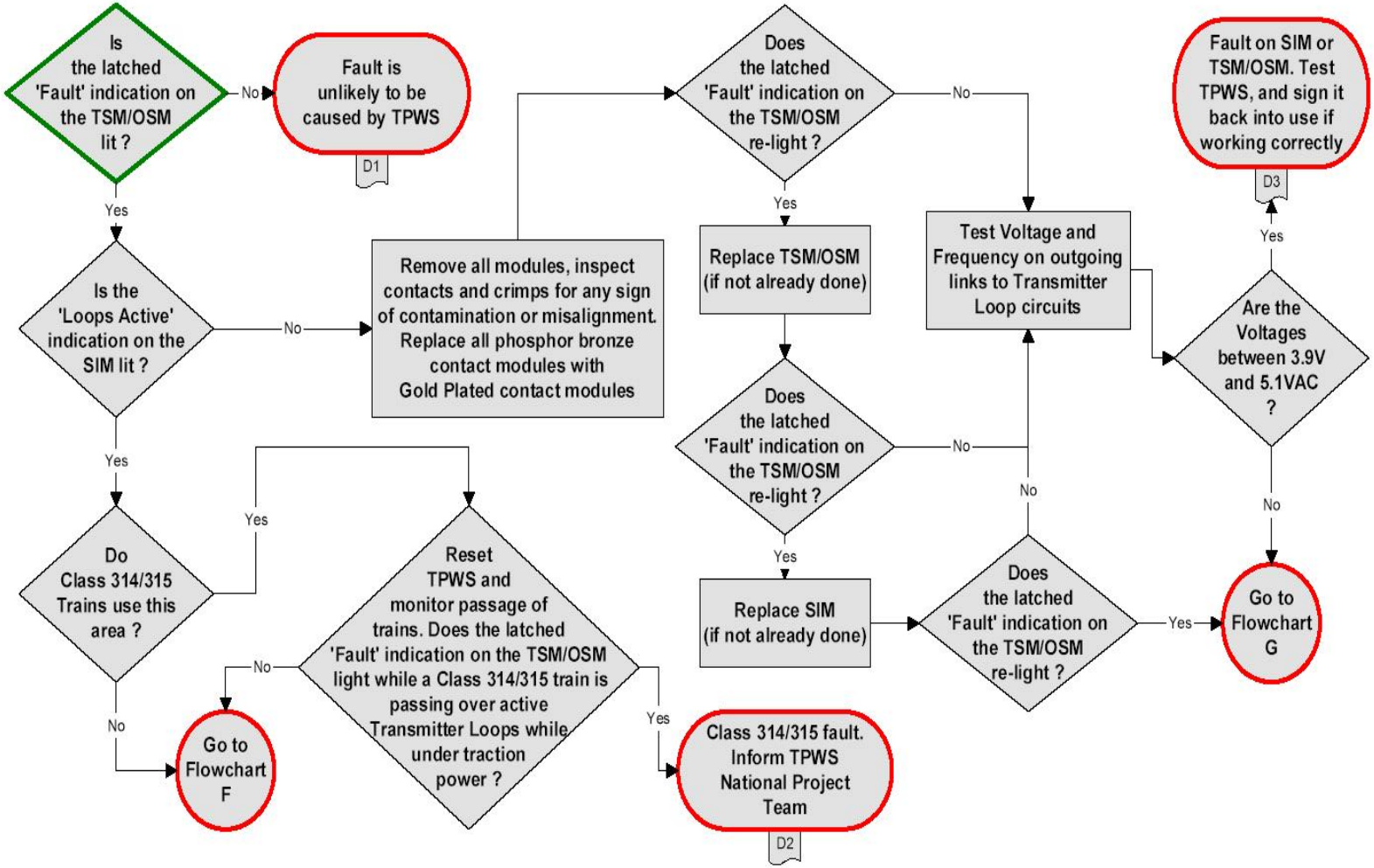
Flowchart A
Initial Fault Diagnosis - At Signal Box



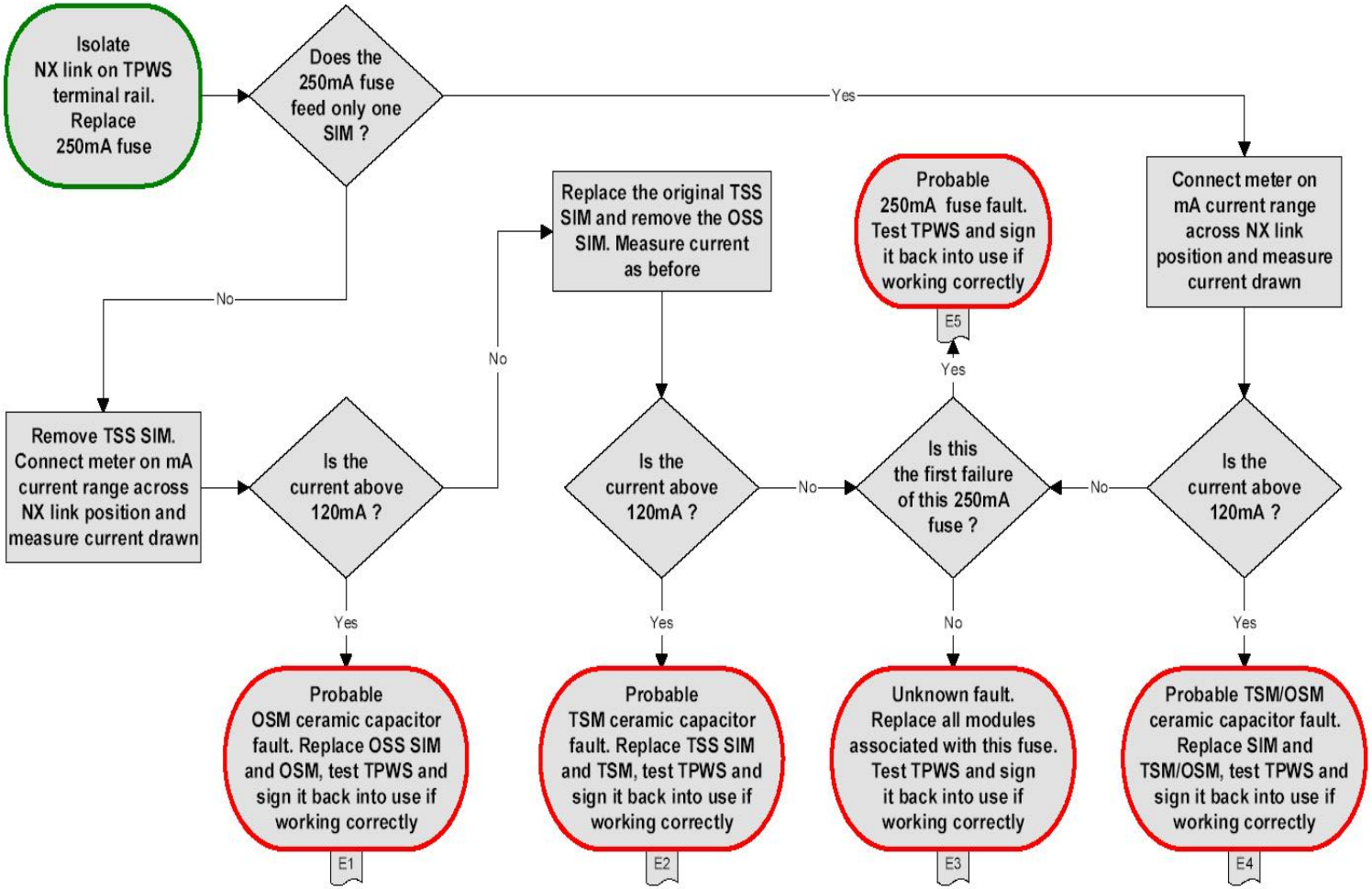
Flowchart B
Initial Fault Diagnosis - Trackside



Flowchart C
No TSM / OSM Power - SIM / TSM / OSM / Baseplate / Plugboard Panel Faults

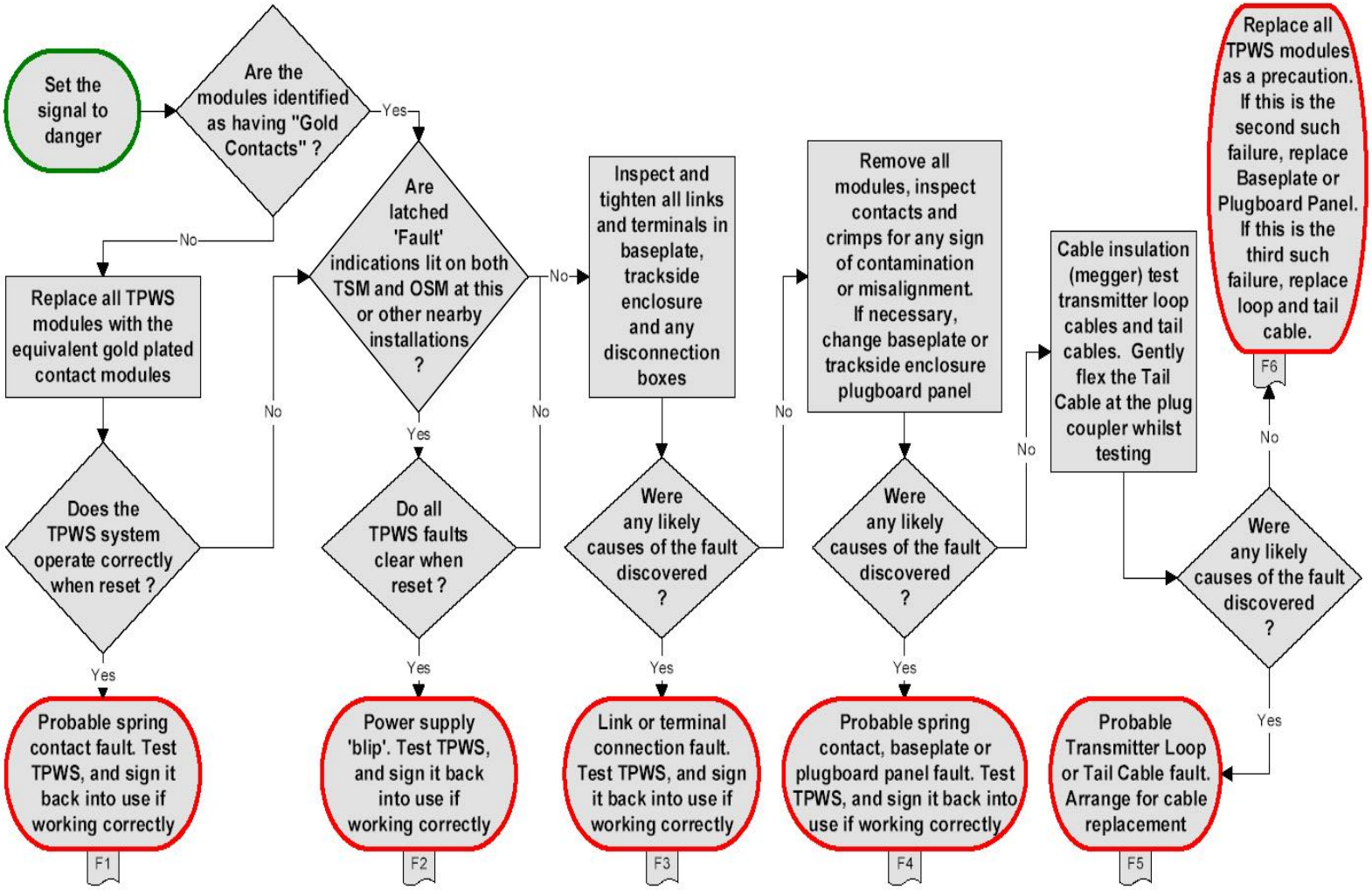


Flowchart D
TSM / OSM Fault LED Lit - TSM / OSM / Class 314/315 Fault

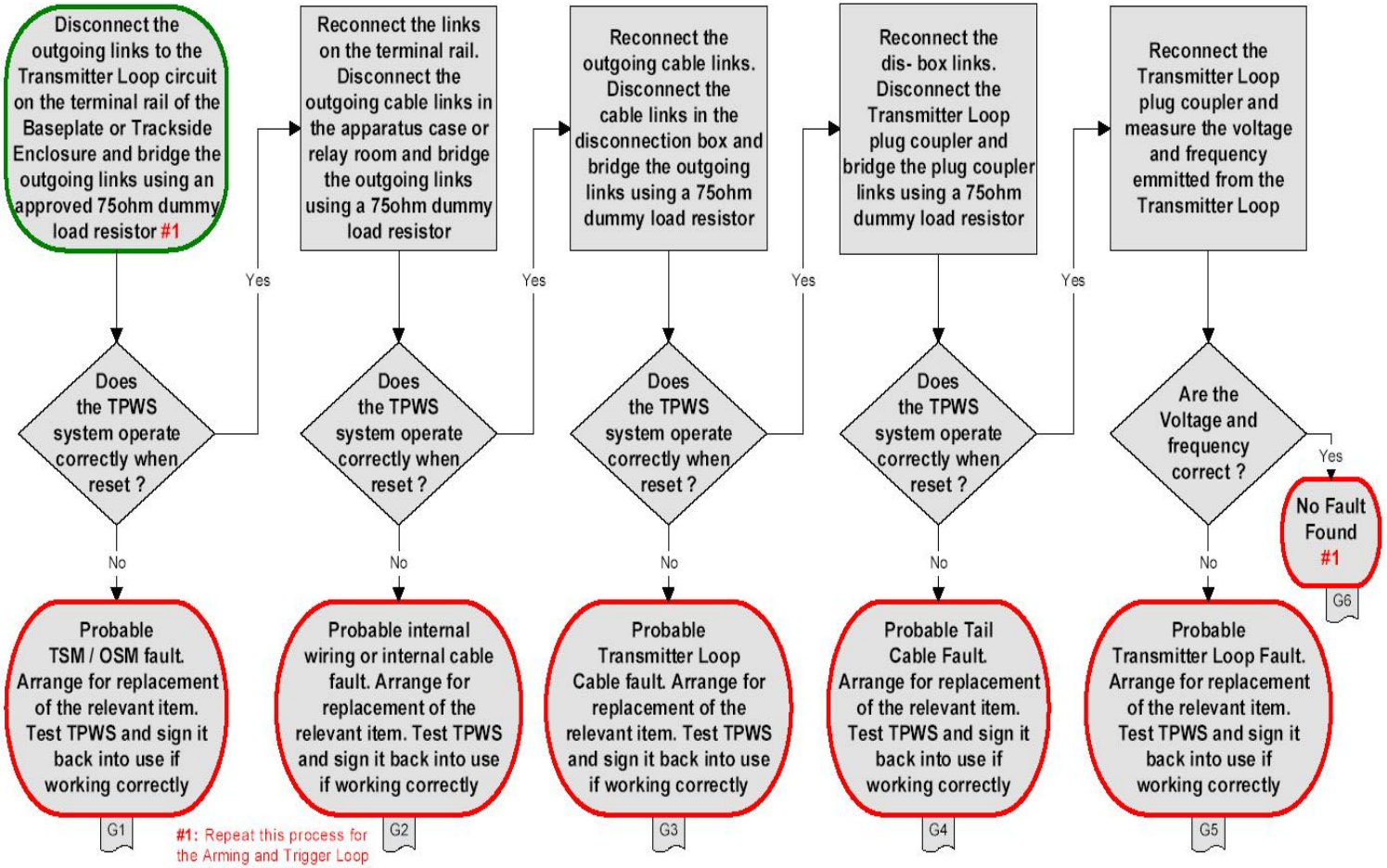


Flowchart E

No SIM Power - Blown 250mA Fuse / Ceramic Capacitor Fault In TSM / OSM

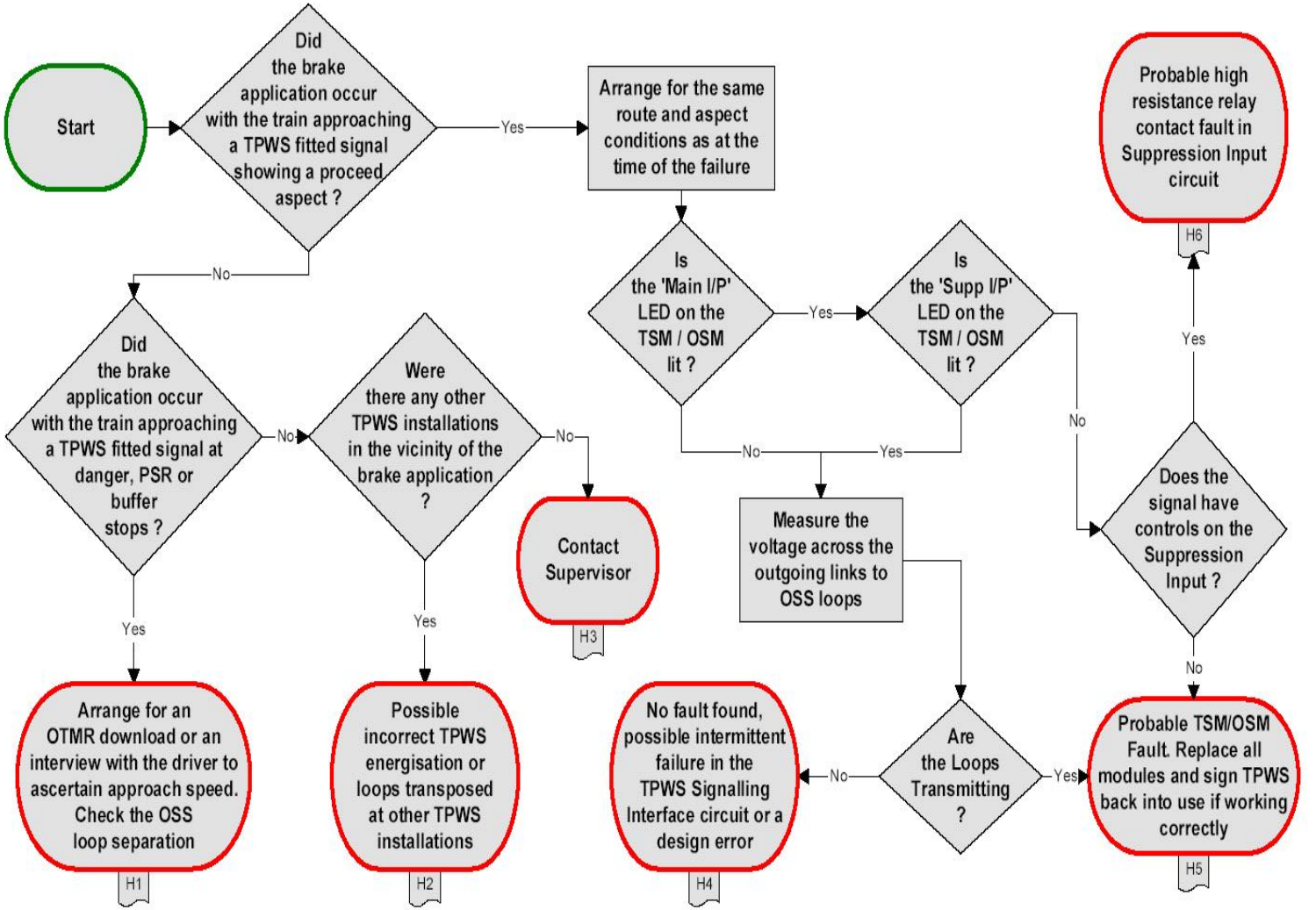


Flowchart F
Intermittent Faults

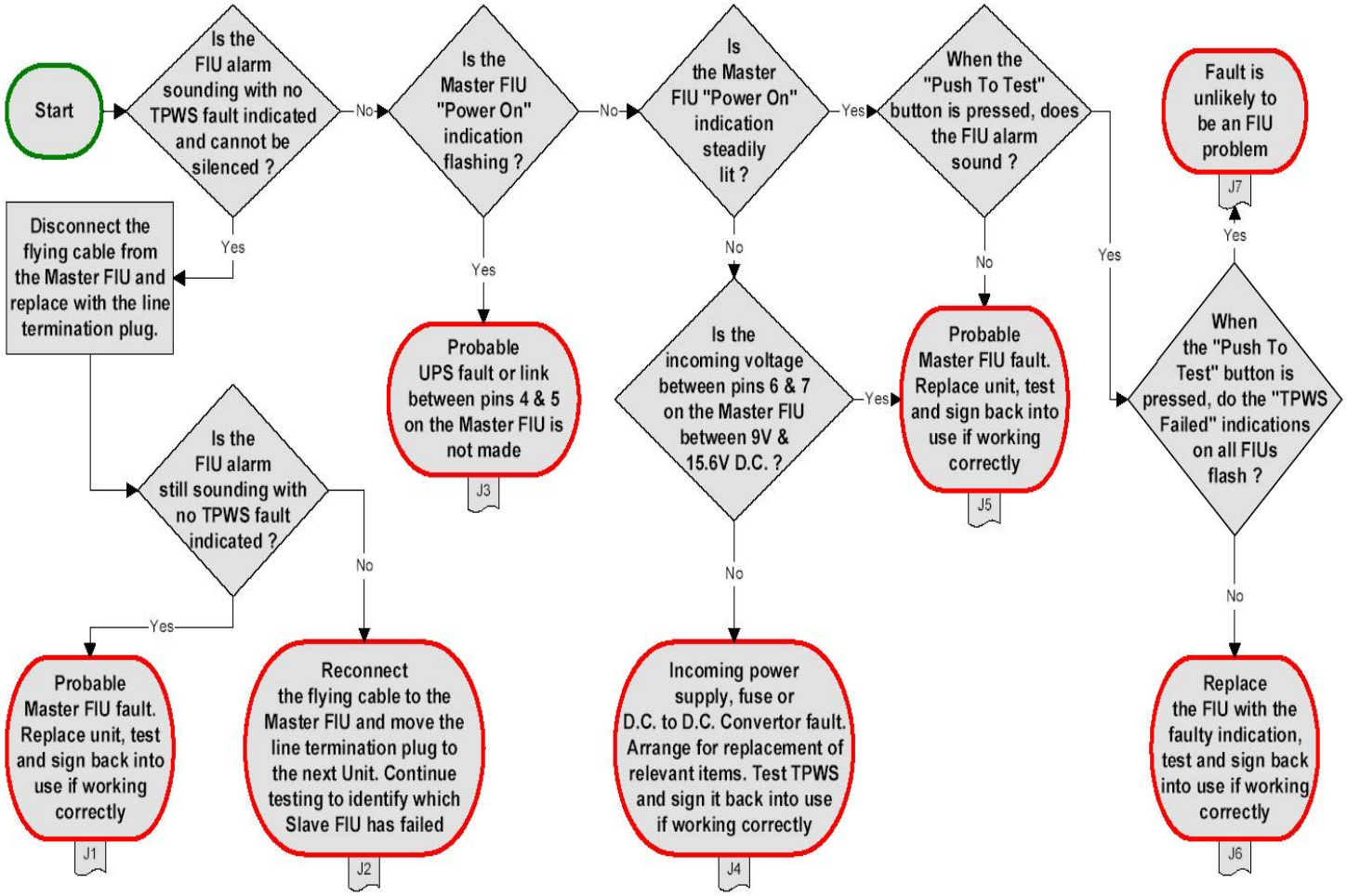


Flowchart G

Transmitter Loop / Plug Coupler / Cable Faults - 75 Ohm Dummy Load Testing



Flowchart H
Right Side Failures - TPWS Brake Applications



Flowchart J
Failure Indication Unit (F.I.U.) Faults

END

1. Faulting Guide

1.1 Upon notification of a signalling power failure the Technician should:

Refer to the signalling power schematic diagrams to ascertain which feeder or section of feeder has failed, the exact start of that feeder or section.

1.2 The Technician should then isolate the fault using NR/SMTH/Part10/FF15 (Faulting Guide: Signalling Power supplies over 175V Flowchart) to facilitate the rapid restoration of the signalling system.

1.3 Fault vehicles should be equipped with the following:

a) Crimps, fuses and heatshrinks as applicable.

b) A bar for lifting glued troughing lids.

c) Back to back radios.

d) Class 0 or 00 Insulated gloves are tested and in date.

e) Gas bottle with heatshrink attachments.

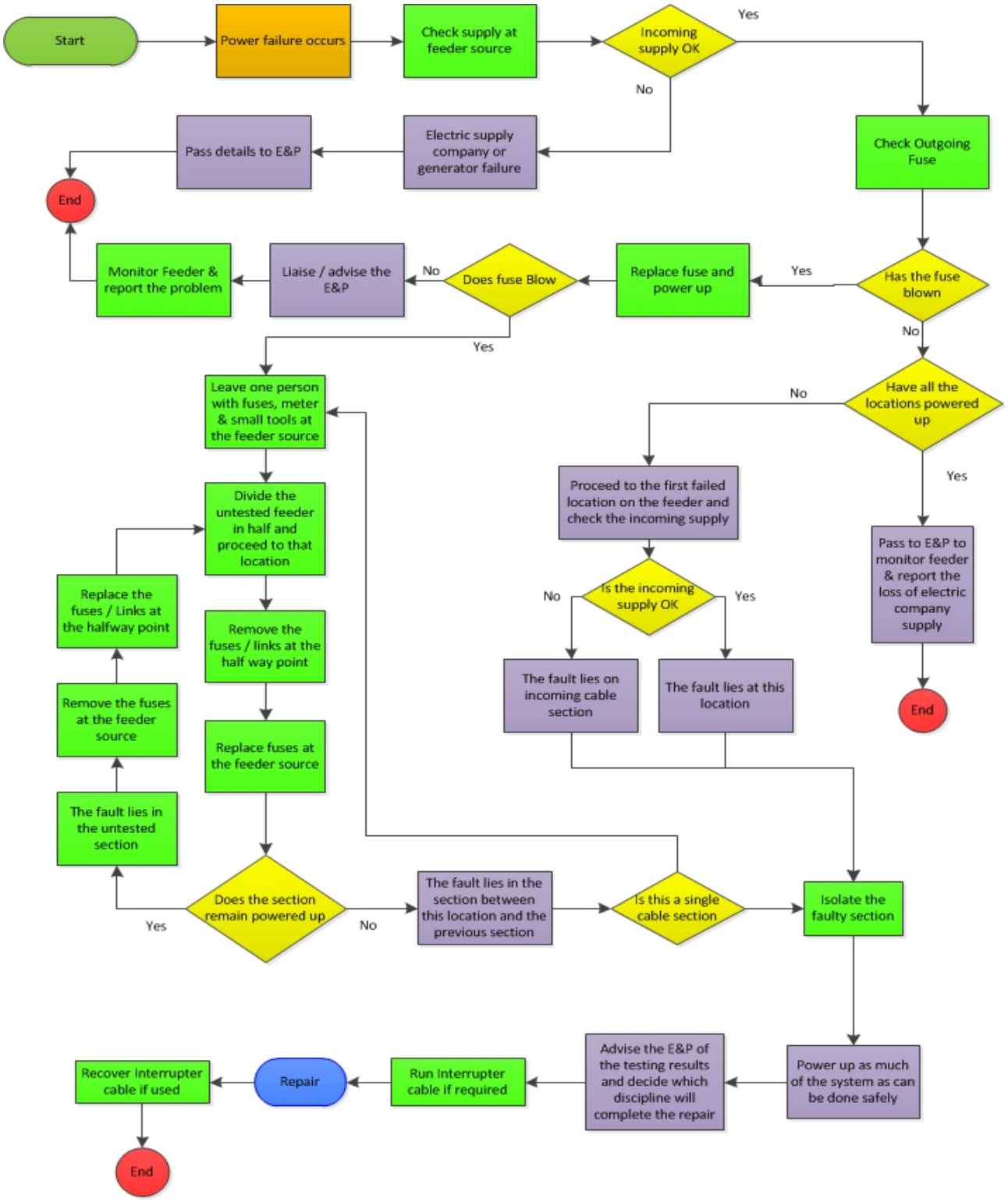
f) Personal padlocks and danger notices for power supply lockout devices/isolators/switches.

g) Pulse echo equipment.

h) Temporary cable jointing kits.

END

S&T may undertake this process when liaising with the E&P during a failure.



END

Do not smoke in the vicinity of the methanol 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

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).

ERRORS AND SOLUTIONS

1. Error message on the display

In the event of interruptions and errors, the operating panel displays warning messages on the display panel, including an error code and instructions on how to resolve the error.

By following these instructions, you can quickly and easily eliminate some of the errors that might occur.

Error message on the display	Error code	Solution
Service is required. Protect device against frost! Please contact EFOY hotline or hotline@sfc.com.	1 10 15 76 83	Advise your SM(S).
A restart is required. If the error occurs again please contact EFOY hotline **or** hotline@sfc.com. Press OK for restart.	13 14 17 70 73 75 80 84	Select the "System reset" option in the main menu to restart the device (max. twice). If the error still occurs, Advise your SM(S).

Error message on the display	Error code	Solution
Please make sure the exhaust hose is not clogged, bent or frozen. Press OK for restart.	11 18	Check the installation of the exhaust hose and position it so that no condensation can gather. Do not bend the exhaust hose. If necessary, clean the exhaust hose and protect the opening from becoming clogged. Shorten the exhaust hose if condensation is gathering in it.
Fuel cartridge empty. Please replace the fuel cartridge, and press OK.	20 22	Replace Empty Fuel Cell.
Please refill service fluid. To restart press ok. If this problem occurs again, please contact your service partner.	30 31	Make sure that the off-heat can escape without obstruction and that the ambient temperature is below 50 °C / 122 °F. If the fuel cell is installed within a sealed container, please check that the opening for supply air has a diameter of at least 10 cm / 3.94 in. Then refill the fuel cell with EFOY service fluid (see chapter 7.3 "Adding EFOY service fluid" on page **Error! Bookmark not defined.**).
Interruption: Cooling insufficient. Please check installation and air supply!	32	The cooling air is insufficient, or the ambient air is too warm. Check whether the room in which the fuel cell is installed has sufficient ventilation, or whether the openings for the air supply in the EFOY Pro fuel cell are blocked.
Interruption: Device frozen. Please defrost device slowly for at least 24h at room temperature.	40	The device was exposed to temperatures below 1°C / 34°F without a connected battery and/or an EFOY fuel cartridge that was not filled sufficiently.

Error message on the display	Error code	Solution
		It has to be allowed to defrost for approx. 24 hours at room temperature.
Interruption: Surroundings too warm. Please wait for the device to cool down.	41	The ambient temperature is too high. The device starts automatically if the temperature drops to below 50 °C / 122 °F.
Battery voltage low. Please check battery connection and load battery.	50 52	Check the cabling and check whether an approved battery is connected. Check the battery voltage. If it is too low, load the battery with a battery charger. Also check other loading devices for defects, e.g. alternator or charge controller.
Battery voltage high. If applicable, please check additional charging devices.	51 53	Check the cabling and check whether an approved battery is connected. Also check other loading devices for defects, e.g. alternator or charge controller.
Please disconnect fuel cartridge connection, shake cartridge firmly and reconnect. Restart device at most 2 times. Press OK for restart.	72	Check the fuel cartridge connection and, if necessary, check for any contamination and remove it. Then perform a system reset (max. twice). If the error still occurs, Advise your SM(S).

Error message on the display	Error code	Solution
EFOY GO! cannot be charged currently. Please refer to the user manual of the EFOY GO!		The EFOY GO! includes a lithium battery (LiFePO4), which cannot be charged below 0°C. If this is recognized by the EFOY Pro fuel cell, the charging is interrupted, and the EFOY Pro switches in the manual off mode. A warning is displayed. The frost protection mode is not affected. Confirm the warning once the temperature has increased. The EFOY Pro returns to Automatic Mode.
Battery defective, too small or too old. Please check the battery and the battery parameters. Replace battery if necessary or review battery parameters.		The on-board electrical system including the battery has to be checked. The EFOY Pro has measured charging cycles which were too short. This is an indication of a defective, too old or too small battery. The battery parameters may also need to be reviewed. Advise your SM(S).

2. Errors without display messages

Possible cause	Solution
The operating panel is not connected or is not properly connected.	Check the connection to the operating panel.
No battery is connected, the battery has not been properly connected, or a deep discharge has occurred.	Check the pins, polarity and cables. Connect a charged battery to start the device.
Short-circuit has occurred.	Verify that the polarity of the charge line is correct. Switch off the device, check the cause of the short circuit or overload, and eliminate the error.

END

Siemens ACM 100 Axle Counter System

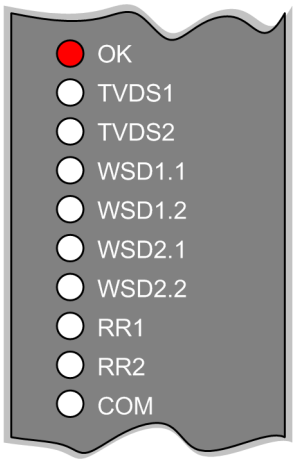
The diagnostic facilities of the ACM100 are via the ACMs front panel and via the webserver.

After a fault has occurred, it is displayed via the LEDs on the relevant ACM's front panel. The LED indications permit fault diagnostics. After the fault has been rectified, the ACM's operability can be checked via its LEDs.

Diagnostics is supported by an online diagnostic function via a webserver. The diagnostic information of the selected ACM is displayed on a graphical user interface. Additional diagnostic data can be called up via status, statistics and fault tables. Fault texts are highlighted in red.

Diagnostics via the ACM100 Front Panel and web-site

The ACM is shut down (safety cut-off).

LED indication on the ACM

The OK LED shows a steady red light. All other LEDs are off.

Measure

Step	Action
1	Restart the ACM module: Press the RST restart button of the affected ACM for a minimum of 2s.

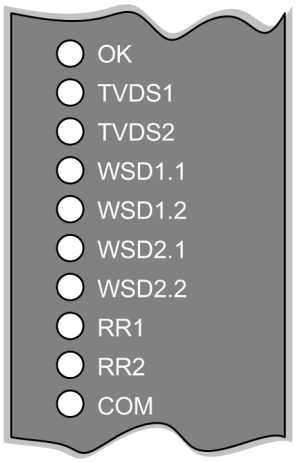
Cause / Measure

If …	**Then …**
the affected ACM shuts down frequently,	Replace the ACM.

Test

If …	**Then …**
the OK LED shows a steady green light after the restart,	Inform the Signaller that the restart has been successful. Request the Signaller to perform an axle count reset.
the OK LED shows the following after the restart: steady red light no light	Replace the ACM.
the OK LED shows the following after the restart: flashing red light	Check the other LEDs based on the LED indications.

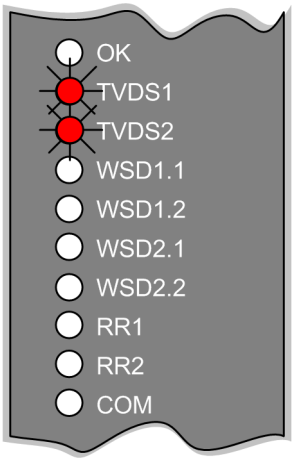
<u>The Power supply has failed</u>

LED indication on the ACM

All LEDs are off.

Test

If …	**Then …**
all LEDs on other ACMs are off as well,	the power supply is faulty. Check the power supply and UPS system if fitted.
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.

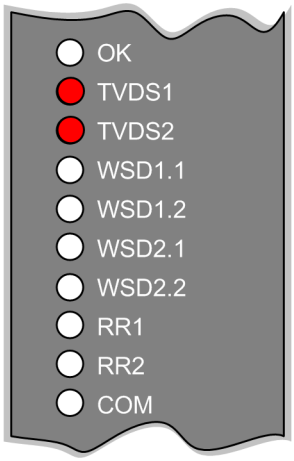
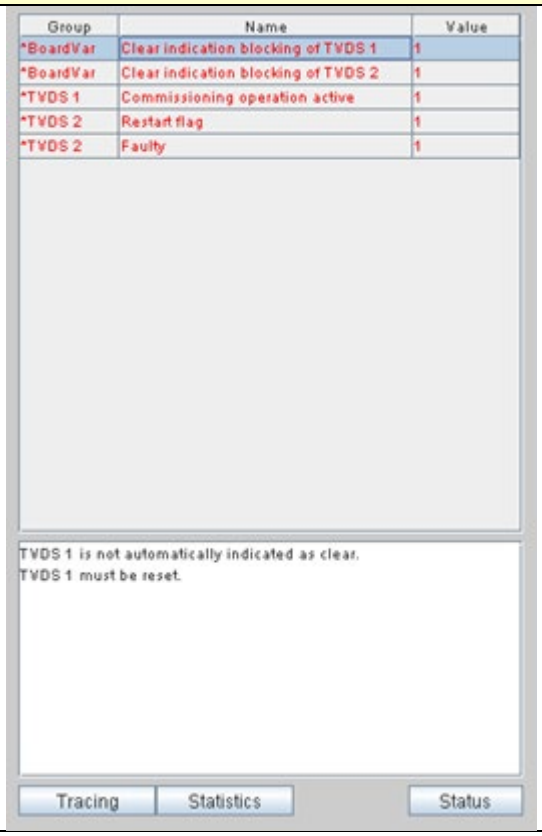
Track vacancy detection section faulty

LED indication on the ACM	**Indication on the web site**
	
The TVDS1 LED and / or TVDS2 LED show(s) a flashing red light.	The following is highlighted in the fault table: affected TVDS 1 and / or TVDS 2

Measure

Step	Action
1	Request the Signaller to perform an axle count reset for the affected track vacancy detection section.

Track vacancy detection section permanently occupied

LED indication on the ACM	Indication on the web site
	
The TVDS1 LED and / or TVDS2 LED show(s) a steady red light. The RR1 LED and / or RR2 LED do(es) not show a steady green light.	The following is highlighted in the fault table: affected TVDS 1 and / or TVDS 2 and "Commissioning operation active" or affected TVDS 1 and / or TVDS 2 and "Restart flag"

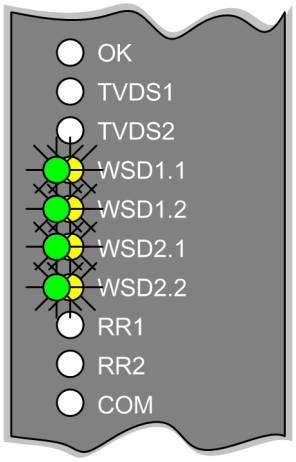
Cause

- There is no fault.
- Possible cause:
- The affected ACM has been restarted and has not been reset yet.
- The commissioning operation has been activated.

Measure

Step	Action
1	Request the Signaller to perform an axle count reset for the affected track vacancy detection section.

WSD wheel detector(s) faulty

LED indication on the ACM

The WSD1.1 / WSD1.2 LEDs and / or WSD2.1 / WSD2.2 LEDs show a flashing green or yellow light.

Cause

There is wheel detector monitoring error (not a fault: the wheel detector has detected wheel pulses on one channel). Possible cause:

a) The wheel detector has detected pulses without a train movement (e.g. due to a lightning strike or a metal object).

b) Wheels could not be detected unambiguously during a train movement (e.g. only one subsystem of the wheel detector has been traversed during a shunting movement).

Measure

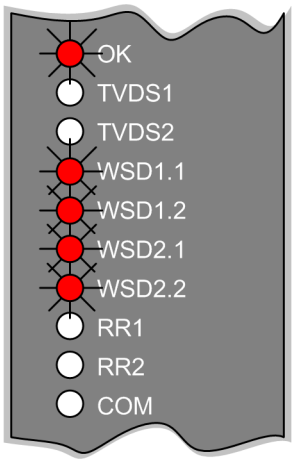
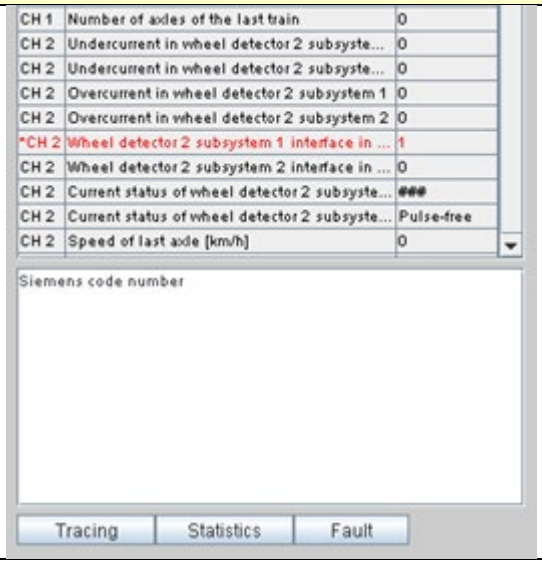
Agree with the Signaller on the following procedure:

Step	Action
1	Have a train movement performed over the affected wheel detector(s) or perform a functional test of the affected wheel detector(s) by simulating a train movement (move an adjustment gage over the wheel detector(s)). If the simulation of a train movement results in counting errors. The sections shall then be reset by means of an auxiliary and immediate axle count reset operation.
2	After simulation of a train movement: Request the person responsible to cancel the reset restriction by means of an auxiliary axle count reset operation and the Signaller to perform an axle count reset for the affected track vacancy detection sections.

Test

If …	Then …
the WSD1.1 / WSD1.2 LEDs and / or WSD2.1 / WSD2.2 LEDs show a steady green light,	the train movement or simulation has successfully eliminated the wheel detector monitoring error.
the WSD1.1 / WSD1.2 LEDs and / or WSD2.1 / WSD2.2 LEDs continue to show a flashing green or yellow light,	the affected WSD wheel detector shall be calibrated (NR/SMS/PartB/Test/038). If the fault persists after calibration the affected WSD wheel detector is faulty, replace the wheel detector (NR/SMS/PartC/AX51).

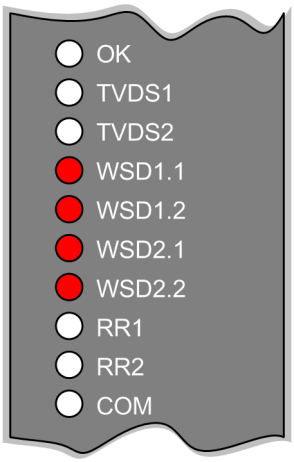
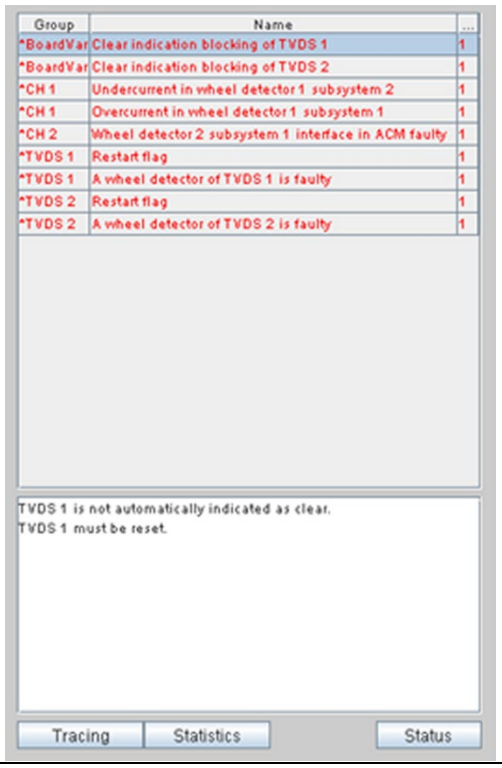
The ACM is faulty

LED indication on the ACM	Indication on the web site
	
The OK LED shows a flashing red light and the WSD1.1 / WSD1.2 and / or WSD2.1 / WSD2.2 LEDs show a flashing red light.	The following is highlighted in the fault table: type of fault

Cause / Test

If …	Then …
"Wheel detector ... subsystem ... interface in ACM faulty" or "Current status of wheel detector ...“ ”subsystem ...###" is displayed on the web site, Cause: internal test of ACM has failed	the ACM is faulty: Replace the ACM.

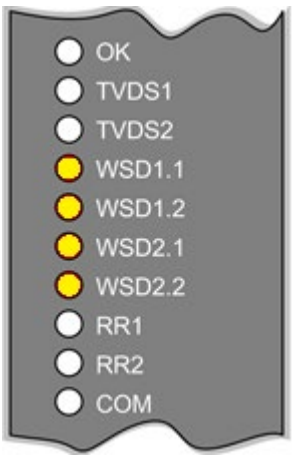
WSD wheel detector(s) or cable faulty

LED indication on the ACM	Indication on the web site
	
The WSD1.1 / WSD1.2 LEDs and / or WSD2.1 / WSD2.2 LEDs show a steady red light.	The following is highlighted in the fault table: affected wheel detectors, WSD 1 and / or WSD 2 (CH 1, CH 2)

Cause / Test

If …	**Then …**
"Overcurrent in ..." is displayed on the web site, Possible cause: ACM faulty WSD wheel detector faulty WSD wheel detector detached from rail short-circuit in signaling cable First check the ACM. To do so, query the current wheel detector status via the web site.	replace the ACM. If the fault persists: Check the affected WSD wheel detector and / or the cable connection to the wheel detector. If there is a fault, replace the wheel detector.
"Undercurrent in ..." is displayed on the web site, Possible cause: ACM faulty interrupted core in signaling cable First check the ACM. To do so, query the current wheel detector status via the web site.	replace the ACM. If the fault persists: Check the affected WSD wheel detector and / or the cable connection to the wheel detector. If there is a fault, replace the wheel detector (NR/SMS/PartC/AX51).

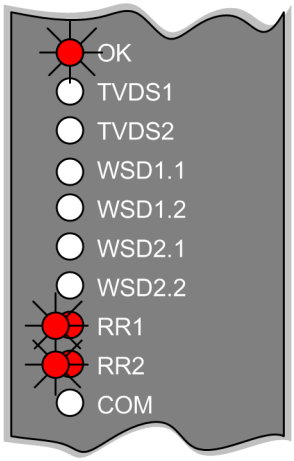
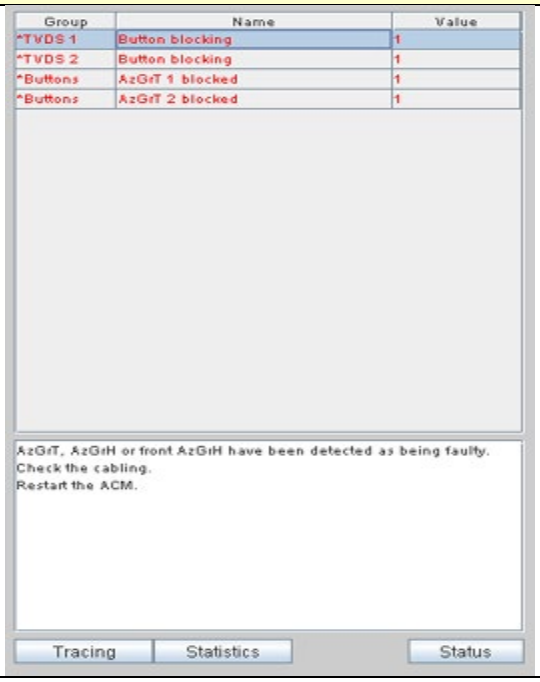
WSD wheel detector(s) Permanently Occupied

LED indication on the ACM

One or more of the WSD1.1 / WSD1.2 / WSD2.1 / WSD2.2 LEDs show a steady yellow light.

Cause / Test

If …	**Then …**
A train or track trolley wheel is stopped over the sensor	This is normal operation
No wheel is over the sensor	Check the affected WSD wheel detector. If there is metallic debris on or close to the wheel sensor, remove it. If the fault persists: Check the affected WSD wheel detector is at the correct height and parallel with the rail head. If necessary, adjust the mounting position and recalibrate the sensor (NR/SMS/PartC/AX51), (NR/SMS/PartB/Test/038). If the fault persists: Check the cable to the affected WSD wheel detector for loose or high resistance connections. If necessary, replace the cable. If the fault persists: Replace the wheel sensor (NR/SMTH/PartC/AX28)

Button fault

LED indication on the ACM	Indication on the web site
	
The OK LED shows a flashing red light. The RR1 LED and / or RR2 LED show(s) a steady or flashing red light.	The following is highlighted in the fault table: button blocking for affected TVDS 1 and / or TVDS 2 blocked type of button

Cause

The cause of button blocking for the AZG and / or AZGH buttons might be the following:

- The buttons have been operated incorrectly.
- The cabling is faulty.

Measure

The ACM shall be restarted:

Step	Action
1	Inform the Signaller that you want to restart the ACM.
2	Press the RST reset button of the affected ACM for a minimum of 2s.
3	Wait 15s until the LEDs are on.

Test

If …	**Then …**
the OK LED shows a steady green light,	inform the Signaller that the restart has been successful. Request the Signaller to perform an axle count reset.
the RR1 LED and / or RR2 LED continue(s) to show a steady red light, continue(s) to show a flashing red light,	replace the ACM (NR/SMTH/Part04/AX29).

Cause / measure: fault continues to be displayed although ACM has been replaced

The cable connection to the AZG and / or AZGH or SRI buttons shall be checked.

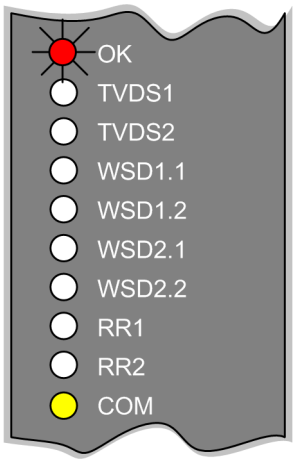
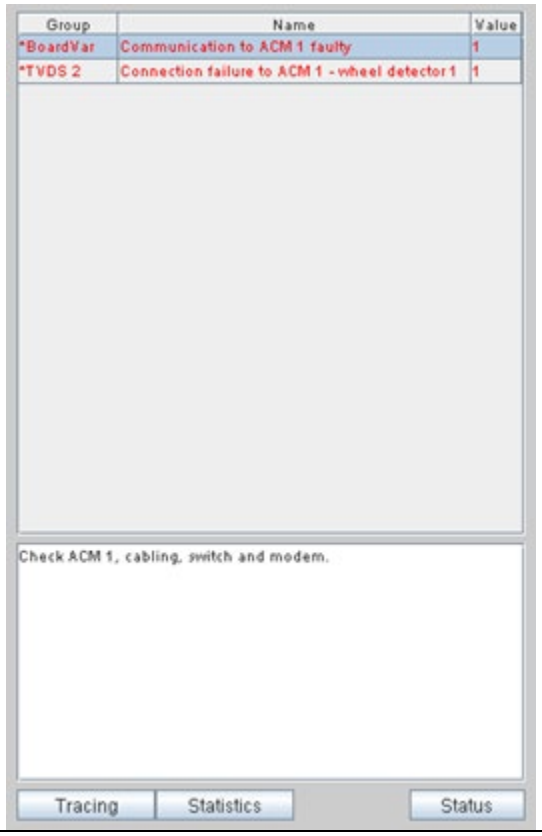
Step	**Action**
1	Locate the status of the affected buttons via the web site.
2	To do so, select the status table. The blocked button(s) is (are) displayed. The status of the blocked button(s) is displayed (operated / not operated).

Test

If …	**Then …**
the status **"operated"** is displayed for the blocked button on the web site,	a core might be broken: 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.
the status **"not operated"** is displayed for the blocked button on the web site,	a core might be broken: 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.

Connection to partner ACM has failed

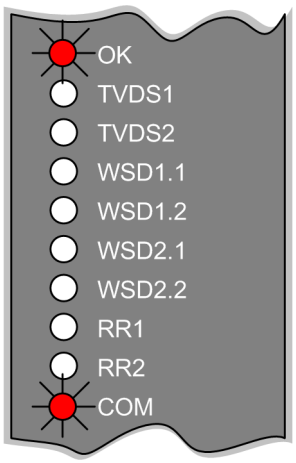
Data exchange with one or more ACMs faulty

LED indication on the ACM	Indication on the web site
	
The OK LED shows a flashing red light and the COM LED shows a steady yellow light.	The following is highlighted in the fault table: affected partner ACM and associated track vacancy detection section.

Cause / Measure

If …	**Then …**
the connection failure of a partner ACM is displayed on the web site, The fault is in a partner ACM: the LEDs of this ACM are off or show a flashing red light.	proceed step by step as follows to locate the fault in the affected partner ACM: Check the cables of the Ethernet connection. 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. Check the connected switch(es) / modem(s) and replace it (them), if required. Detailed information can be found in the manufacturer documentation for the relevant switch / modem.

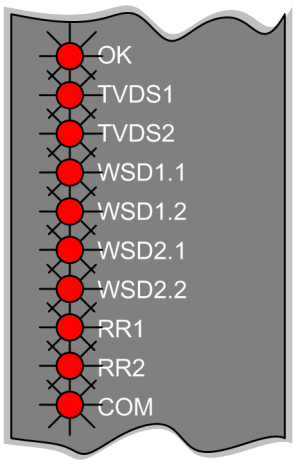
<u>Ethernet connection interrupted</u>

LED indication on the ACM

The OK LED and the COM LED show a flashing red light.

Measure

Step	Action
1	Check the power supply of the switch connected to this ACM.
2	Check the cables of the Ethernet connection. 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.
3	Replace the faulty ACM (NR/SMTH/Part04/AX29).
4	Check the connected switch(es) / modem(s) and replace it (them), if required. Detailed information can be found in the manufacturer documentation for the relevant switch / modem.

ID plug faulty

LED indication on the ACM

All LEDs show a flashing red light.

Measures

If …	**Then …**
there is an ID plug with identical configuration data,	replace the ID plug and restart the ACM. Inform the Signaller that you want to restart the ACM. Replace the ID plug with the failed ID plug. Press the RST reset button of the affected ACM for min. 2 s. Wait 15 s until the LEDs are on. Request the Signaller to perform an axle count reset for the affected track vacancy detection section.
there is an empty ID plug,	program the ID plug and agree on any further measures. Remove the connector of the Ethernet connection from the affected ACM. Remove the process connector Program the spare ID plug with the associated configuration data via the web site. Request an authorized person to perform correspondence checking and plan verification.

Checking of the power supply

Step	**Action**
1	Set the on / off switch to ON.

Test

Proceed as follows depending on the status of the DC 24 V LED on the front panel:

If …	**Then …**	
LED shows a flashing light,	the output circuit is overloaded. For voltage dip: automatic voltage restoration For voltage reduction: impairment of service life Check the circuit.	
If …	**And if …**	**Then …**
The LED is off	the output circuit is short-circuited (0 V),	remove the short-circuit (automatic voltage restoration after its removal).
	there is an under voltage on the input side (automatic shutdown, automatic voltage restoration),	check the mains voltage.
	there is an overvoltage on the input side, the power supply board is faulty,	replace the power supply.

WSD Wheel Detector

Troubleshooting

Step	**Action**
1	Perform measurements and tests on the interface components

Step	Action
2	If the results point to a fault in the wheel detector, proceed as follows: 1. Check the mounting height and correct it , if required. Required values for the mounting height- Rail Web Mounting: 43 to 45 mm Rail Clamp Mounting: 42 to 45mm 2. Check whether the wheel detector switches in response to the adjustment gage. Observe the switching points on the adjustment gage – a subsystem of the wheel detector can only switch when moving the adjustment gage if the area between the "On" and "Off" markings is above the subsystem. Required values for current consumption: 4.75 to 5.25 mA (for an untraversed wheel detector) 1.3 to 2.99 mA (for a traversed wheel detector)

If …	Then …
The wheel detector does not switch as required.	Measure the operating voltage at the wheel detector (required value between 10.5 V and 28 V). Calibrate the wheel detector (NR/SMS/PartB/Test/038). Check again whether the wheel detector switches in response to the adjustment gage. If the wheel detector again does not switch as required, replace it.
The wheel detector switches as required.	Search for the fault in the cabling or series-connected signaling and safety equipment.

Possible causes of faults

Fault	Possible cause	Remedy
Subsystem does not switch when a wheel passes, current consumption of 4.75 to 5.25 mA	Incorrect mounting height	1. Check the mounting height and correct it, if required. 2. Calibrate the wheel detector (NR/SMS/PartB/Test/038).
	Wheel detector not correctly calibrated	Calibrate the wheel detector (NR/SMS/PartB/Test/038).
	Wheel or wheel flange dimensions too small	Have usability of the wheel detector and the required mounting height checked by Siemens.
Subsystem does not switch when a wheel passes, current consumption of 1.3 to 2.99 mA	Foreign metal object(s) on wheel detector	Remove any foreign object(s).
	Incorrect mounting height	1. Check the mounting height and correct it, if required. 2. Calibrate the wheel detector (NR/SMS/PartB/Test/038).
	Wheel detector not correctly calibrated	Calibrate the wheel detector (NR/SMS/PartB/Test/038).
Subsystem does not switch when a wheel passes, current consumption of 5.76 to 7.0 mA OK again after interruption of operating voltage	Detachment detection function triggered	1. Check the mounting height and correct it, if required 2. Calibrate the wheel detector (NR/SMS/PartB/Test/038). 3. If unsuccessful (wheel detector returns to fault condition after 120 s): replace the wheel detector (NR/SMS/PartC/AX51).
Subsystem does not switch when a wheel passes, current consumption of 5.76 to 7.0 mA Fault persists after interruption of operating voltage	Subsystem connected wrong way round	Check the polarity of the wheel detector connection.
	a / b interchanged (wrong polarity of used pair of wires) in cable system	Check the cable system for a/b interchanging.

Fault	Possible cause	Remedy
Subsystem does not switch when a wheel passes, current consumption in one of the following ranges: < 1.3 mA 3.0 to 4.74 mA 5.26 to 5.75 mA	Insufficient supply from indoor equipment	1. Measure the voltage on the subsystem (required value 10.5 V to 28 V). 2. Check the connection of the wheel detector and the indoor equipment.
	Fault in signaling cable	Check the signaling cable.
Subsystem does not switch when a wheel passes, current consumption rises cyclically to 5.76 to 7.0 mA	Permitted temperature range of -40 °C to +85 °C considerably exceeded	Replace the wheel detector as components might be damaged (NR/SMS/PartC/AX51).
Subsystem does not switch when a wheel passes, current consumption > 7 mA	Operating voltage too high	1. Measure the voltage on the subsystem (required value 10.5 V to 28 V). 2. Check the connection of the wheel detector and the indoor equipment.
	Short-circuit in wheel detector	Replace the wheel detector (NR/SMS/PartC/AX51).
No measurable operating voltage between wires 1 and 2 (or wires 4 and 5) of wheel detector	Fault in indoor equipment	Check the interface component and its power supply.
	Wheel detector connected incorrectly	Check the wheel detector connection.
	Interruption or short-circuit in signaling cable	Check the cable system.
	Short-circuit in wheel detector	1. Measure the current consumption of the wheel detector directly at the connecting cable (in the trackside connection box). 2. Replace the wheel detector if the current consumption is > 7 mA (NR/SMS/PartC/AX51).

Fault	Possible cause	Remedy
Functional test after calibration unsuccessful Wheel detector does not switch at all or not between the relevant markings on the adjustment gage	Calibration failed: times not observed adjustment gage incorrectly placed. position of placed adjustment gage altered. additional damping due to tools, passing wheels, etc. during calibration.	Repeat the calibration (NR/SMS/PartB/Test/038).
	Rail currents (traction return currents) exceeding approx. 1000 A or electromagnetic interference occurred during calibration	Repeat the calibration (NR/SMS/PartB/Test/038).
Subsystem switches when a wheel passes but interface component does not respond	Wheel detector output faulty	Measure the current consumption of the wheel detector in the undamped and damped states. Required values: undamped: 4.75 to 5.25 mA damped: 1.3 to 2.99 mA
	Loop resistance too high	Check the cable system.
	Shunt in signaling cable	Check the cable system.
	Fault in interface component	Replace the interface component.
Subsystems switch when a wheel passes but interface component does not count axles or there are sporadic counting errors	Incorrect mounting height	1. Check the mounting height and correct it, if required 2. Calibrate the wheel detector (NR/SMS/PartB/Test/038).
	Wheel detector not correctly calibrated	Calibrate the wheel detector (NR/SMS/PartB/Test/038).
	Wheel or wheel flange dimensions too small	Have usability of the wheel detector and the required mounting height checked by Siemens.

Fault	Possible cause	Remedy
Axle counting system counts passing axles in wrong direction	Subsystems connected the wrong way round	1. Check the connection and mounting location (track layout plan) of the wheel detector. 2. Check the cable system and configuration of the axle counting system.

It might be necessary to replace the wheel detector (NR/SMS/PartC/AX51) if you cannot identify and rectify the cause of the fault.

END

1. Power supply testing flowchart

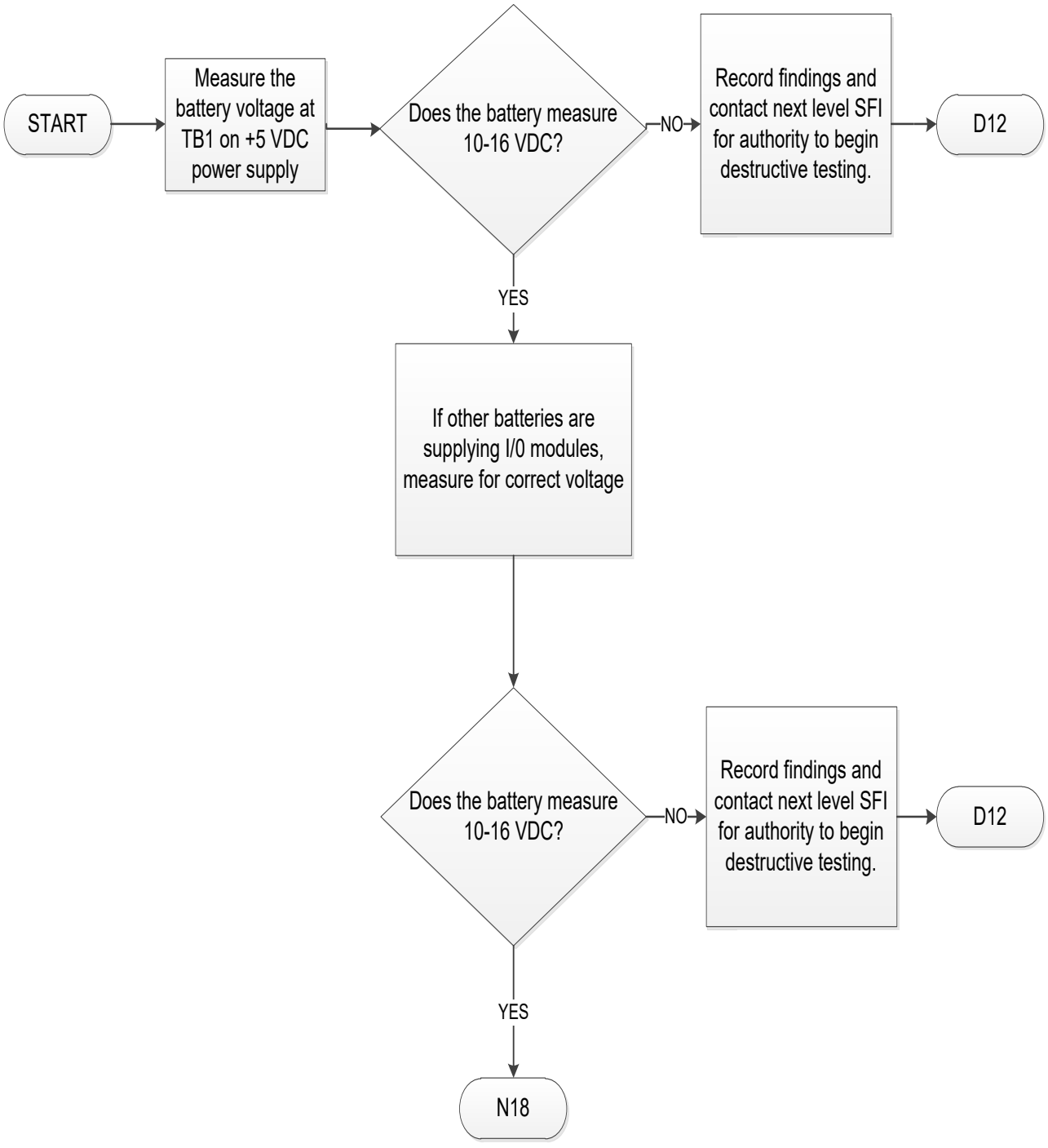


Figure 1 – Power supply testing flowchart

2. General Fault diagnostic flow chart.

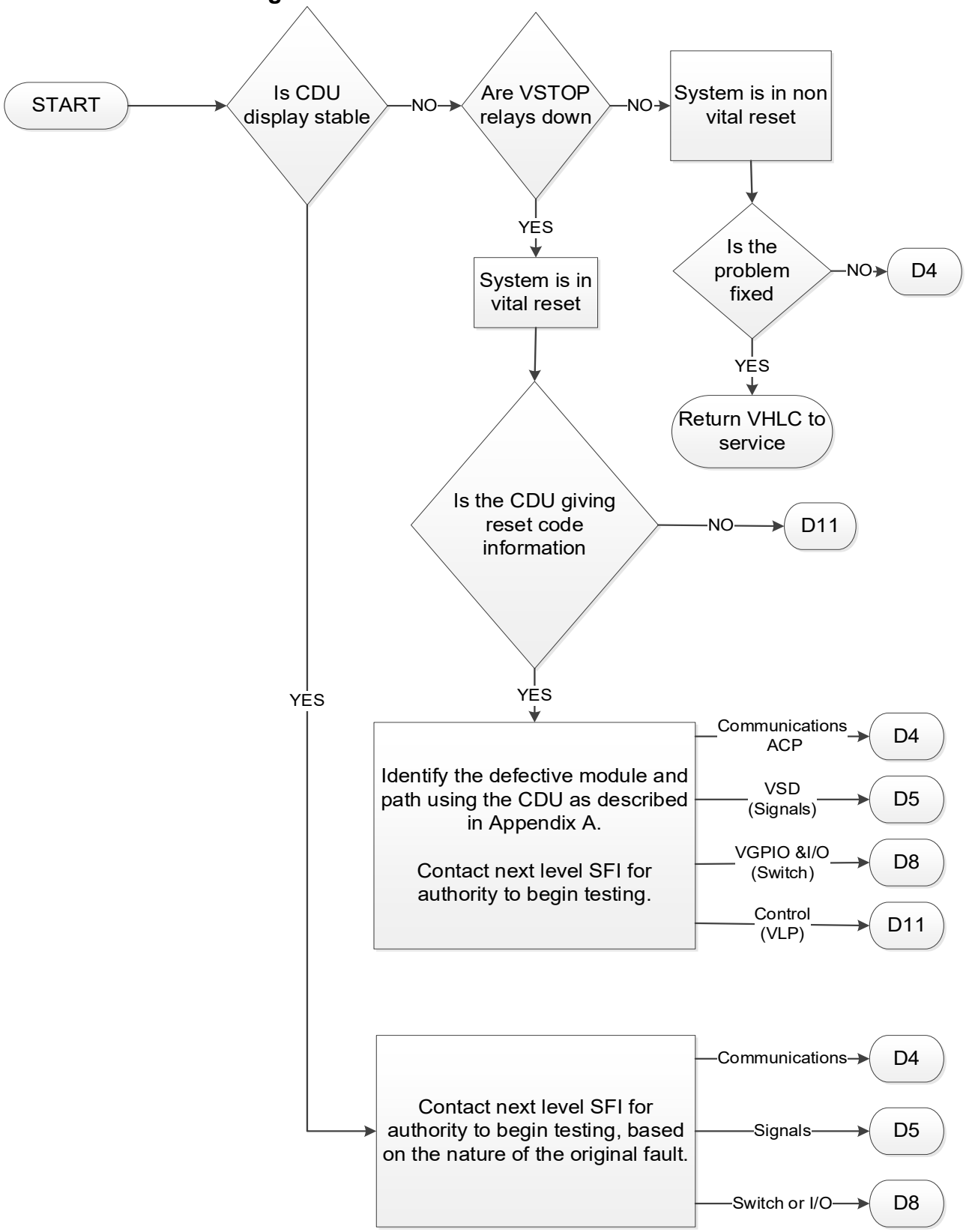
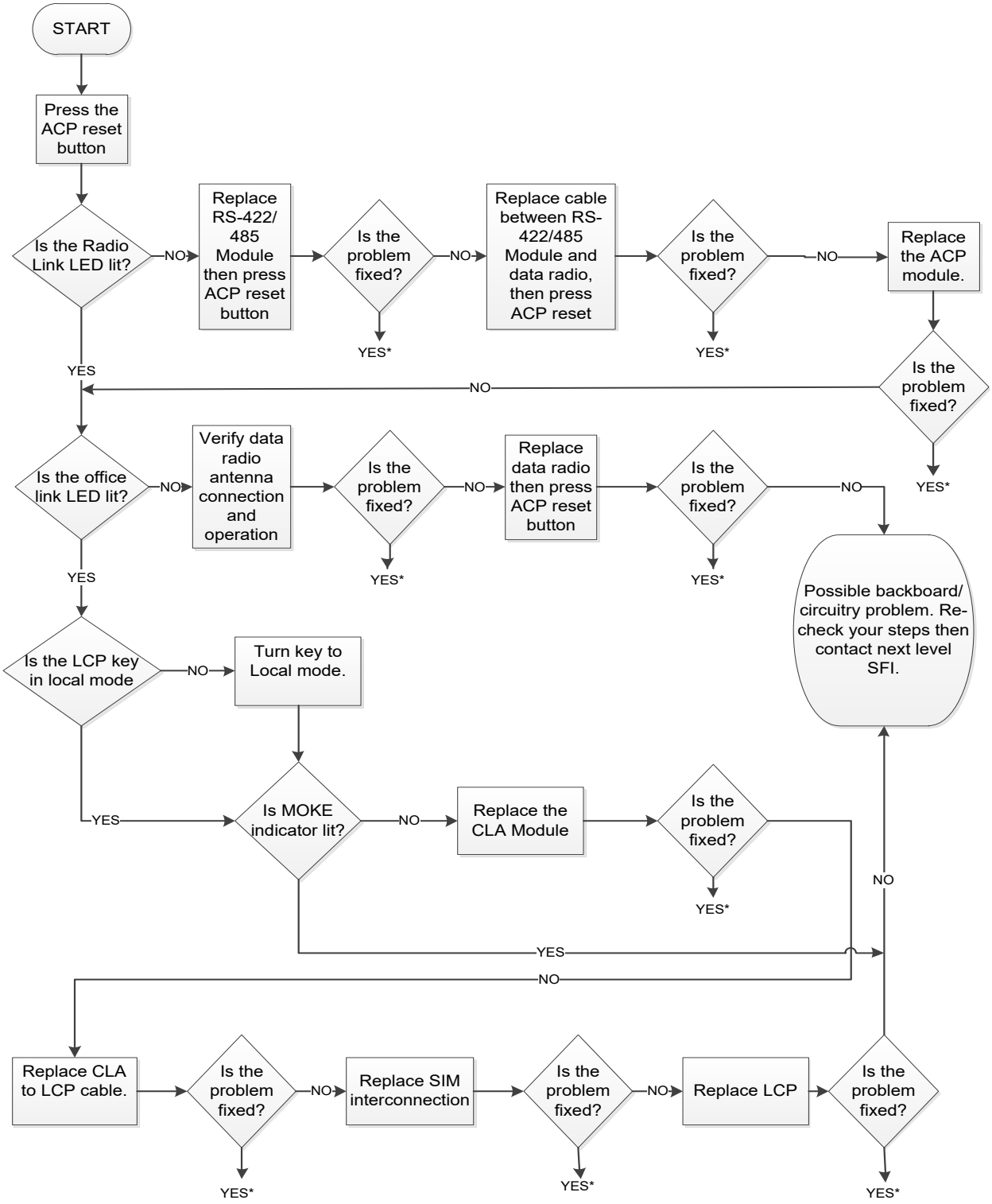


Figure 2 – General Fault diagnostic flow chart.

3. Auxiliary Communications Processor (ACP) fault finding flowchart



* Once the fault has been identified and fixed, return VHLC to service

Figure 3 – Auxiliary Communications Processor (ACP) fault finding flowchart

4. Vital Signal Driver AC (VSDAC) fault finding flow chart

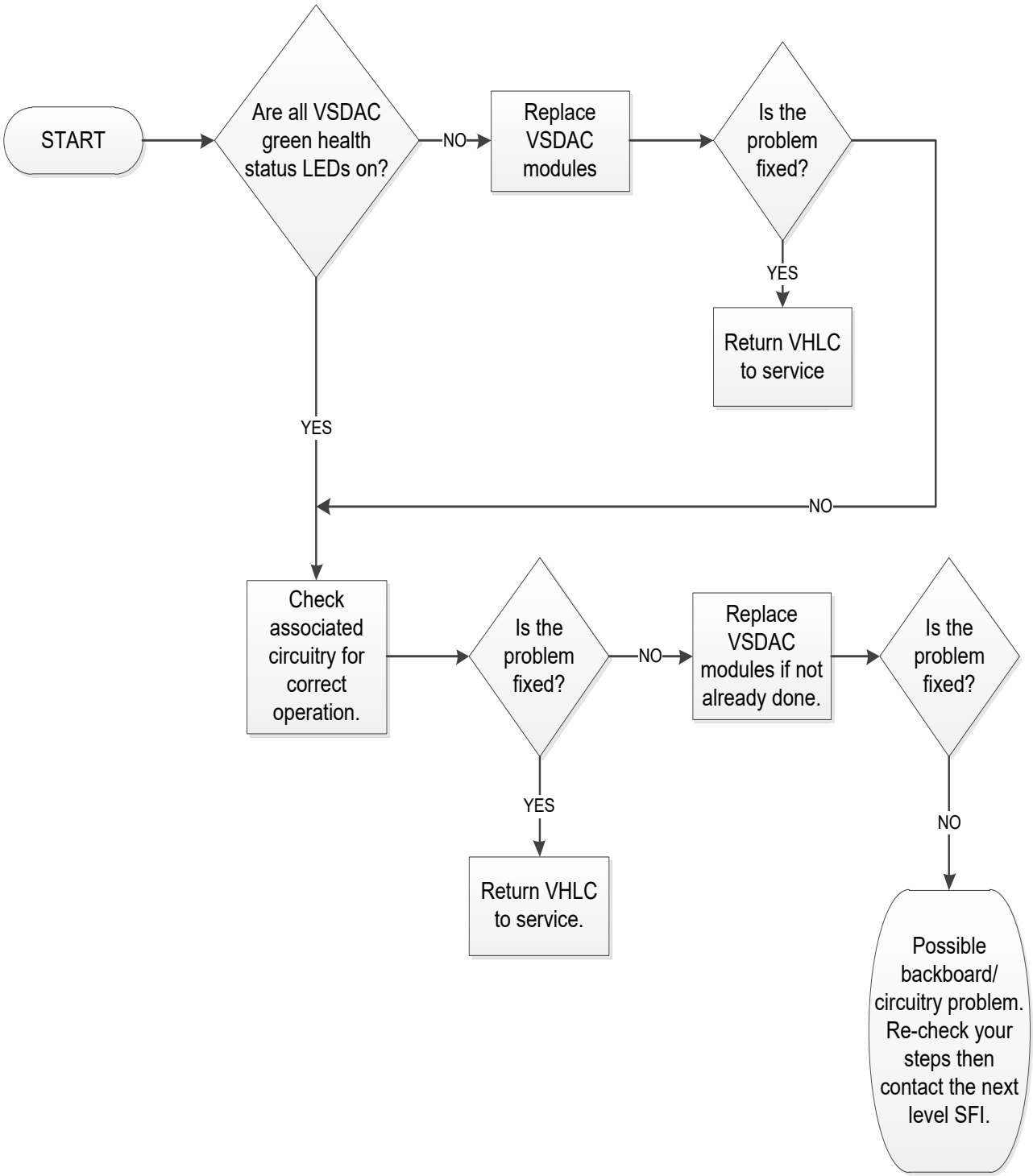


Figure 4 - Vital Signal Driver AC (VSDAC) fault finding flow chart

5. VGPIO and Input/output fault finding flowchart

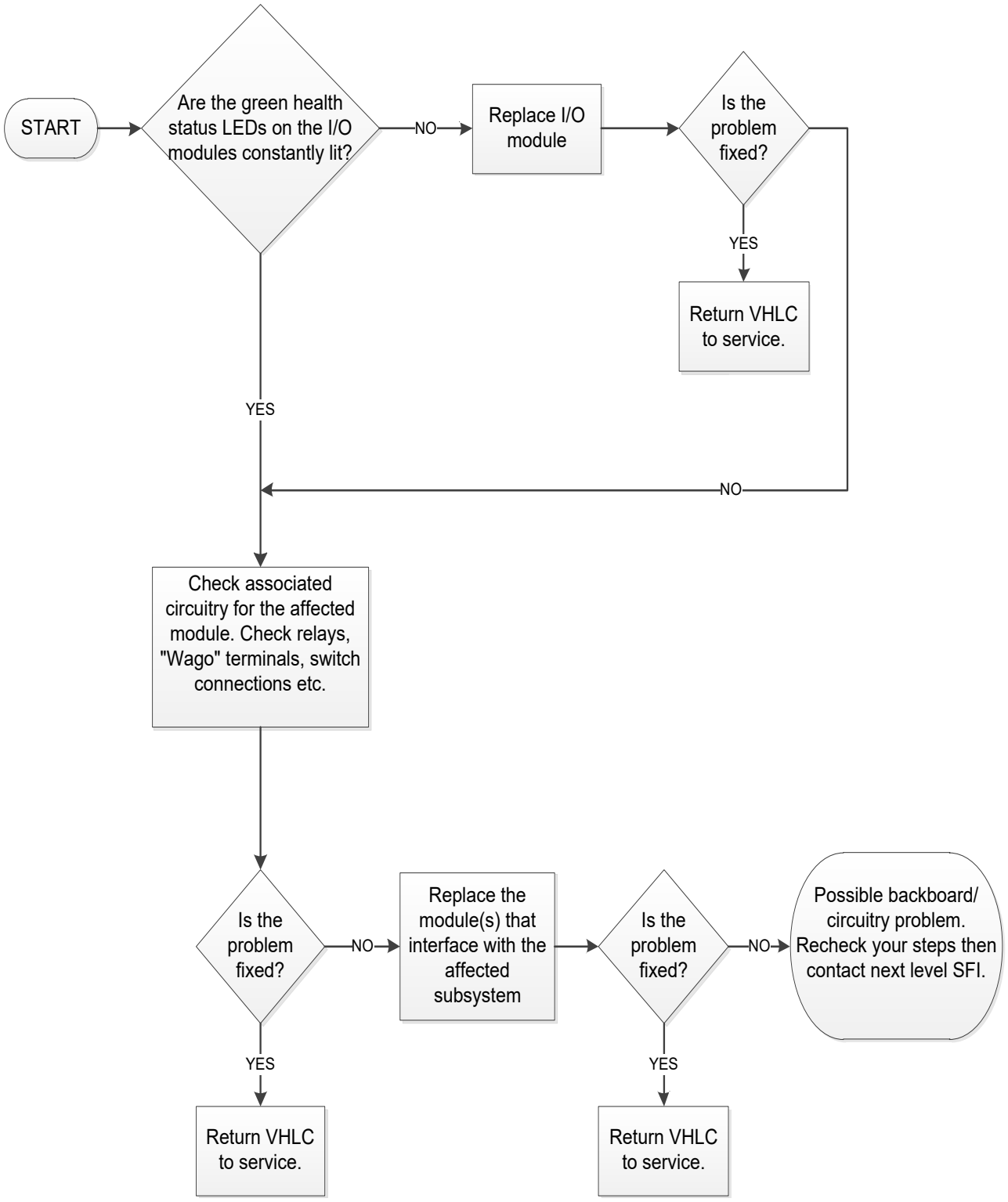


Figure 5 - VGPIO and Input/output fault finding flowchart

6. Vital Logic Processor (VLP) Fault finding flowchart

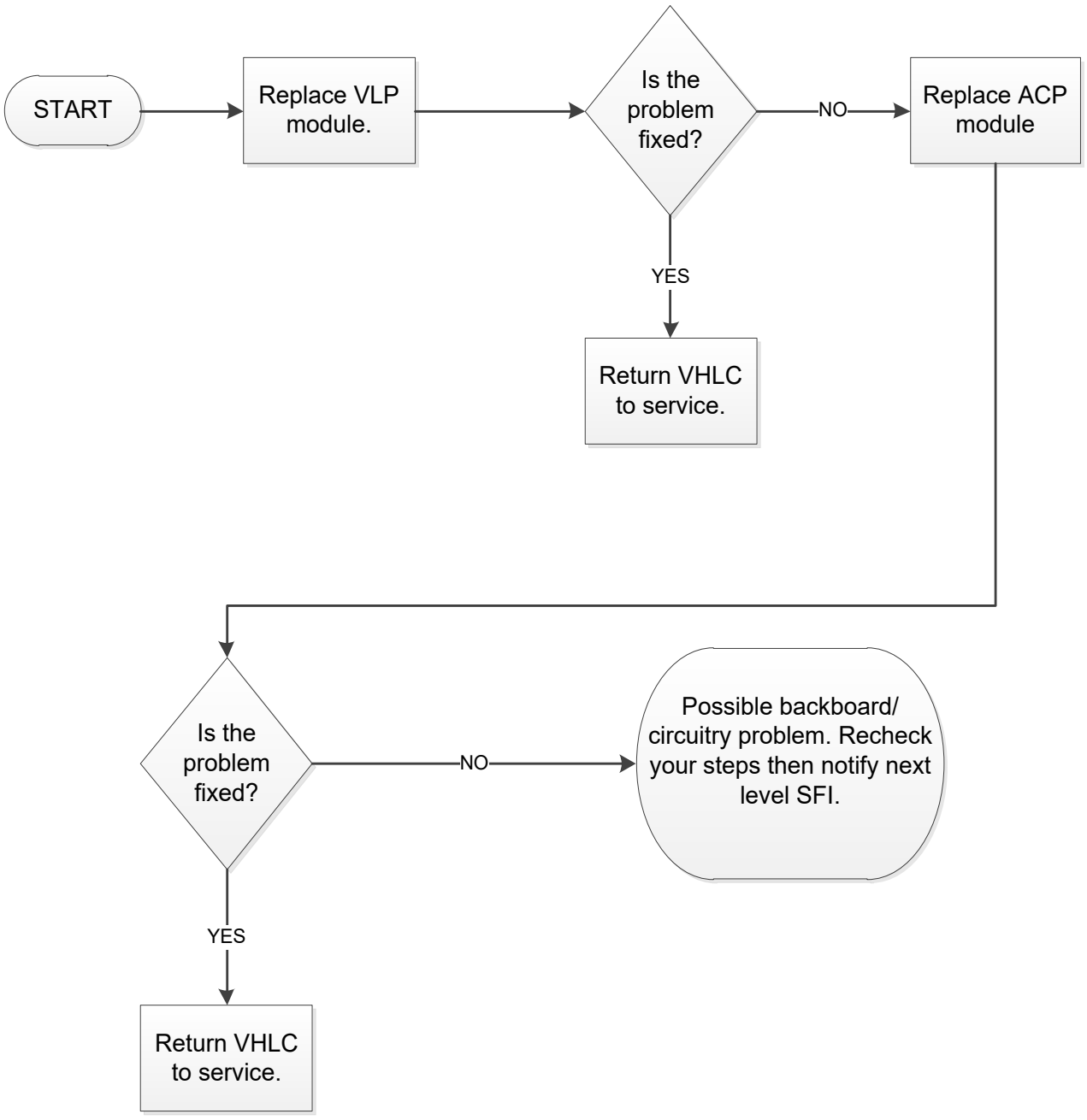


Figure 6 – Vital Logic Processor (VLP) Fault finding flowchart

7. Replacing a battery or 50vDC power supply flowchart

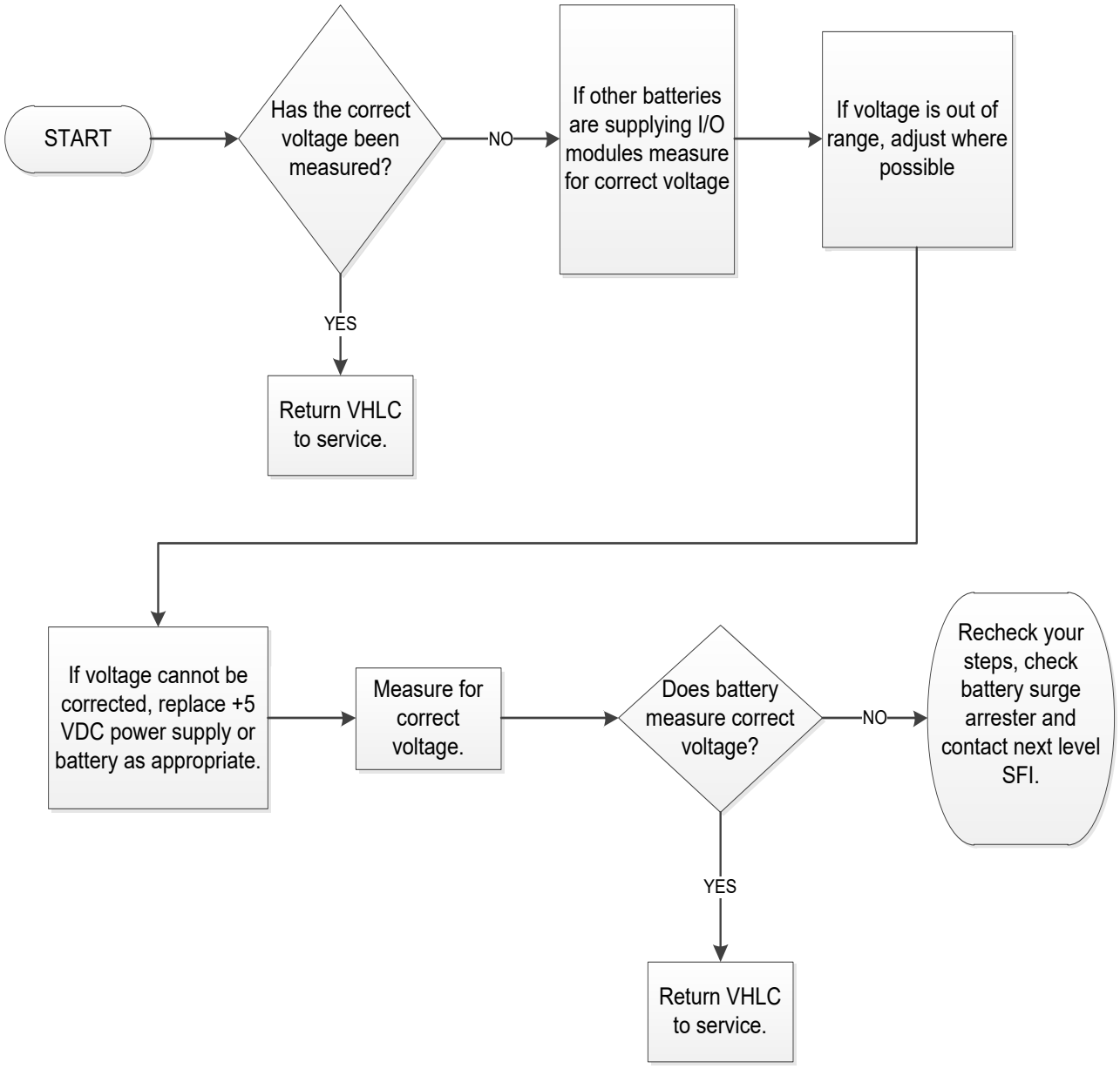


Figure 7 – Replacing a battery or 50vDC power supply flowchart

8. Fault finding using the CDU

Fault finding on the VHLC is carried out using the reset source code and software reset code, which are incorporated as part of the error messages displayed on the CDU. These error messages take two distinct forms:

a) VLP specific error messages.

b) ACP specific error messages.

These error messages are made up of a series of up to13 numbers and letters, which can be interpreted to give fault finding information.

The CDU can also be used to access the VHLC's fault log, which records faults codes for the last 16 faults experienced by the machine.

9. VLP Error Messages

The VLP specific error messages displayed by the CDU are made up of a series of 12 number and letters and take the following format:

a) 31 RS mm qqqq pp

All VLP error messages begin with the number 31, as shown here, and contain two elements specific to the fault finding process. These are the reset source code, indicated above as 'mm', and the software reset code, indicated above as 'qqqq'.

The remaining information contained within these error messages is not relevant to the fault finding process. A full list of VLP reset source codes and software reset codes is given in the following tables along with information on how to interpret them.

10. VLP reset source codes

Table 1 lists the VLP reset source codes, their possible causes and the corrective actions to take.

VLP Reset Source Codes: 31 RS mm qqqq pp		
Code	**Possible Cause**	**Corrective Action**
DF EF F7 FB FD FE FF	Any of these codes can indicate a problem with VLP hardware or software. See if the software reset code provides any further information.	1. Look up the software reset code. 2. If no software re-set code is given, replace the VLP module. 3. If problem continues, notify Manager.
7F	+5 VDC power failure.	1. Check battery voltage into power supply module. 2. Check voltage output of power supply module. 3. Replace power supply.

Table 1 – VLP Reset Source Codes

If an I/O module problem occurs, an error message identifying the slot number of the defective module will be displayed for a period of only 2 seconds.

The I/O specific error message will begin with the number 32 and appear directly after the VLP specific error message.

If an I/O specific error message is identified, remove the module in the specified slot and check to see if the system now functions correctly.

I/O module specific error messages will be in the format:

a) 32 IO SLOT nn

Where nn is the slot number of the I/O module causing the failure.

11. VLP software reset codes

Table 2 lists the VLP software reset codes, their possible causes and the corrective actions to take.

VLP Software Reset Codes: 31 RS mm qqqq pp		
Code	**Possible Cause**	**Corrective Action**
010F 0112 0114 0203 0207 0304 0402	Any of these codes can indicate a problem with the CCI module.	Replace the CCI module. Check the cable from the back of the VHLC to the Electro Code interface unit. Carry out a fault-finding exercise on the Electro Code section. Notify your manager.
0500 0503 0508	Any of these problems can indicate a problem with the VSD module or cable.	Replace the VSD module. Check the VSD cable. If you have another cable, replace it and see if the problem continues.
0501 0503 0504 0506	Any of these codes can indicate a problem with the VSDAC or VGPIO modules.	Replace the VSD module. Replace the VGPIO module.
0507	VGPIO module.	Replace VGPIO module.
0505	I/O module	Replace I/O module.
0700 0900 0901 0902 0904 0905 0906 0907 0908 0909 090A 090B 090C 090D 0C01	VLP module	Replace VLP module.
0B01 0B05	These codes could indicate: I/O module is in the wrong slot; There is a problem with the I/O module; or Chassis configuration is wrong.	Check to make sure the I/O module is in the correct spot. Replace I/O module. Check Chassis configuration against site plans.

VLP Software Reset Codes: 31 RS mm qqqq pp		
Code	**Possible Cause**	**Corrective Action**
0B02 0B03 0B04 0B06	These codes could indicate a problem with the I/O module or a motherboard failure.	Replace I/O module. Check Chassis configuration against site plans. Replace the motherboard.
0B07	Chassis ID wrong	Check that the chassis ID jumpers are set correctly by referring to the site plans.
Any other code	If you have any other code, the problem could be caused by either Software error; Memory failure of; Set-up error.	Notify your manager.

Table 2 - VLP Software Reset Codes: 31 RS mm qqqq pp

12. ACP Error Messages

The ACP specific error messages displayed by the CDU are made up of a series of 13 numbers and letters and take the following format:

a) 34 RST xxxx yyyy

All ACP specific error messages begin with the number 34, as shown here, and contain two elements specific to the fault finding process. These are the reset source code, indicated above as 'xxxx', and the software reset code, indicated above as 'yyyy'.

The remaining information contained within these error messages is not relevant to the fault finding process. A full list of reset source codes and software reset codes is given the following tables along with information on how to interpret them.

13. ACP reset source codes

Table 3 lists the ACP re-set source codes, their possible causes and the corrective actions to take.

VLP Reset Source Codes: 34 RST xxxx yyyy		
Code	**Possible Cause**	**Corrective Action**
0000	Low site battery voltage	1. Check the battery voltage. 2. If low repair battery related problem.
0001 0002	ACP module failure	Replace ACP module (be sure to install original EPROMs onto module).
0004	VLP module has initiated a system-wide re-set	Carry our fault finding on the VLP as described in section 7.2.
0010	ACP software has caused the re-set	Carry out fault finding using ACP software reset codes as described in section 7.3.5.
0080	Low +5 VDC power	1. Check the battery voltage into power supply module. 2. Check voltage output of power supply module. 3. Replace power supply if defective.

Table 3 – VLP Reset Source Codes: 34 RST xxxx yyyy

Table 4lists the ACP software re-set codes, their possible cause and the corrective action to take.

VLP Software Reset Codes: 34 RST xxxx yyyy		
Code	**Possible Cause**	**Corrective Action**
5102	Memory hardware error.	Check that memory chips IC30-33 are installed correctly on the ACP module. Check that these memory chips have the correct checksums. These are identified on the site plans. Notify your manager.
5107 5108 5109	Memory error	Check that memory chips U9 and U10 on the ACP module have the correct checksums. These are identified on the site plans. Notify your manager.
510A	Chassis ID error or memory error.	Check that the chassis ID jumpers are set correctly by referring to the site plans. Check that memory chips U9 and U10 on the ACP module have the correct checksums. These are identified on the site plans. Notify your manager.

VLP Software Reset Codes: 34 RST xxxx yyyy		
Code	**Possible Cause**	**Corrective Action**
510C	Memory hardware error	Look for loose or missing IC chips. Replace ACP module. Notify supervisor.
Any other code	If you have any other code, the problem could be caused by: Software error; Application logic error.	Notify your manager.

Table 4 – VLP Software Reset Codes: 34 RST xxxx yyyy cont

14. VHLC Fault Log

The fault log forms part of the information available through the CDU and can be used during the fault finding process. Its position within the memory of the CDU is described in the following menu map, see Figure 8.

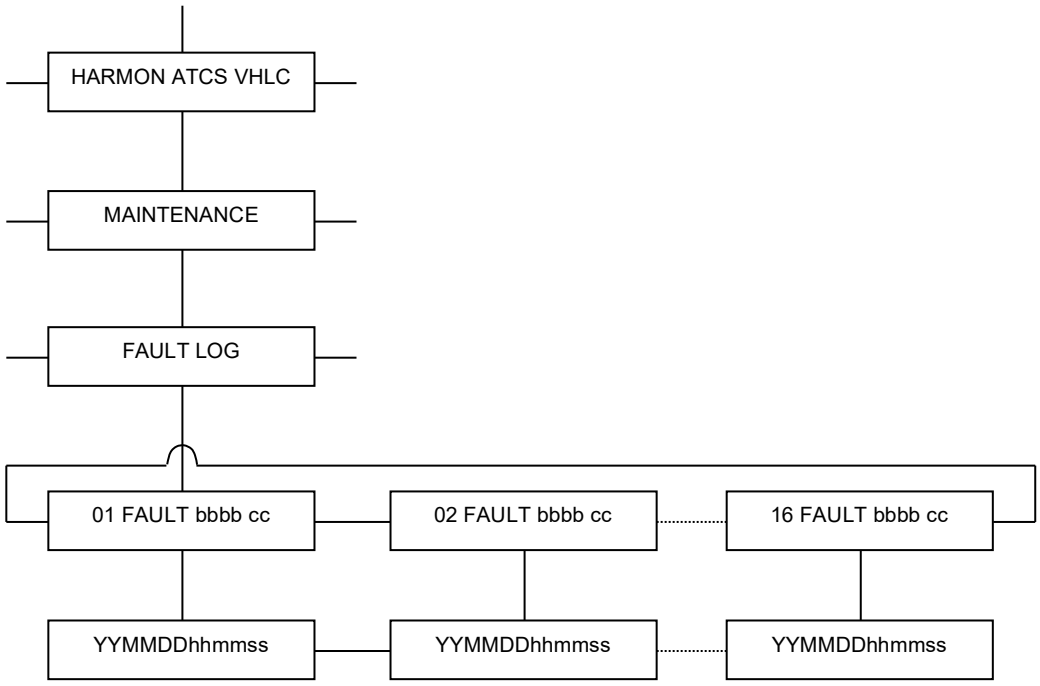


Figure 8 – VHLC Fault Log

The last 16 fault codes recorded can be displayed using the fault log and each memory location can be selected to display a fault code along with the date and time that the fault occurred.

Each fault that is logged is expressed in the following format.

a) aa FAULT bbbb cc

Where:

a) aa is the fault number

b) bbbb is the fault code; and

c) cc is the slot number of the defective module.

The fault will also be give a date and time code, expressed in the following format.

a) YYMMDDhhmmss

Where:

a) YY is the year

b) MM is the month

c) DD is the day

d) hh is the hour

e) mm is the minute

f) ss is the second.

Table 5 lists a number of problems, identifies their possible causes and gives corrective actions.

Fault Code	What it means	Slot Number
1807	Changing track rate	Track (1-8)
2801	I/O NVIO input error	Slot
2802	I/O NVIO output error	Slot
2803	I/O module output sense error	Slot
2804	I/O module output sense OK	Slot
2805	Remote CRC error	0 = Port B, 1 = Port D
2806	Remote destination error	0 = Port B, 1 = Port D
2807	Remote link down	0 = Port B, 1 = Port D

Fault Code	What it means	Slot Number
2808	Remote sequence error	0 = Port B, 1 = Port D
2809	Remote source ID error	0 = Port B, 1 = Port D
280A	I/O lamp out	Slot
280B	I/O lamp OK	Slot
280C	VSDAC vital AND fail	Slot
280D	VSDAC dual control error	Slot
280E	VSDAC cannot zero A to D	Slot
280F	VSDAC cannot read A to D	Slot
2810	VSDAC sense failure	Slot
2811	VSDAC power enable error	Slot
2812	Dual disabled VSDAC module	Slot
2813	Equations disabled VSDAC module	Slot
2814	VSDAC lamp intermittent	Slot
2815	Cannot zero vital input	Slot
2816	NV132 input error	Slot
2817	Remote link up	0 = Port B, 1 = Port D
2818	VSDAC module recovered	Slot
2819	Equations requested flash and steady on	Slot
281A	Noisy vital input	Slot

Table 5 – Fault codes

END

NR/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part10/FF19		
Faulting Guide: EBI Gate 2000 Level Crossing System		
Issue No. 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	EBI Gate 2000 Level Crossing Systems
Excludes:	All other types of Level Crossing System

Fault Finding

Power Supply and Control Rack (ERR-8) failures are reported by the Remote-Control Device (ERP-9).

The actions required to rectify these failures are presented below. In some more complex situations, it is required to work with signalling wiring diagrams

Usually it is recommended to observe related Programmable Logic Controller (PLC) inputs.

You shall not connect any diagnostic or additional devices to ETHERNET nets within ERR-8.

Failure Mode Index

1. Failure Mode: No battery charging of channel A / B / C

1.1 Check the fuse insert of TYTAN mains fuse.

1.2 Check all fuses – FZX, FZiX, FX (where X is A or B or C).

1.3 Check if the Residual Current is triggered.

1.4 Check the FLASHTRAB mains surge protection – observe inspection indicator

They should be green, red – means replacement is needed.

Figure 1 – FLASHTRAB mains surge protection

1.5 Measure the voltage on the input terminals of battery chargers.

1.6 Check the voltage on the disconnected batteries (20÷28Vdc).
Before measurement switch off fuse FZX (where X is A or B or C).

1.7 Switch off the TYTAN fused switch, then switch it back on.

1.8 Before the corresponding EMK-2 module is activated (indicated by audible click of contactor) measure the charging current of batteries.

To do this switch off the fuse FZX (where X is A or B or C) and measure the charging current (0,1÷20A DC) directly on terminals of the corresponding fuse.

1.9 Check continuity of the cabling towards the PLC inputs.

1.10 Check for indication on related PLC input (according to list of inputs).

2. Failure Mode: Battery voltage is too low

2.1 When this failure is reported together with indication “No battery charging of channel A/B/C” than it means that the batteries are discharged due to the lack of mains power supply.

2.2 The other option is that the batteries are broken. Disconnect the batteries using fuse FZX (where X is A or B or C) and measure the voltage directly on terminals of each battery (10÷15Vdc).

2.3 Reconnect the batteries (using the respective fuse) and cycle the mains power supply.

2.4 Observe the batteries voltage before and after the moment when module EMK-2 is activated (audible click of contactor). In each case the voltage of the battery should be in the range 10-15Vdc.

2.5 If the batteries voltage is above 25V DC and the failure is still reported this means failure of the EMK-2 module. Replace the faulty EMK-2 module.

2.6 Check continuity of the cabling towards the PLC inputs.

2.7 Check for indication on related PLC input (according to list of inputs).

3. Failure Mode: Battery voltage is too low

3.1 When this failure is reported together with indication „No battery charging of channel A/B/C” than it means that the batteries are discharged due to the lack of mains power supply.

3.2 The other option is that the batteries are broken. Disconnect the batteries using fuse FZX (where X is A or B or C) and measure the voltage directly on terminals of each battery (10÷15Vdc).

3.3 Reconnect the batteries (using the respective fuse) and cycle the mains power supply.

Observe the batteries voltage before and after the moment when module EMK-2 is activated (audible click of contactor). In each case the voltage of the battery should be in the range 10-15Vdc.

3.4 If the batteries voltage is above 25V DC and the failure is still reported this means failure of the EMK-2 module. Replace the faulty EMK-2 module.

3.5 Check continuity of the cabling towards the PLC inputs.

3.6 Check for indication on related PLC input (according to list of inputs).

4. Failure Mode: Earth leakage detection failure (first threshold/second threshold)

4.1 Check for readout of earth leakage detection modules (Bender Units) marked MD A, MD B, MD C. Compare readouts with defined values for first and second threshold (110kΩ and 100kΩ).

4.2 Check continuity of the cabling towards the PLC inputs.

4.3 Check for indication on related PLC input (according to list of inputs).

4.4 Disconnect external LX devices – this test allows you to narrow down the location of the earth leakage to either inside or outside of the LX hut.

4.5 Disconnect power supply and check the resistance between PE (Protective Earth) and both terminals of DC power supply in all sub circuits.

5. Failure Mode: Door of control cabinet is open

5.1 Check if the door is locked – otherwise the door limit switch is not activated.

5.2 Check continuity of the cabling towards the PLC inputs.

5.3 Check for indication on related PLC input (according to list of inputs) while closing and opening the door lock.

6. Failure Mode: Failure of EOD module & set of EOD related failures

6.1 Check continuity of the cabling towards the PLC inputs.

6.2 Check for indication on related PLC input (according to list of inputs). Test of the EOD module is visible as a short extinguish of the LED in the PLC input card.

6.3 If the result of the above inspection is negative replace the corresponding EOD module.

7. Failure Mode: Discrepancy of engagement in channels of LX controllers

7.1 Restart the LX system. This action should rectify the failure.

7.2 It is absolutely indispensable to inform the manufacturer about occurrence of this failure and all simultaneously reported failures (on the ERP-9).

8. Failure Mode: Road signals / Audible alarms communication failure

8.1 Check if EMF / EDG module is powered.

8.2 Observe and analyse the indications on module – LED indicators, activity of yellow and green LEDs on Ethernet socket of the module.

8.3 Check for communication activity on related Ethernet switch.

8.4 If the result of the above inspection is negative - replace faulty module.

9. Failure Mode: Road signals / Audible alarms hardware failure

9.1 Check if the EMF / EDG module is powered and its wiring is intact.

9.2 The diagnostic information on the ERP-9 provide more detailed information pointing the module for replacement.

10. Failure Mode: Failure of audible alarm

10.1 Check continuity of the cabling.

10.2 Check the overvoltage protection.

10.3 Check for the continuity of the primary winding of the acoustic transducer (KLD-5) sub-assembly within road signal (the measured resistance should be in a range of 50Ω-1kΩ).

10.4 Replace EDG module or the acoustic transducer (KLD-5) subassembly.

11. Failure Mode: Failure of red / amber road signal

11.1 Check if the corresponding chamber is lit – if it is working according to LX state.

11.2 Observe the LED indications on EMF module.

11.3 Measure the output voltage of EMF module (it should be 22V to 25V DC).

11.4 Check continuity of the cabling.

11.5 Replace EMF module.

12. Failure Mode: Failure of Crossing Clear Unit / Local Control Unit

12.1 Check for failures of related signals.

12.2 Check continuity of the cabling towards the PLC inputs.

12.3 Check the corresponding fuse.

12.4 Check for indication on related PLC input (according to list of inputs).

12.5 Observe if outputs (5Hz waveform) are returned to corresponding PLC inputs (LED indications on output/input cards).

12.6 Observe the signal on input and output of the EDZ modules.

12.7 Replace broken EDZ module, buttons and lamps.

13. Failure Mode: Failure of Signal Box control panel

13.1 Check for power supply delivered from channel C.

13.2 Check the Ethernet cabling if all plugs are latched correctly.

13.3 Check for the Ethernet communication activity on the switch towards DNC.

13.4 Observe the indications on local diagnostic panel.

14. Failure Mode: Failure of the barriers / exit barriers direction of movement

14.1 Check the presence of the power supply and output signal of EDL module while the barrier machines are supposed to be moving up.

14.2 Check the contactors for proper operation – contacts operation should follow the presence of coil voltage.

14.3 Observe the related PLC input.

14.4 Check the WAGO optocouplers for proper operation – output transistor keys operation should follow the presence of input current.

14.5 Check continuity of the cabling.

14.6 Depending on results of above checks replace EDL module / contactor / WAGO optocoupler respectively.

15. Failure Mode: Barrier machine not ready

15.1 Check if the crank flap of the individual barrier machine is open.

15.2 Check continuity of the cabling towards the PLC inputs.

15.3 Check the corresponding fuses.

15.4 Check the indications on related PLC inputs (according to list of inputs).

16. Failure Mode: Boom intact failure of barrier

16.1 Check the continuity of the cabling towards the PLC inputs (also in the barrier machine).

16.2 Check the corresponding fuses.

16.3 Check the indications on related PLC inputs (according to list of inputs).

17. Failure Mode: Failure of barrier machine position

17.1 Check the real position of the boom.

17.2 Check continuity of the cabling towards the PLC inputs (also in the barrier machine).

17.3 Check the corresponding fuses.

17.4 Check the operation of limit switches.

17.5 Check the indications on related PLC inputs (according to list of inputs).

17.6 Check the operation of all related WAGO optocouplers – output transistor keys operation should follow the presence of input current.

17.7 Check the operation of contactors – contacts operation should follow the presence of coil voltage.

18. Failure Mode: Failure of current transducer of barriers

18.1 Cycle the power of the current transducer using its plugs.

18.2 Check continuity of the cabling towards the PLC inputs.

18.3 Check for the ERROR (ERR) indication on the WAGO current measurement unit.

18.4 Replace the WAGO current measurement unit / PLC analogue input card.

19. Failure Mode: Overcurrent failure of barrier

19.1 Check if barrier machine is not broken or blocked.

19.2 Check for short-circuit in motor power supply circuit.

20. Failure Mode: Failure of event logger

20.1 Check presence of the CF card in PLC CPU.

20.2 Replace CF card in PLC CPU.

21. Failure Mode: Failure of event logger backup

21.1 Visually check continuity of the cabling.

22. Failure Mode: Failure of interlocking interface

22.1 Check the interface sub circuit accordingly to the reported failure.

END

Includes:	JE Style Trainstop
Excludes:	Any other type or make of Trainstop or sub-component

Trainstops contain moving parts which can cause severe personal injury.

Fault Finding Guide

1. Trip Arm Fails to Lower

1.1 Possible cause - Signalling System not set to Proceed

a) Check associated signal is set to the proceed aspect.

b) If signal not at proceed and Trip Arm is lowered – Follow actions for loss of motor drive voltage.

If signal is at danger, Trip Arm should not be lowered.

1.2 Possible cause - Loss of Motor Drive Voltage

With associated signal set to proceed:

a) Check for 110 V a.c. motor drive voltage at incoming terminals of the distribution box.

b) If voltage is not present, fault is external to the Trainstop.

c) If voltage is present, check disconnection box links are correctly made to pass voltage to the tail cables.

d) Check for 110 V a.c. voltage across Rectifier Assembly terminals 1 and 2.

e) If voltage is not present, check the tail cables for damage or disconnection and repair / re-connect as necessary.

f) If voltage is present, follow actions for Motor failure.

1.3 Possible cause - Trip Arm Jammed

a) Isolate the train stop and disconnect the tail cables.

b) Check for and remove any debris, ballast etc that can jam the Trip Arm.

c) Inspect the Trainstop looking for damage, distortion or cracks to the casing, Trip Arm or detector arm.

d) If the Trip Arm is damaged, but the remainder of the Trainstop is serviceable, replace the Trip Arm.

e) Other damages could require the replacement of the complete Trainstop.

f) If no damage is found, attempt to manually operate the Trip Arm.

g) If Trip Arm remains jammed, replace Trainstop.

h) If manual operation is satisfactory, re-connect the tail cables and supply.

i) Test the operation under power. If fault still present, replace the Trainstop.

1.4 Possible cause - Motor Failure.

a) With motor supply applied, at the Rectifier Assembly terminals measure the D.C. voltage between terminal 4 (+100 V) and terminal 5 (0 V).

b) If the voltage is present, replace the motor.

c) Isolate the supply from the Trainstop and disconnect the tail cables.

d) If the motor brushes are badly worn, replace them.

e) Re-connect the tail cables and the supply then check for correct operation.

f) If the voltage was not present, replace Trainstop.

1.5 Possible cause - Clutch Failure

a) A clutch failure is indicated by the motor operating, driving Gear C via Gear B (see Figure 1) but Gear D not being driven.

b) If Gear D is not being driven, then the replace the Trainstop.

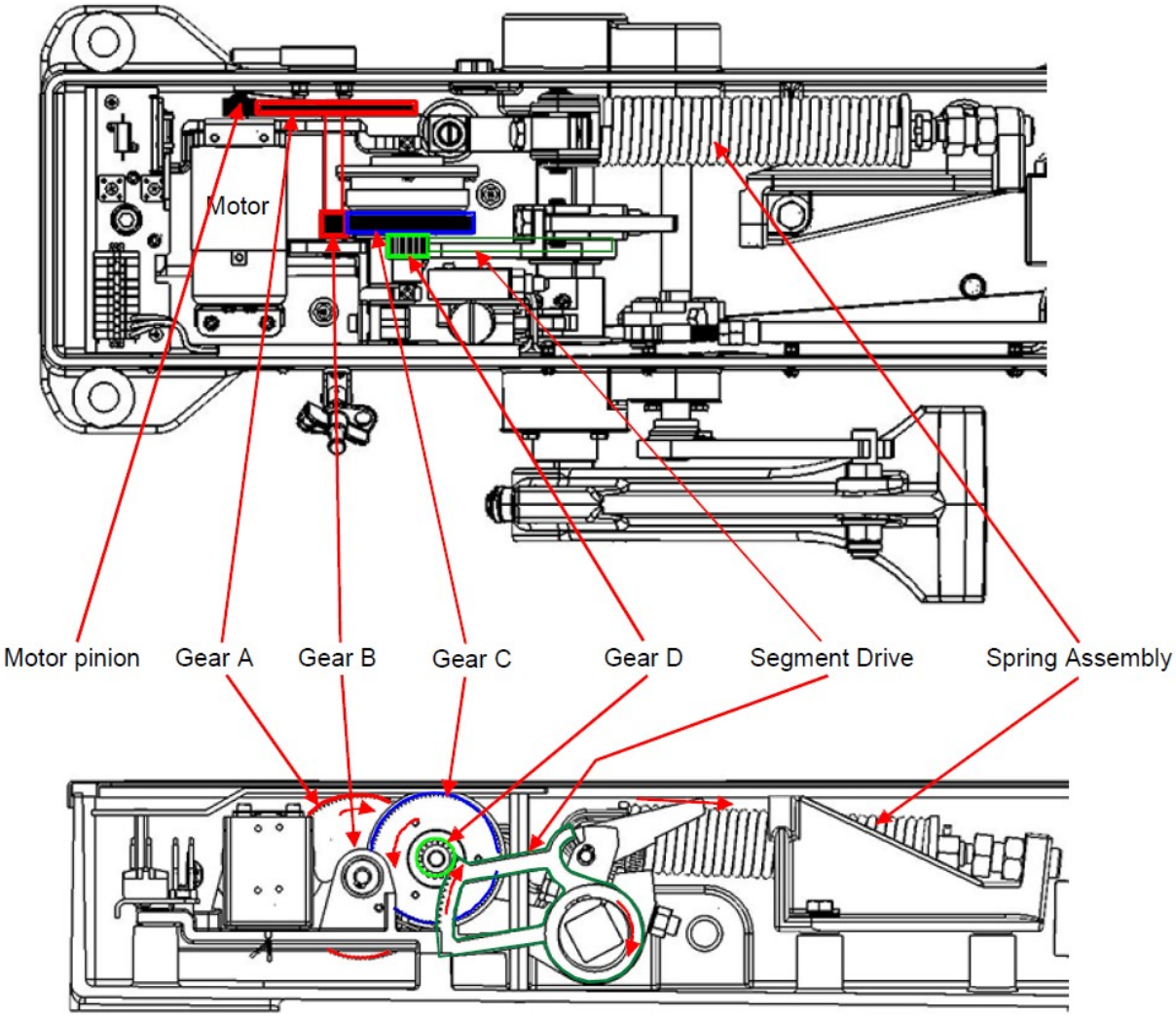


Figure 1 – Trainstop Drive System

2. Trip Arm Fails to Rise

2.1 Possible cause - Trainstop receiving motor drive voltage from signalling system.

a) Isolate the supply from the Trainstop and unplug the tail cables.

b) If Trip Arm immediately rises check for motor drive voltage of 110 V a.c. on the incoming terminals of the disconnection box.

c) If this voltage is present, the Trainstop is not faulty.

d) Report findings to the SM(S) and investigate.

e) Re-connect the tail cables then re-connect the supply.

2.2 Possible cause - Trip Arm jammed

a) Isolate the supply from the Trainstop and unplug the tail cables.

b) If the Trip Arm does not rise when the electrical supply is isolated, visually check for jamming of the Trip Arm.

c) If jammed by debris, manually depress the Trip Arm and carefully remove the debris.

d) Release the Trip Arm and check it moves freely to the fully raised position.

e) If not jammed by debris, but the Trip Arm does not rise, make the machine safe by securing the Trip Arm in the lowered position.

f) With the Trip Arm of the faulty machine secured, replace the Trainstop.

g) Mark the faulty Trainstop prominently with a warning “Not to release the Trip Arm”.

2.3 Possible cause - Return mechanism broken.

a) Replace the Trainstop.

3. Symptom – Trip Arm attempt to Lower and then Rises

3.1 Possible cause - Debris / ballast preventing Trip Arm from lowering fully.

a) Isolate the supply from the Trainstop and unplug the tail cables.

b) Remove any debris / ballast preventing the Trip Arm from lowering.

c) Manually lower the Trip Arm to check for correct operation.

d) If manual operation appears to be correct, re-connect the tail cables to the Trainstop and then re-connect the supply.

e) Request the Signaller to operate the signal associated with the Trainstop and check for correct operation of the Trainstop.

3.2 Possible cause – Clutch Failure.

a) A clutch failure is indicated by the motor operating, driving Gear C via Gear B (See Figure 1) but Gear D not being driven.

b) If Gear D is not being driven, then the replace the Trainstop.

3.3 Possible cause - Trip Arm distorted.

a) Isolate the supply from the Trainstop and unplug the tail cables.

b) Inspect the Trainstop looking for damage, distortion or cracks to the casing, Trip Arm or detector arm.

c) If the Trip Arm is damaged, but the remainder of the Trainstop is serviceable, replace the Trip Arm. Other damage entails replacement of the complete Trainstop.

3.4 Possible cause - Trainstop loose on fixings.

a) Keeping clear of the Trip Arm, isolate the supply from the Trainstop and unplug the tail cables.

b) Slacken the four fixings securing the Trainstop to the bearer.

c) Adjust the position of the Trainstop to give required distance of the Trip Arm from the running rail.

d) Tighten the fixings and re-check the measurement.

e) Re-connect the tail cables to the Trainstop and then re-connect the supply.

f) Request the Signaller to operate the signal associated with the Trainstop and check for correct operation of the Trainstop.

3.5 Possible cause - Trainstop badly damaged.

a) Replace the Trainstop.

4. Symptom – Trip Arm Out of Gauge

4.1 Possible cause - Trainstop loose on fixings.

a) Isolate the supply from the Trainstop and disconnect the tail cables.

b) Check the centre of the Trip Arm is 222 mm +/-3 mm from the inside of the running rail (Figure 2).

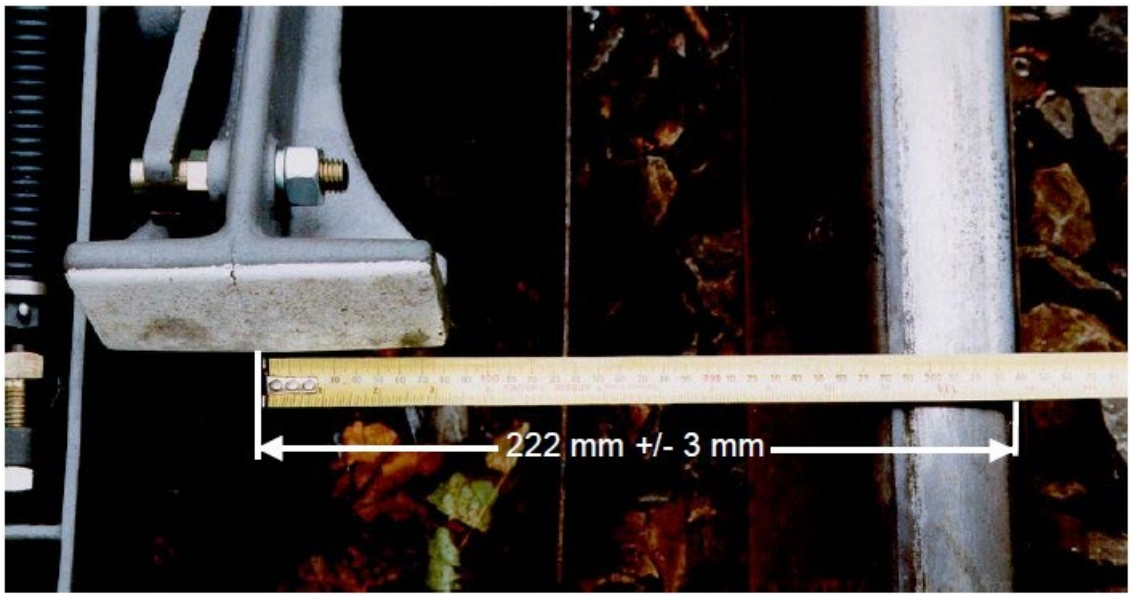


Figure 2 – Distance from Rail

c) Adjust as necessary by moving the complete Trainstop, keeping it parallel to the running rail.

d) Tighten the Trainstop fixings and re-check the dimension.

e) Place the Trip Arm Gauge in position and confirm the Trip Arm height is 76 mm +/- 3 mm above a line joining the tops of the running rails. If the height is incorrect, see Rail wear.

f) Remove the Trip Arm Gauge.

g) Re-connect the tail cables then re-connect the supply to the Trainstop.

h) Request the Signaller to operate the signal associated with the Trainstop and check for correct operation of the Trainstop.

4.2 Possible cause - Rail wear.

a) Isolate the supply from the Trainstop and disconnect the tail cables.

b) Place the Trip Arm Gauge in position and measure the Trip Arm height above a line joining the tops of the running rails.

c) If the Trip Arm height is greater than 79 mm above the line, carry out NR/SMS/PartB/Test/028 (JE Style TrainStop Positioning Check).

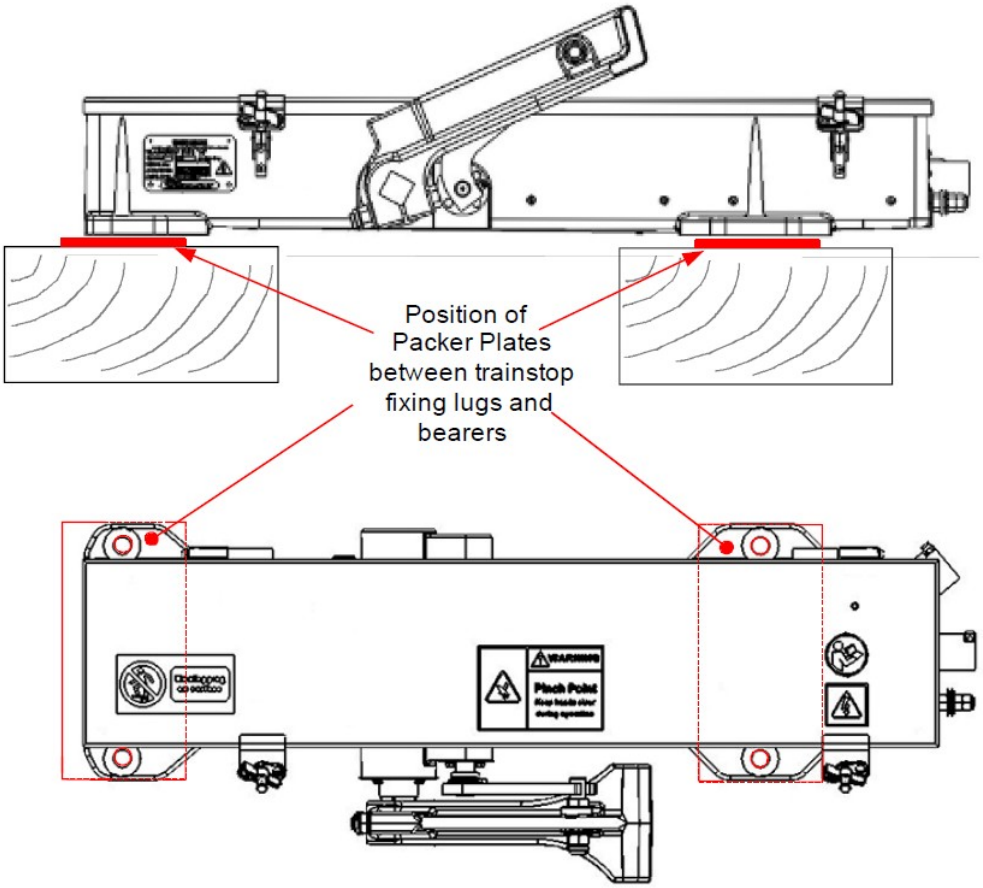


Figure 3 – Position of Packer Plates

5. Symptom - Detection Failure

5.1 Possible cause – Loss of detection voltage from signalling system.

a) Isolate the supply from the Trainstop and disconnect the tail cables.

b) Check for the presence of the detection voltage at the disconnection box terminals.

c) If the detection voltage is not present at the distribution box check the associated fuses.

d) If detection voltage is correct leaving location case / equipment room, report a cable fault between the location case / equipment room and the disconnection box.

e) If the detection voltage is present, re-connect the tail cables to the Trainstop, then re-connect the supply.

f) Proceed with actions listed under Tail cable fault.

5.2 Possible cause – Tail cable fault.

a) Visually check the tail cables between the disconnection box and the Trainstop for cuts, crushing or other damage likely to cause short or open circuits within the cable.

b) With the supply and tail cables connected to the Trainstop, undo the four screw fixings securing the polycarbonate cover over the Circuit Controller (see Figure 4).

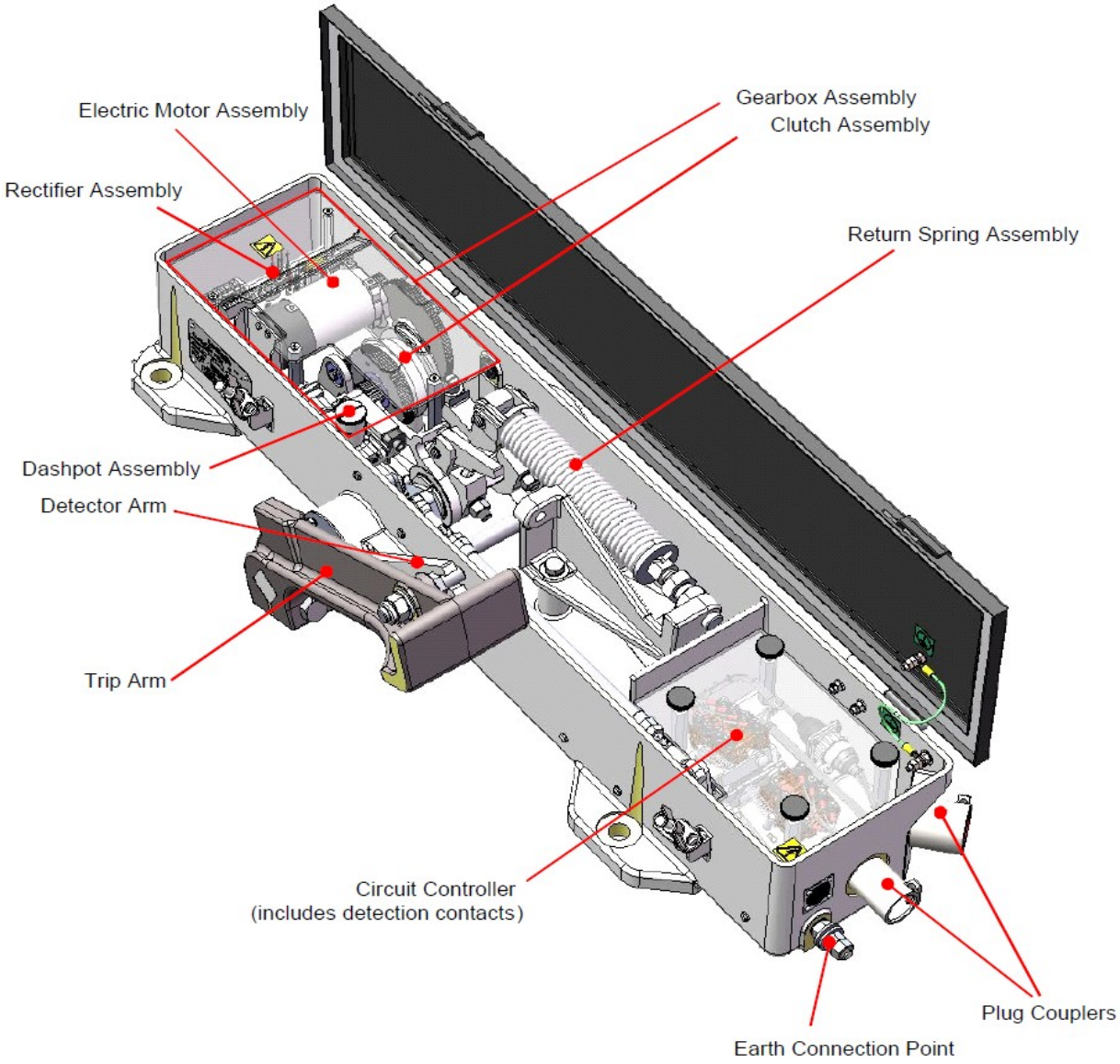


Figure 4 – JE Trainstop Main Assemblies

c) At Circuit Controller Switches (Figure 5), use a voltmeter to check for the presence of the detection voltage between Switch A terminals 3 and 7.

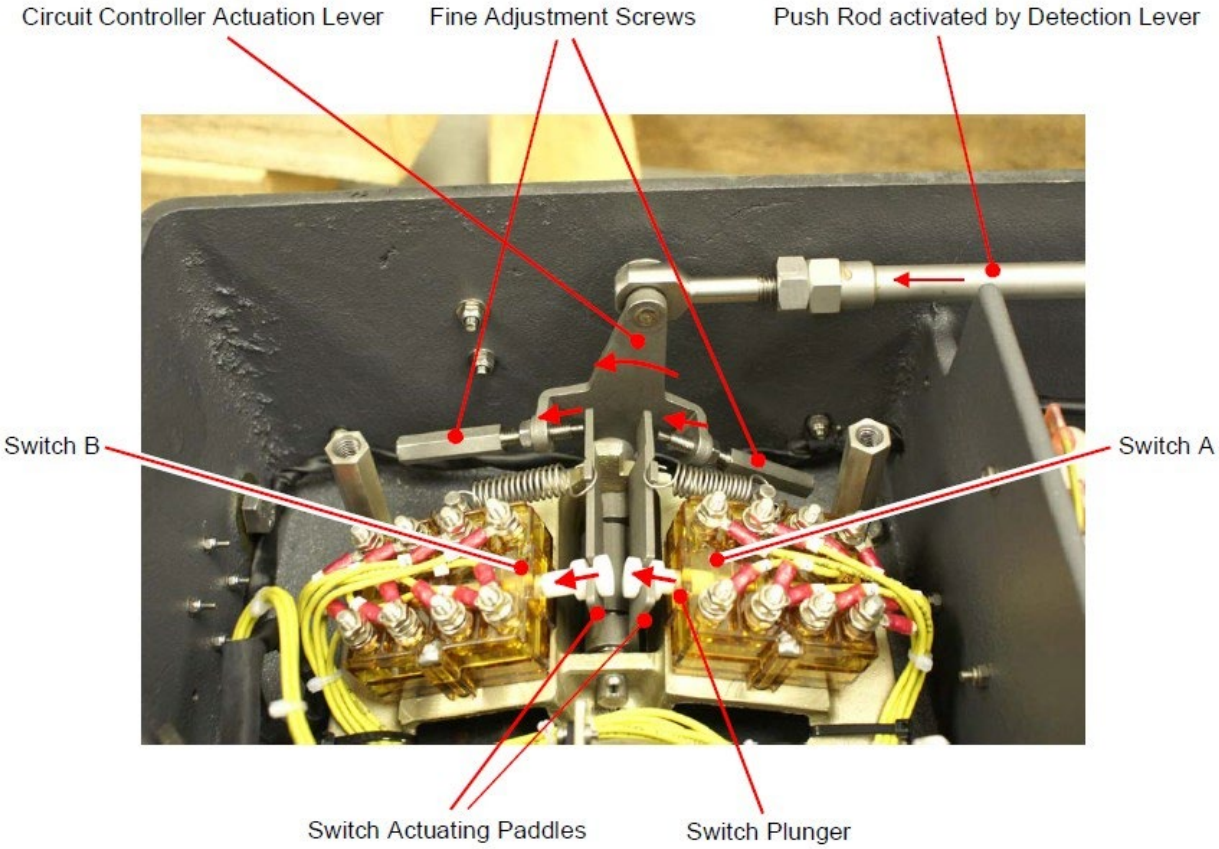


Figure 5 – Circuit Controller Detail
(shown with the Trip arm raised, with arrows indicating the direction of movement as the arm lowers)

d) If the detection voltage is present, keeping clear of the Trip Arm, isolate the supply from the Trainstop and disconnect the tail cables.

e) Check the detection contacts within the Trainstop by using a multimeter to check that continuity between the terminals of the Circuit Controller switches is as shown in Table 1 for the stated Trip Arm positions.

f) If the detection contacts are incorrect, replace the Trainstop.

g) If the detection voltage is not present, replace or repair the tail cables.

h) Re-fit the polycarbonate cover over the Circuit Controller.

i) If the detection check is satisfactory, or when the tail cables are repaired / replaced, re-connect the tail cables and re-connect the supply.

j) Request the Control Centre to operate the signal associated with the Trainstop and check for correct operation of the Trainstop.

k) Check the Trip Arm position corresponds with the associated stop signal.

l) Request the Signaller to alter the signal aspects and check the Trainstop operates correctly and that detection is correctly received at the Control Centre.

5.3 Possible cause – Fault within Trainstop.

a) Replace the Trainstop.

6. Circuit Controller Switches Detection Terminals

Trip Arm Position	Terminals	Switch A	Switch B
Raised	1-2	Open	Closed
	3-4	Closed	Open
	5-6	Open	Closed
	7-8	Closed	Open
Lowered	1-2	Closed	Open
	3-4	Open	Closed
	5-6	Closed	Open
	7-8	Open	Closed

Table 1 – Circuit Controller Switches Detection Terminals

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part10/FF23		
Faulting Guide: SmartIO resilient power supply sub-system		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	SmartIO Power Rack Systems
Excludes:	All other Power Rack Systems

1. SmartIO power rack fault indications

1.1 The SmartIO system has two methods of indicating faults in the resilient power supply systems located in the SmartIO housing; Alarms raised on the Support System (SSys) display, and visual indications (LEDs or flags) on the power supply sub-system devices located on the rack.

1.2 All incoming signalling supplies are monitored and protected by:

a) Supply availability monitors.

b) Surge arrestors.

c) MCBs.

d) Earth leakage detectors.

1.3 The supplies on the power rack are designed to be resilient such that failure of one incoming supply, or a single secondary supply device will not impact either the correct operation the SmartIO system, or the communication between the CIXL and the SmartIO.

2. Power rack resilient supplies block diagram

2.1 Double pole MCBs in the locations shown in Figure 1 are used to isolate supply devices before replacement and are test points for voltage measurements to confirm the correct operation of the power sub-system devices.

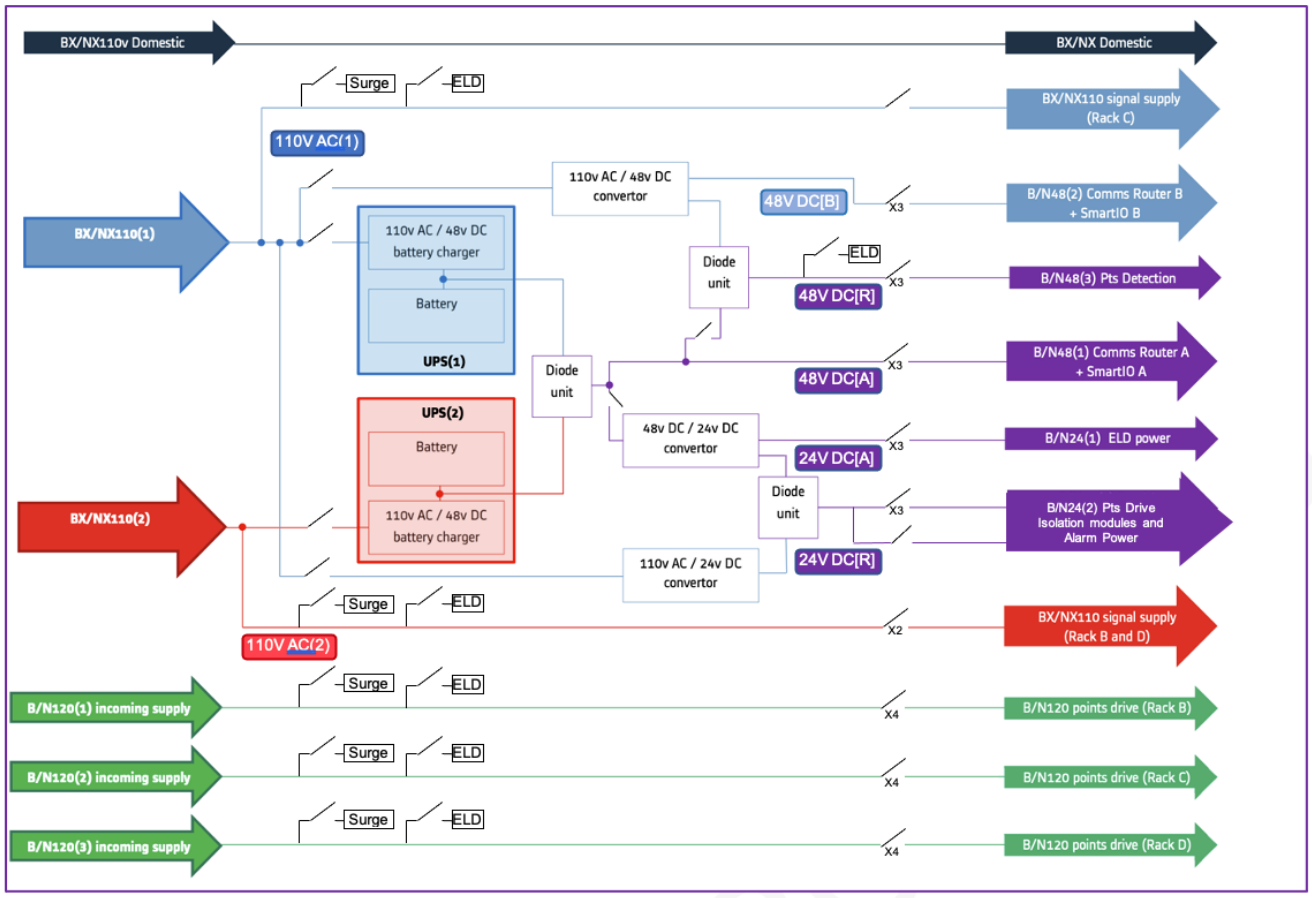


Figure 1 - SmartIO Power Rack block diagram

3. Support system fault reporting

3.1 The following faults are reported on the Support System display available in the SmartIO housing and in the Signalling Control Centre.

3.2 Where alerts are indicated as non-critical, they do not immediately impact the running of trains, however they indicate faults which shall be attended to with high priority before a subsequent failure does impact train operation.

Description and status	Likely Cause	Potential impact
110V AC (1) FAULT (Critical) *	Loss of incoming 110V FSP supply	**Signal aspects and train protection circuits connected to rack B unpowered.**
110V AC (2) FAULT (Critical) *	Loss of incoming 110V FSP supply	**Signal aspects and train protection circuits connected to racks C, D unpowered.**
120V SUPPLY 1 FAULT (Critical) *	Loss of incoming 120V DC FSP supply	**Loss of movement of points attached to rack B.**
120V SUPPLY 2 FAULT (Critical) *	Loss of incoming 120V DC FSP supply	**Loss of movement of points attached to rack C.**
120V SUPPLY 3 FAULT (Critical) *	Loss of incoming 120V DC FSP supply	**Loss of movement of points attached to rack D.**
CRITICAL COMBINED ELD (Critical) *	One or more ELDs insulation resistance below second threshold <20kΩ	Unreliable operation or proving detection of assets connected to affected circuits(s)
AC/DC CONVERTER UPS FAULT (Non-critical) *	Loss of either incoming 110v AC input to either UPS	No immediate impact due to resilient supply design.
48V UPS BATTERY FAULT (Non-critical) *	UPS indicates battery health is failing	No immediate impact due to resilient supply design.
110V-24V CONVERTER FAULT (Non-critical) *	Loss of, or out of spec, DC output (<90% of target voltage)	No immediate impact due to resilient supply design.
110V-48V CONVERTER FAULT (Non-critical) *	Loss of, or out of spec, DC output (<90% of target voltage)	No immediate impact due to resilient supply design.
48V-24V CONVERTER FAULT (Non-critical) *	Loss of or out of spec, DC output	No immediate impact due to resilient supply design.
110V AC SURGE PROTECTION FAULT (Warning) *	Either 110V surge protectors in critical alert state	No immediate impact, expired device requires replacement.
120V SURGE PROTECTION FAULT (Warning) *	Any 120V DC surge protectors in critical alert state	No immediate impact, expired device requires replacement.
EARTH LEAKAGE 110V (1) (Warning)	Insulation fault resistance below first threshold (<200kΩ)	No immediate impact affected circuit shall be checked, and fault rectified.
EARTH LEAKAGE 110V (2) (Warning)	Insulation fault resistance below first threshold (<200kΩ)	No immediate impact affected circuit shall be checked, and fault rectified.

Description and status	Likely Cause	Potential impact
EARTH LEAKAGE 120V (3) (Warning)	Insulation fault resistance below upper threshold (<200kΩ)	No immediate impact affected circuit shall be checked, and fault rectified.
EARTH LEAKAGE 120V (2) (Warning)	Insulation fault resistance below upper threshold (<200kΩ)	No immediate impact affected circuit shall be checked, and fault rectified.
EARTH LEAKAGE 120V (1) (Warning)	Insulation fault resistance below upper threshold (<200kΩ)	No immediate impact affected circuit shall be checked, and fault rectified.
EARTH LEAKAGE 48V (Warning)	Insulation fault resistance below upper threshold (<200kΩ)	No immediate impact affected circuit shall be checked, and fault rectified.
110V DOMESTIC SUPPLY FAULT (Warning) *	Status of incoming 110V domestic supply	No impact on operation, loss of power for lighting, forced ventilation and Support System Client Terminal.
DOOR OPEN (Warning) *	SmartIO Housing door is open	No impact on operation, security issue.
LOW TEMPERATURE (Warning)	Temperature is above lower threshold (>40^{0}C)	No impact on operation, diagnostic message.
HIGH TEMPERATURE (Non-Critical)	Temperature is above upper threshold (>50^{0}C)	Potential impact on reliability of operation if condition is prolonged and not rectified.
FORCED AIR VENT FAULT (Warning) *	Failure of ventilation system. Refer to local building and equipment housing maintenance procedures.	Potential impact on reliability of operation if coupled with alarm 23 for prolonged period.
* Multiple simultaneous indication of these alarms	This indicates a failure of the 24V Alarms feed which will trigger multiple alarms	**Multiple error messages on Support System HMI and signallers console.**

Table 1 – Fault Indications and Possible Causes

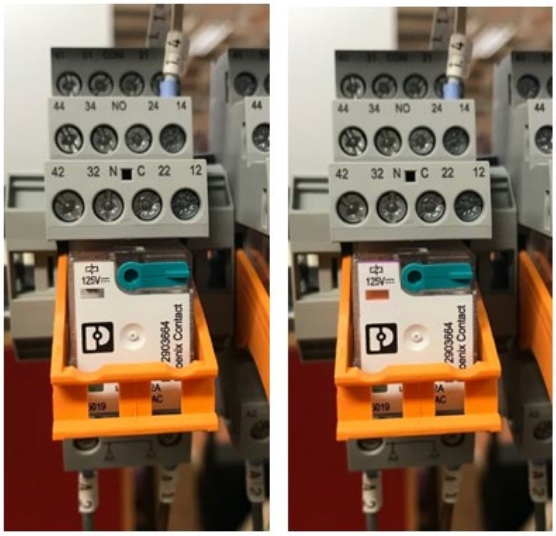
4. Failure of surge arrestors

4.1 Surge arrestors are a consumable item, they shall be replaced when they have been overloaded. The visual indication of failure is shown in Figure 2.

Figure 2 - Visual indication of an operational (green), and a blown Surge protector (red).

5. Failure of incoming supply

5.1 The availability of the incoming 110V AC and 120V DC signalling supplies from the FSP is indicated on the supply monitors shown in Figures 3 and 4.



Supply off Supply on

Figure 3 - 120V DC supply monitor relay

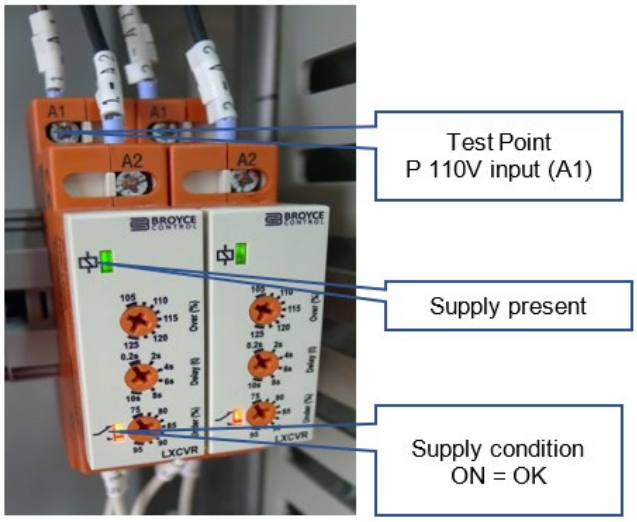


Figure 4 - 110V AC Supply monitor

5.2 If failure of an incoming supply is indicated, the supply shall be checked by measurement of the voltage at the input to the supply isolation switch as shown here in Figure 5.

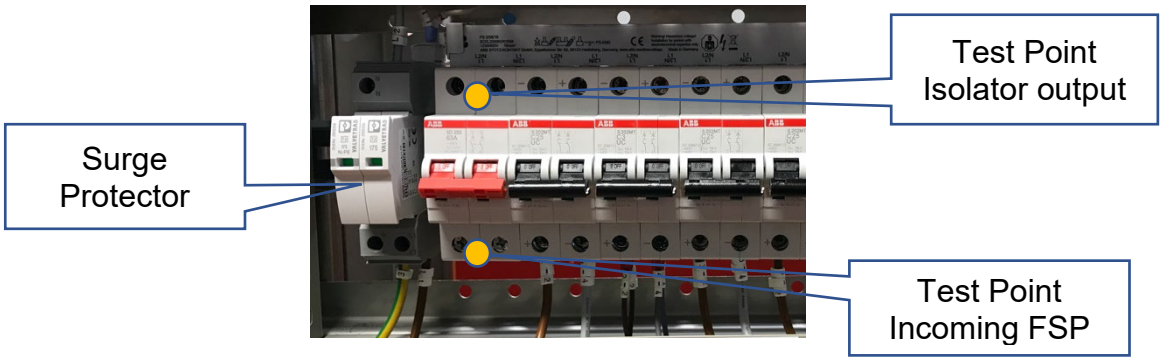


Figure 5 - Incoming supply isolation test point 110VAC and 120V DC

5.3 Failure of the incoming supply shall be reported to the SM(S).

6. Failure indication, Earth Leakage Detection

6.1 Earth leakage detection indicates a fault in a circuit which ultimately feeds trackside cables. When a critical earth leakage detection is indicated, a correlated non-critical indication occurs to identify the faulty circuit. To confirm that the fault is in the trackside cable, trackside cables can be isolated by opening the outgoing fuses on the SmartIO Object Controller rack.

6.2 Earth leakage faults in trackside cabling shall be investigated using established trackside cable fault finding processes.

6.3 If the fault is not in the trackside circuit, an earth leakage fault is indicated within the SmartIO system racks, the fault can be traced by opening MCBs and fuse holders indicated on the site-specific drawings to progressively isolate the SmartIO sub systems.

6.4 The correct operation of each earth leakage detector may be checked by operating the self-test function, press and hold the test button for longer than 1.5 seconds. During this test, internal functional faults, or connection faults are determined and appear in form of an error code on the display:

a) E01 = PE connection fault, no low-resistance connection between E and KE.

b) E02 = system connection fault, no low-resistance connection between L1 and L2.

c) E03...Exx = internal device error.

6.5 The alarm relays are checked during this test, an audible click should be heard from the relays.

7. Failure of AC-DC and DC-DC converters and UPSs

(Excluding 48V-24V DC-DC converter).

7.1 The front panels of the voltage converters and UPSs show a green indicator of correct operation as shown here in Figures 6 and 7.

7.2 The presence of the output supply from each converter can also be confirmed by voltage measurement at the next downstream device which is either an MCB or one of the three Y-Diode networks.

Figure 6 - AC-DC converters showing DC OK indication

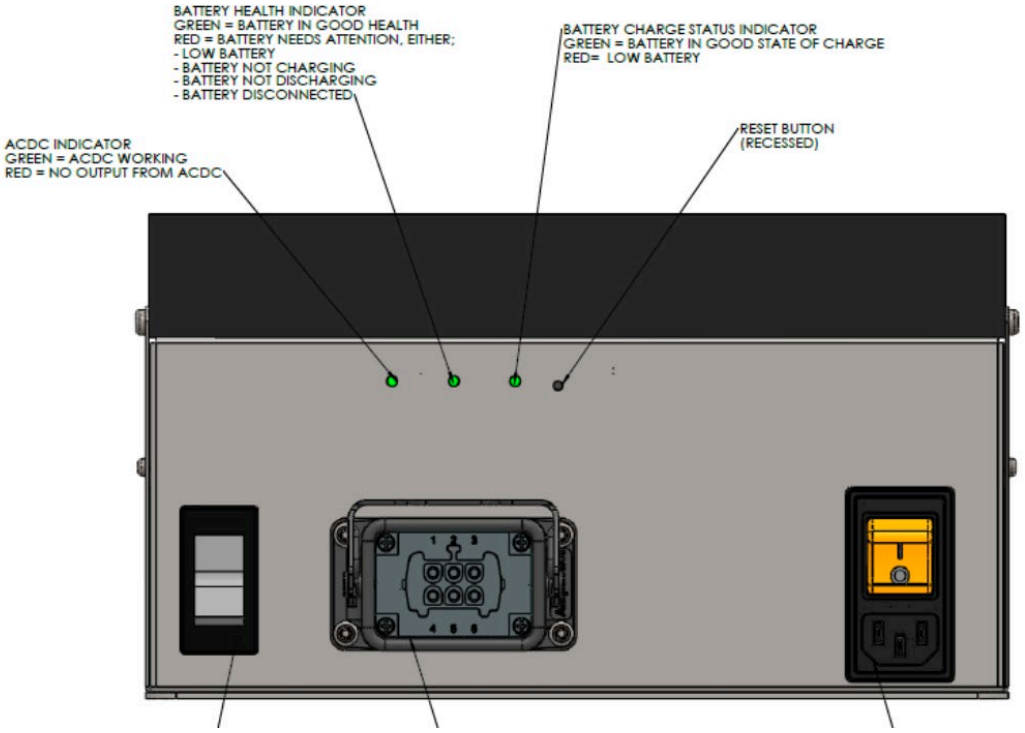


Figure 7 - UPS with indication of correct operation

8. Failure of MCBs

8.1 Open circuit failure of MCBs can be confirm by measurement of the voltages present on the input and output side of the device.

8.2 Incorrect tripping of MCBs can be confirmed by isolating the output side of the MCB. If isolating the output side clears the fault, then the output side wires shall be reconnected, and the downstream devices disconnected. Tripping of the MCB after disconnection of the downstream devices indicates a fault in the rack wiring which requires escalation to 2nd line maintenance.

8.3 If the MCB tripping has been cleared by disconnection of the downstream devices, each device may be reconnected in turn until the faulty device is identified.

9. Failure of the 48V-24V DC-DC converter

9.1 No indications are available on the device. Failure may be indicated in the Support System alarms. Failure of this converter can be verified by checking if the 24V feed has been lost on the input side of the MCB that switches this supply to the Earth Leakage detectors.

10. Failure of Y-Diode Network

10.1 The Power rack sub-system includes three Y-Diode networks as shown in Figure 8. Each diode unit has at least one downstream MCB where the Diode network output voltage can be checked.

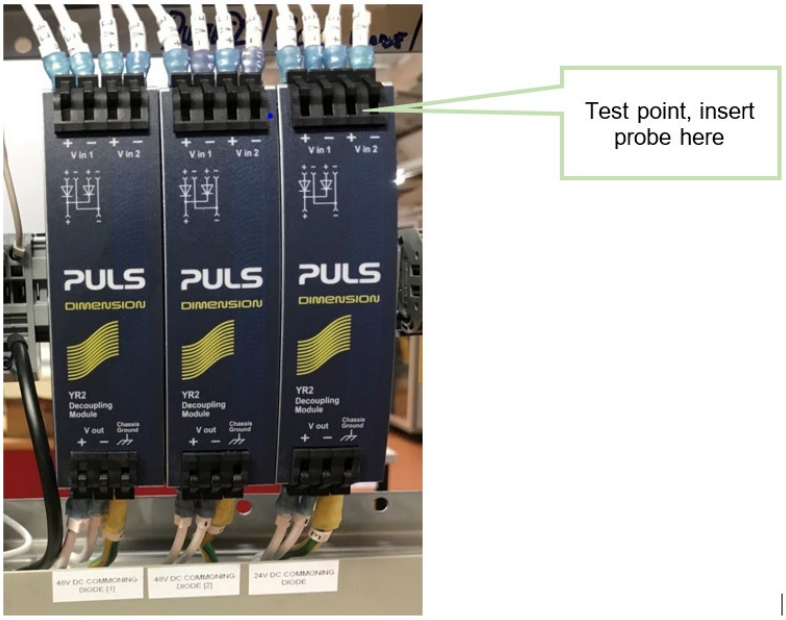


Figure 8 - Three Y-Diode networks showing a test point

10.2 If the output voltage is not present when either of the inputs is present the unit is faulty.

11. Failure of inter-rack cables

11.1 Cable damage which has resulted in short, open circuit or earth leakage fault on inter-rack cables is identified by checking the test points, alarms and indicators described here.

110V AC Signalling feeds

11.2 Test points on the incoming fuses to the SmartIO Object Controller racks can be used to check for the incoming 110V Signalling supply. Open circuit failure (or loss) of this supply is indicated by Support System alarms and the PW_TRK indication is switched off on the affected SmartIO SM module front panel.

11.3 Short circuits and earth leakage faults are detected by the MCB, or ELD display respectively.

120V DC Point drive feeds

11.4 Open circuit failure (or loss) of the 120V DC supply is indicated by Support System alarms when the points are driven. The error is indicated on the Support System, also the PW_TRK LED is switched off on the affected Smart IO PM module front panel when and after an attempt has been made to drive the point.

11.5 Short circuits and earth leakage are detected by the MCB tripping, or ELD display respectively when the points are driven.

11.6 The following 24V and 48V circuits are combined in a single cable between racks if faulty, the entire cable is replaced.

48V DC point detection feed

a) Test points on the incoming fuses to the SmartIO Object Controller racks can be used to check for the incoming 48V Point detection supply. Open circuit failure (or loss) of this supply is indicated by Support System alarms, also the PPM LED is switched off on the affected Smart IO PM module front panel.

b) Short circuits and earth leakage are indicated by the MCB tripping, or the ELD display respectively.

24V DC Point Drive Isolation Module (PDIM) supply

c) Test points on the incoming fuses to the SmartIO Object Controller racks can be used to check for the incoming 24V PDIM supply. Open circuit failure (or loss) of this supply is detected when the SmartIO PM module is commanded to drive the points. Open circuit failure of the supply is indicated by Support System alarms, also the PMC LED is switched off on the front panel of the affected Smart IO PM module when and after an attempt has been made to drive the point.

d) Short circuits and earth leakage are indicated by the MCB tripping, or the ELD display respectively.

48V DC supplies to Smart IO (and Network switch – rack B only)

e) Test points on the incoming fuses to the SmartIO Object Controller racks can be used to check for both of the incoming 48V SmartIO supplies. If either supply is not present, the “Vin OK” indication is switched off on the front panel of the affected SmartIO PS module.

f) Short circuits are indicated by the MCB tripping on the affected circuit. There is no ELD monitoring on these two 48V supplies to the SmartIO as they do not feed trackside circuits.

11.7 Damaged or faulty inter rack cables shall be replaced.

END

Contents

1. System Monitoring and Fault Identification

The ARAMIS Traffic Management system is deployed with a monitoring system which is based on the Nagios application.

This provides the maintainers primary system status overview and eliminates most of the requirements to attend a piece of equipment to determine its status.

Detailed information on the Nagios Monitoring system including the pertinent alerts can be found in the “Network Rail Traffic Management System Monitoring Solution SSD” document issued by Thales, reference 0001-0034989599.

1.1 WIKI

In order to enable users to understand the system, and to minimise the amount of training required a number of wiki articles are provided with the solution to reduce the amount of information that has to be remembered by the maintainers.

The WIKI is accessed by clicking the ‘document’ icon next to the relevant item on the Nagios screen. See circled area of Figure 1.

It should be noted that not all items have What I Know Is (WIKI) articles produced. In these cases, a blank screen is accessed.

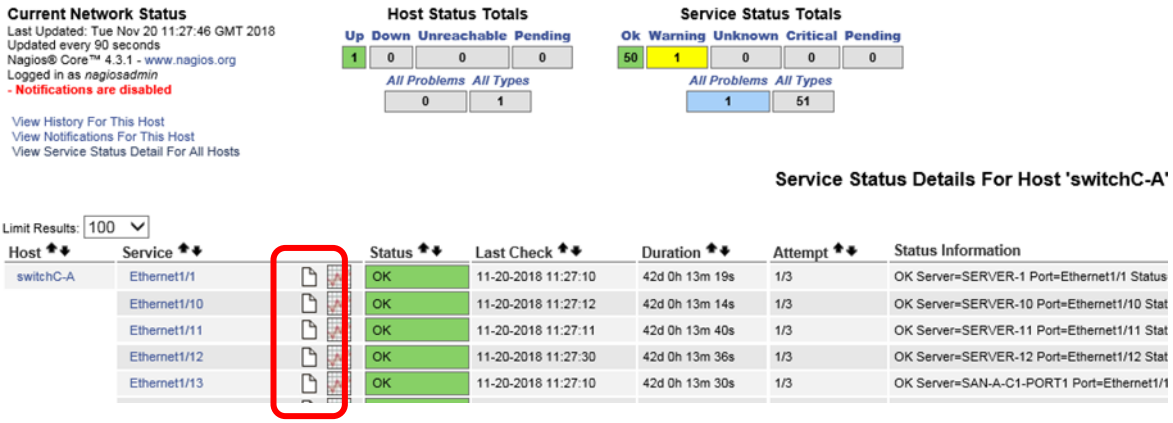


Figure 1 - Nagios screen with the link to WIKI entry circled

1.2 Alerts

Nagios is not an alarm management application. It is a status monitoring tool that raises alerts to indicate where a status has exceeded a defined threshold. Alerts are broken down into a number of sections:

Hardware

- Maintenance Switches.
- ARAMIS Client Machines.
- Core Servers.
- Maintenance Servers.
- Core Switches.
- Storage Area Network.
- Firewalls.
- Other switches.

Software

- Oracle Real Application Clusters (RAC) Storage.
- Oracle RAC Processing Nodes.
- ARAMIS Client Software.
- Application Virtual Machines.
- ESX Core.

A number of services and application level components are monitored for each of the above groups. Alerts fall into one of the categories detailed in Table 1:

State	Colour	Description
OK | UP	Green	All services are ok, and the item is functioning correctly.
WARNING	Yellow	The item being monitored is running but has breached a pre-determined tolerance.
FLAPPING	Blue	The item being monitored has changed status a number of times in a short period of time.
UNKNOWN	Orange	It was not possible to determine the state of the item being monitored. This usually indicates a failed state, or an item that is about to enter a failed state.
DOWN	Red	Unable to get a response from the remote item.
CRITICAL	Red	Unable to get a response from the remote item for a prolonged period.
UNREACHABLE	Grey	The monitoring solution is unable to reach the endpoint. This is usually in combination with other errors relating to networking or other hardware failure.
PENDING	Grey	The item is due for checking and is currently waiting in a queue for analysis. This is an unusual state and usually only occurs when a number of other faults are present on the system which increases the workload on the monitoring solution.

Table 1 - Categories

1.3 Alert Thresholds

The monitoring solution utilises generic alarm thresholds across all the hardware being monitored, detailed in Table 2.

Item	Warning Threshold	Critical Threshold
Disk Free	80% Utilised	90% Utilised
Memory Free	80% Utilised	90% Utilised
CPU Utilisation	80% Utilised	90% Utilised
SWAP Utilisation	>0% Utilised	25% Utilised

Table 2 - Thresholds

Remaining alerts have been set to manufacturers default settings.

1.4 Monitoring System Menu

The Nagios Monitoring System provides a comprehensive status monitoring tool. Figure 2 shows the Nagios menu which can be found at the right-hand side of all Nagios pages.

The two circled view options provide overviews for the Network Rail maintenance tasks.

These views are:

- Host Groups.
- Host Groups Summary.

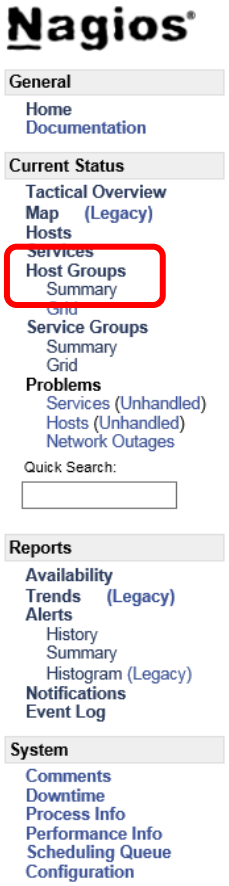


Figure 2 – Nagios Menu

1.5 Host Groups Summary Screen

The Host Groups Summary screen provides a clear, concise dashboard overview of the status of system components. This view is useful for a snapshot overview and is ideal to be left permanently displayed for a quick reference.

Figure 3 shows the host groups summary screen with the locations of the system hardware components identified.

A host group is a group of similar system components. For example, there are two Nexus switches deployed as core switches.

Figure 3 - Host Groups Summary Screen

The host status summary details the total number of components of a particular type that are up and also the number that are down.

The service status summary column provides an overview of the status of monitored parameters across an entire host group and an indication of the number and severity of alerts.

This overview screen can be used to identify the emergence of issues and guide the maintainer where to look next to obtain more detailed status information. As with all screens, most items are hyperlinks to navigate to a more detailed view.

Clicking on the host group name, e.g. NEXUS Switches, provides a status view for each individual component in a particular host group.

Details of these views are in the next section of this document.

Clicking on the coloured boxes provides a list of all alerts of the chosen severity within the host group.

Figure 4 - Top of Page Summary

Figure 4 shows the high-level system summary screen that is found at the top of every page.

This also provides a quick reference snapshot to determine if there are any issues with the system the maintainer needs to address.

1.6 Host Groups Screen

The Host Groups screen expands on the Host Groups Summary by displaying the high-level status of each individual component rather than an aggregated view per component type. The groupings tie in with the headings on the summary screen.

It should be noted that a piece of equipment can be repeated in multiple groupings.

For example, a client PC appears in both the client PC grouping and the Dell Agent Free servers grouping.

Figures 5 and 6 show the Host Groups screens. The primary hardware LRUs are identified by the red pointers.

Figure 5 – Host Groups Screen 1

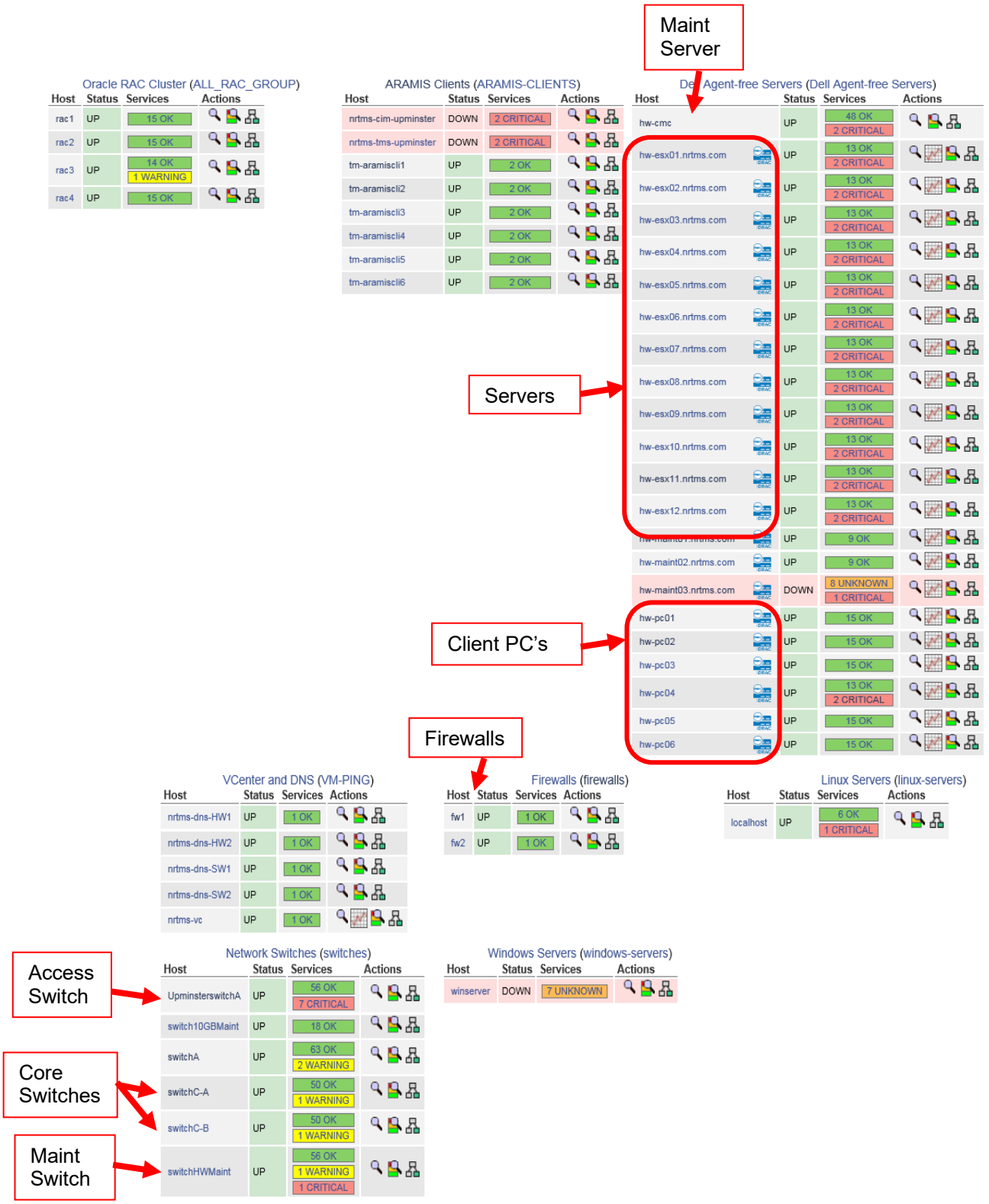


Figure 6 – Host Groups Screen 2

1.7 Fault Identification

The overview screens described above allow the maintainer to have an understanding of system status.

More detailed information can be found by navigating, using the hyper link component name, to the more detailed status screen for a particular component.

The remainder of this section describes the corrective maintenance procedures that the Network Rail Maintainer can undertake for each component.

Each section includes an overview of how the monitoring system and hardware status indications can be used to identify faults.

For all components with faults that are outside of the Network Rail maintainers scope of responsibility a call should be logged with the Thales Service Centre providing a full description of the incident that requires further investigation.

1.8 Wider Traffic Management Systems

The Nagios Monitoring System has been implemented to cover the ARAMIS software components and infrastructure.

Although Nagios does not monitor the wider systems that form the integrated Traffic Management System, it can provide some useful information that aids the maintainer in understanding the location of faults in these wider systems.

<u>Some issues with NRT equipment and services result in alerts on the Nagios system:</u>

- The failure of the NRT firewall produces a loss of signal alert on the associated ARAMIS firewall port. Alerts are also raised as a result of the loss of the NTP reference.
- Failures in message transfers to and from LINX as a result of the loss of NRT services could produce alerts from the ARAMIS TIL VMs.

<u>Some issues with LINX result in alerts on the Nagios system:</u>

- The failure of a LINX ROC Gateway could result in alerts from the ARAMIS TIL VMs.
- The failure of a LINX ROC FTP server could result in alerts from the ARAMIS TIL VMs.
- The failure of a message flow from LINX could result in alerts from the ARAMIS TIL VMs. These failures could be for missing expected messages or messages that have failed validation by ARAMIS.

Figure 7 shows the location of the ARAMIS TIL VMs on the Nagios host groups screen.

This is where alerts are shown that might relate to failures of other aspects of the integrated Traffic Management System.

Clicking on the VM name shows more detail for that particular VM.

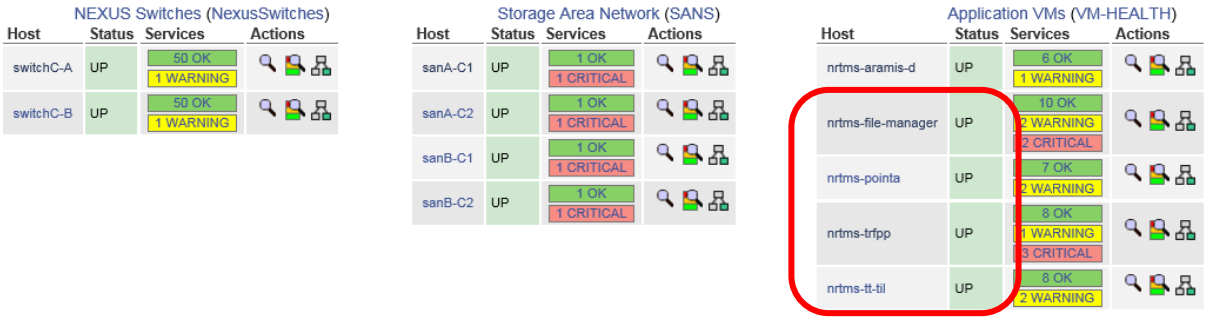


Figure 7 – The Location of ARAMIS TIL VMs on Host Groups Screen

2. Client PC

2.1 Monitoring System

An overview of the status of the client PCs can be viewed on the Host Groups screen on the monitoring system.

Figure 8 displays as section Host Groups Screen which contains the location of the Client PCs where the status of each is summarised.

Where issues are indicated, the hyperlink for the individual Client PC name can be clicked to view more details for that particular device.

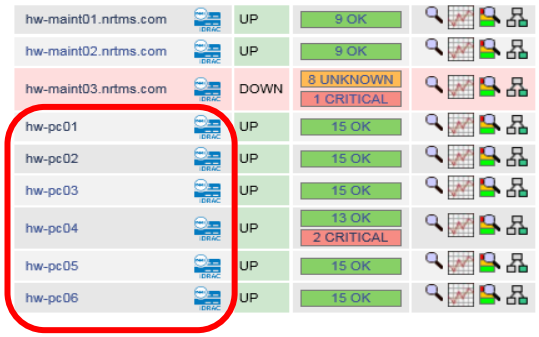


Figure 8 – The bottom right side of Host Groups Screen with the Client PC's indicated

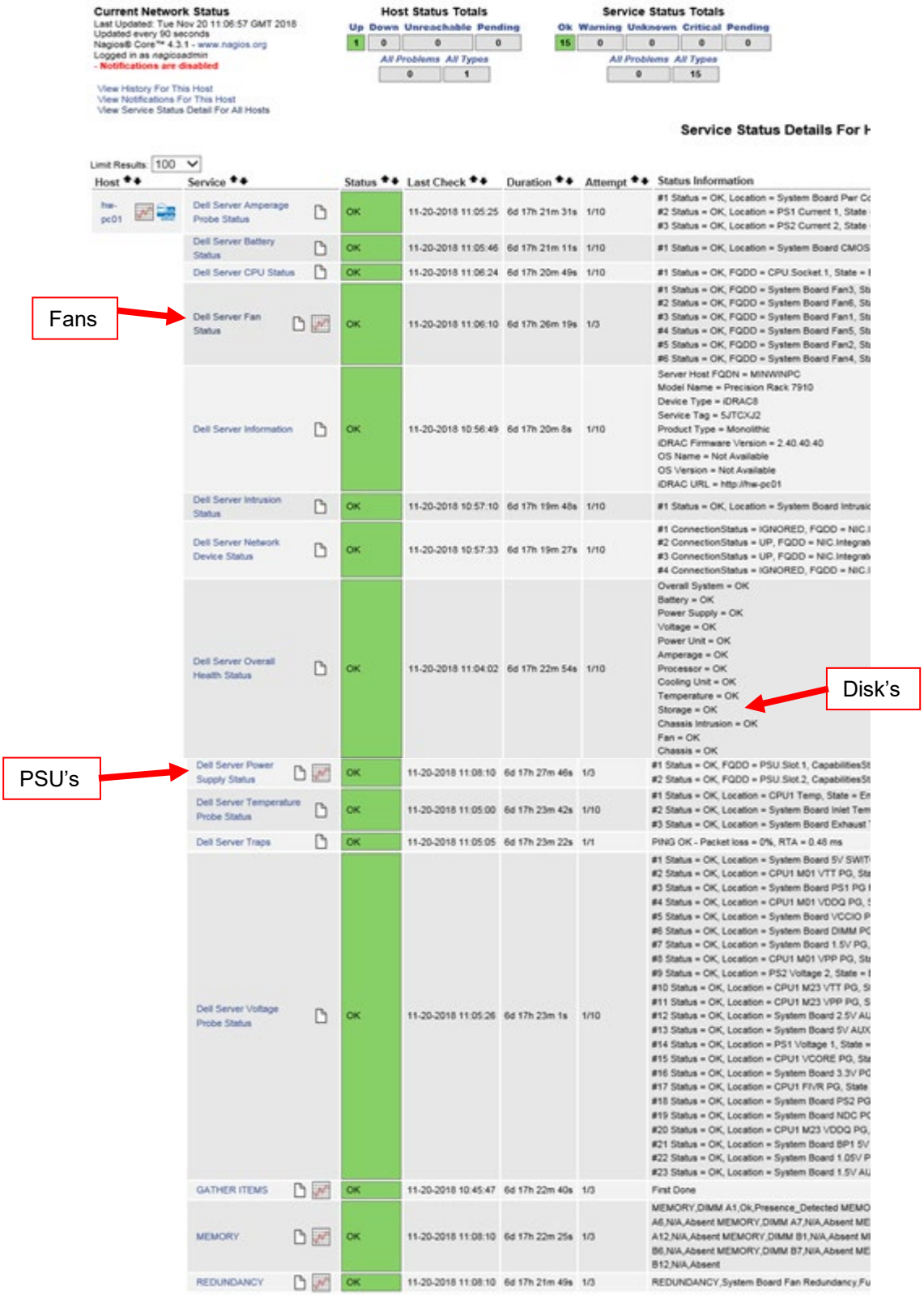


Figure 9 – A detailed view from the monitoring system for an individual Client PC.

The three secondary LRU types for which the Network Rail maintainer has responsibility for corrective maintenance are highlighted in this figure.

Any issues with the fans, disks (storage) and power supplies can be corrected by the Network Rail maintainer by following the maintenance instructions further in this section.

All other Client PC issues should be raised with the Thales Service Centre providing a full description of the incident that requires further investigation.

3. Client PC - PSU

3.1 Hardware Indications

Indication	Meaning
Steady Green	PSU is operational.
Flashing Green	The firmware on the power supply unit is being updated
Flashs Green then turns Off	The PSU is mismatch with the other one (dual PSUs) and should be replaced.
Flashing Amber	There is a problem with the Power Supply Unit.
LED Blank	Indicates power is not connected.

Table 3 – Client PC – PSU Indications

3.2 Physical Faulting Procedure

a) Check that no loose connections exist, for example, loose power cables

b) Check that the power supply handle/LED indications to identify faulty PSU. If both PSU 1 & 2 are showing failure indications, then DO NOT PROCEED FURTHER and refer fault to Thales.

c) Verify that both the power supply units are of the same type and wattage

d) Check both power supply units have Extended Power Performance (EPP) label on the back

e) Disconnect the power cable from the back of the faulty PSU (access from the back of the cubicle) for a few seconds, and then reconnect again

f) Gently pull out the faulty PSU in part (so as to disconnect), and then reseat it back in again.

NOTE: *After re-seating the power supply unit, allow several seconds for the system to recognize the power supply unit and determine if it is working properly.*

g) Check the LED status indications on the hardware and also the status presented on the monitoring system to determine if the fault has been corrected.

h) The component should be replaced using the SMTH.

4. Client PC Fan

4.1 Hardware Indications

Indication	Meaning
Fan not turning	Fan Failed

Table 4 - Client PC Fan Indications

4.2 Physical Faulting Procedure

No specific LED indications present on the Client PC; a fault with a specific fan can be identified through item checking of the Client PC 'LCD Display', which display an amber backlight to indicate an error condition and give details of the faulty fan. The component should be replaced using the SMTH.

5. Client PC Hard Drive

5.1 Hardware Indications

Figure 10 – LED locations on the Hard Drive

LED	Status	Colour	Meaning
1	On	Green	Hard-drive activity
2	Off	N/A	Ready for insertion or removal of drive
2	On	Blue	hard drive identifying drive preparing for removal
2	Blinks	Green – Amber - Off	Predictive drive failure
2	Blinks	Amber 4 times per second	Drive failed
2	Blinks	Green slowly	Drive rebuilding
2	Blinks	Green slowly for 3 seconds then Amber for 3 seconds then off for 3 seconds	Re-build of the hard drive is aborted

Table 5 - Client PC Hard Drive Indications

5.2 Physical Faulting Procedure

a) A failed Client PC Hard Disk should be confirmed by observing the status LEDs. If both drives are showing failure indications, then DO NOT PROCEED and refer fault to Thales.

b) Eject and gently pull out in part the faulty drive (to disconnect), and then reseat it back in again. NOTE: After re-seating the disk, allow several seconds for the system to recognize the hard drive and determine if it is working properly

c) The component should be replaced using the SMTH.

6. Firewall

6.1 Monitoring System

An overview of the status of the Firewalls can be viewed on the Host Groups screen on the monitoring system. Figure 11 identifies the location of the Firewalls on the Host Groups screen where the status of each is summarised.

Where issues are indicated, the hyperlink for the individual component name can be clicked to view more details for that particular device.

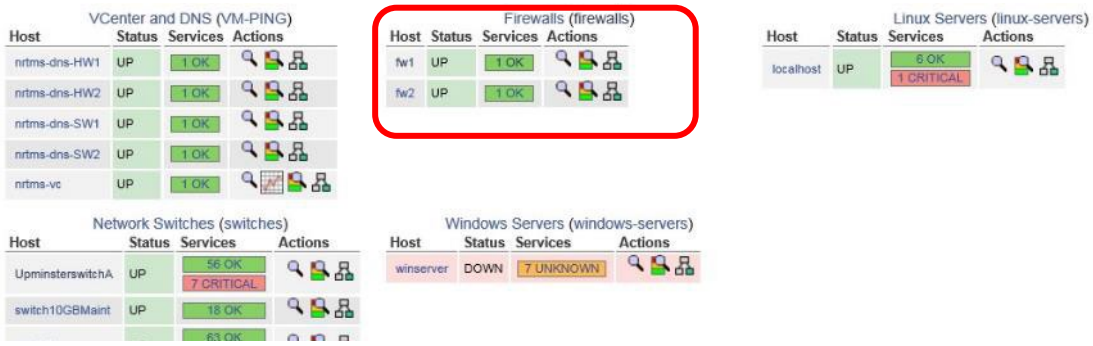


Figure 11 - Firewalls on the Host Groups screen

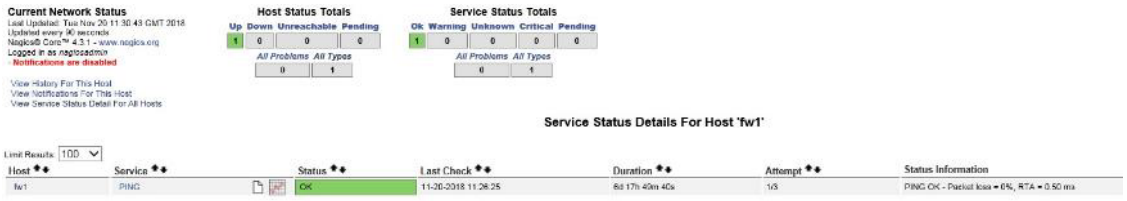


Figure 12 – A detailed view from the monitoring system for an individual Firewall

Any issues with the combined fan and power supply units and disks can be corrected by the Network Rail maintainer.

All other Firewall issues should be raised with the Thales Service Centre providing a full description of the incident that requires further investigation.

6.2 Hardware Indications

The firewalls have a group of status lights that are repeated on the front and back of the chassis.

These show green indications for healthy and red indications for unhealthy status of the firewall subsystems.

There are LEDs for the two PSUs and the two disk drives.

The hot swappable power supplies also contain status indications utilising the same green and red scheme.

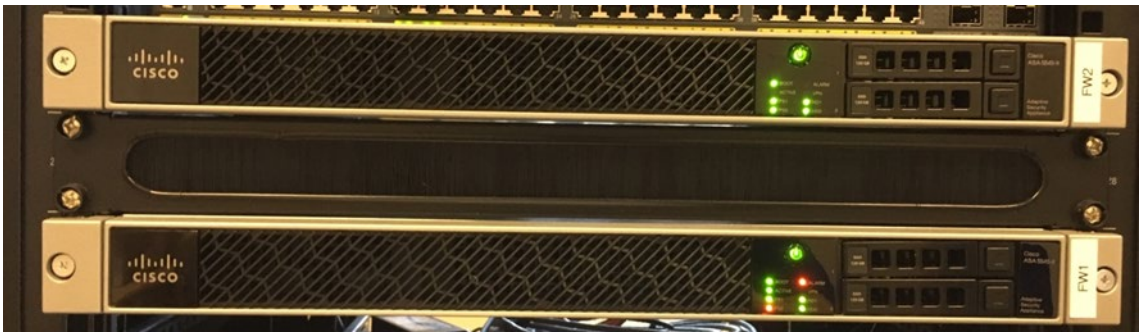


Figure 13 - Status Lights on Front of Firewall

6.3 Monitoring System

An overview of the status of the Firewalls can be viewed on the Host Groups screen on the monitoring system.

Figure 14 identifies the location of the Firewalls on the Host Groups screen where the status of each is summarised.

Where issues are indicated, the hyperlink for the individual component name can be clicked to view more details for that particular device.

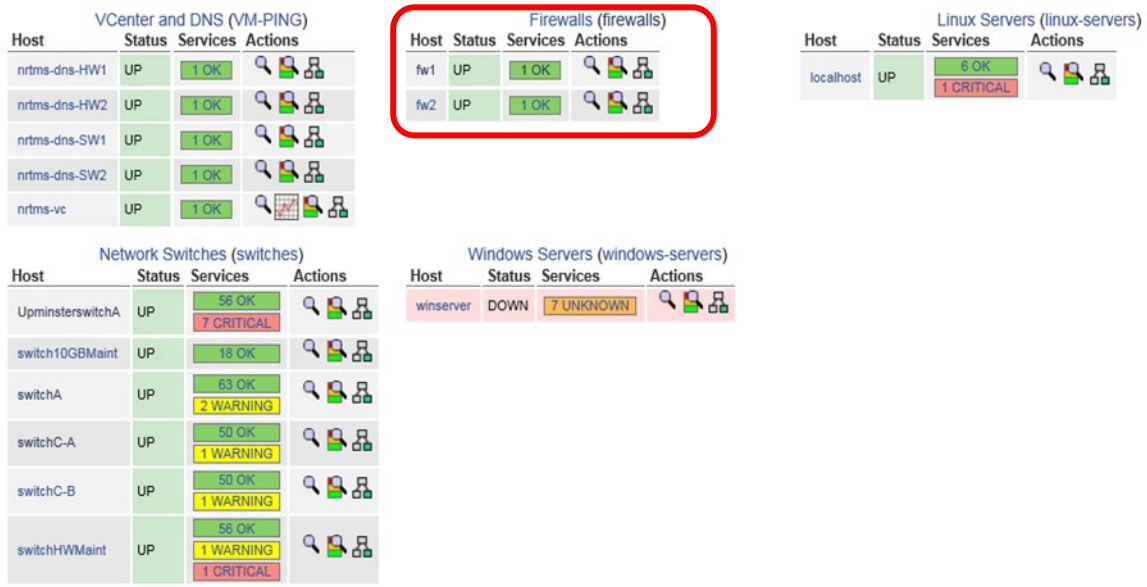


Figure 14 – Firewalls ringed in red on the Host Groups Screen

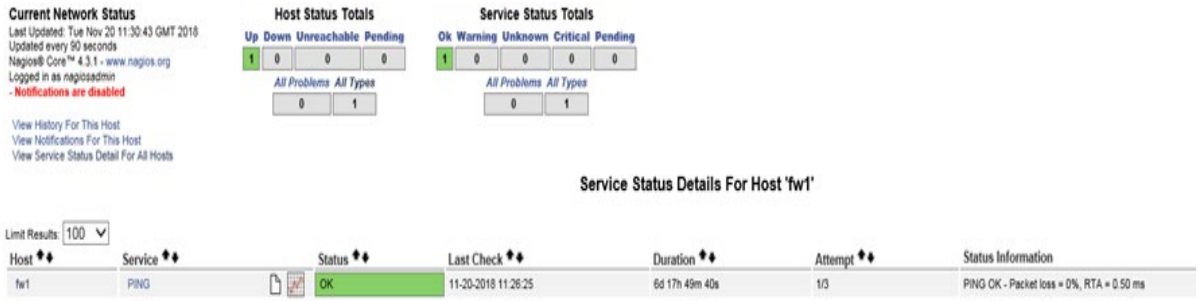


Figure 15 – A Detailed View from the Monitoring System for an Individual Firewall.

Any issues with the combined fan and power supply units and disks can be corrected by the Network Rail maintainer.

All other **Firewall** issues should be raised with the Thales Service Centre providing a full description of the incident that requires further investigation.

7. Core Switch

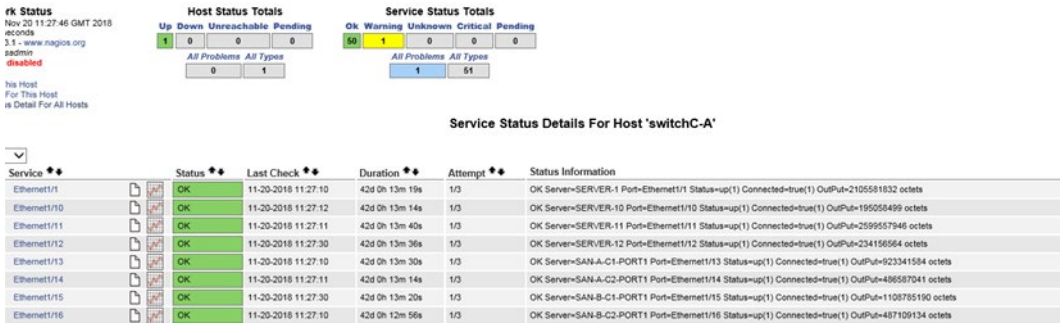
7.1 Monitoring System

An overview of the status of the Core Switches can be viewed on the Host Groups screen on the monitoring system.

Figure 6 identifies the location of the Core Switches on the Host Groups screen where the status of each is summarised.

Where issues are indicated, the hyperlink for the individual component name can be clicked to view more details for that particular device.

Figure 16 – Core Switches ringed in red on the Host Groups Screen



A number of lines have been removed from this screenshot for illustration purposes.

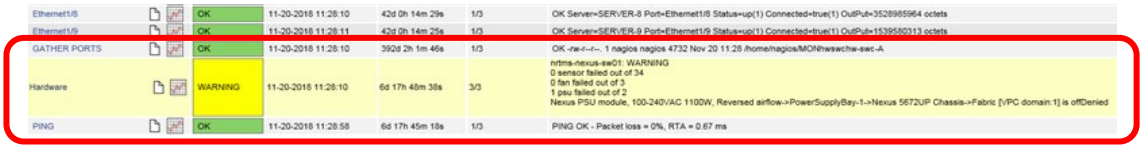


Figure 17 – A detailed view from the monitoring system for an individual Core Switch showing the status of the PSU and fan components.

Any issues with the power supply units and fans can be corrected by the Network Rail maintainer.

All other **Core Switch** issues should be raised with the Thales Service Centre providing a full description of the incident that requires further investigation.

8. ARAMIS Server

8.1 Monitoring System

An overview of the status of the Application Servers can be viewed on the Host Groups screen on the monitoring system.

Figure 18 identifies the location of the Severs on the Host Groups screen where the status of each is summarised. Where issues are indicated, the hyperlink for the individual component name can be clicked to view more details for that particular device.

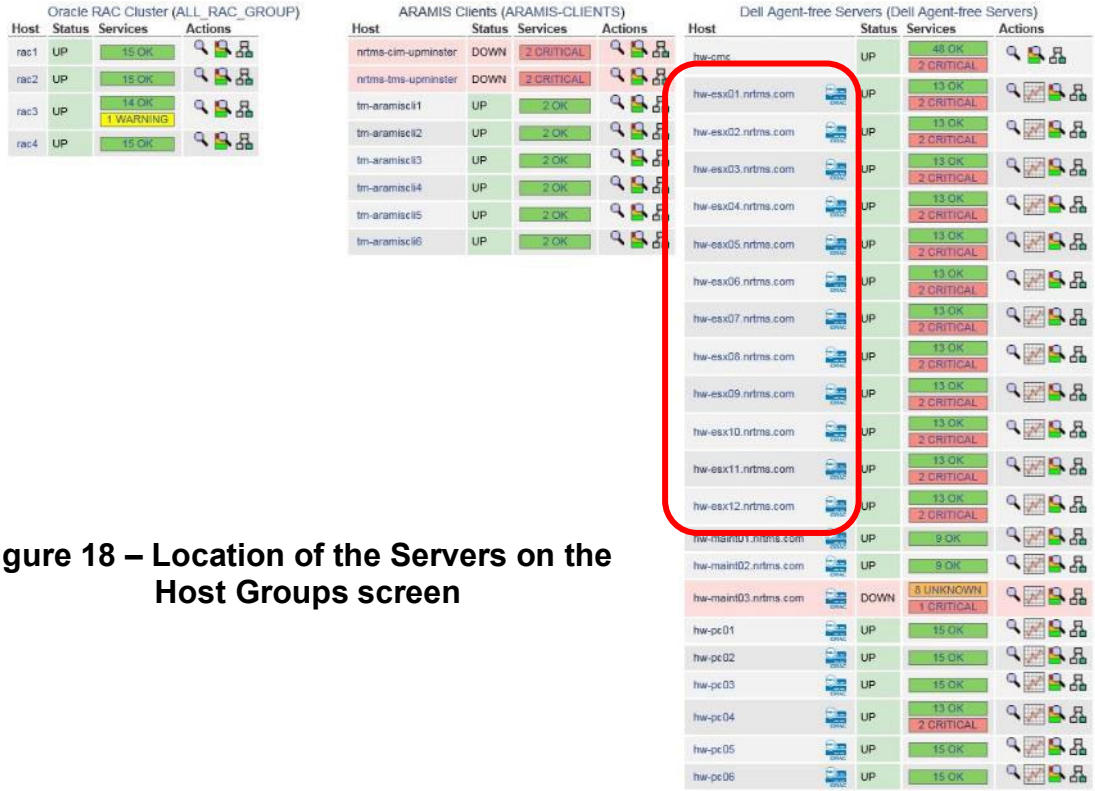


Figure 18 – Location of the Servers on the Host Groups screen

Figure 19 shows a detailed view from the monitoring system for an individual Server.

The locations of the status information for the components under the responsibility of the Network Rail Maintainer (PSUs, fans, disks) are indicated.

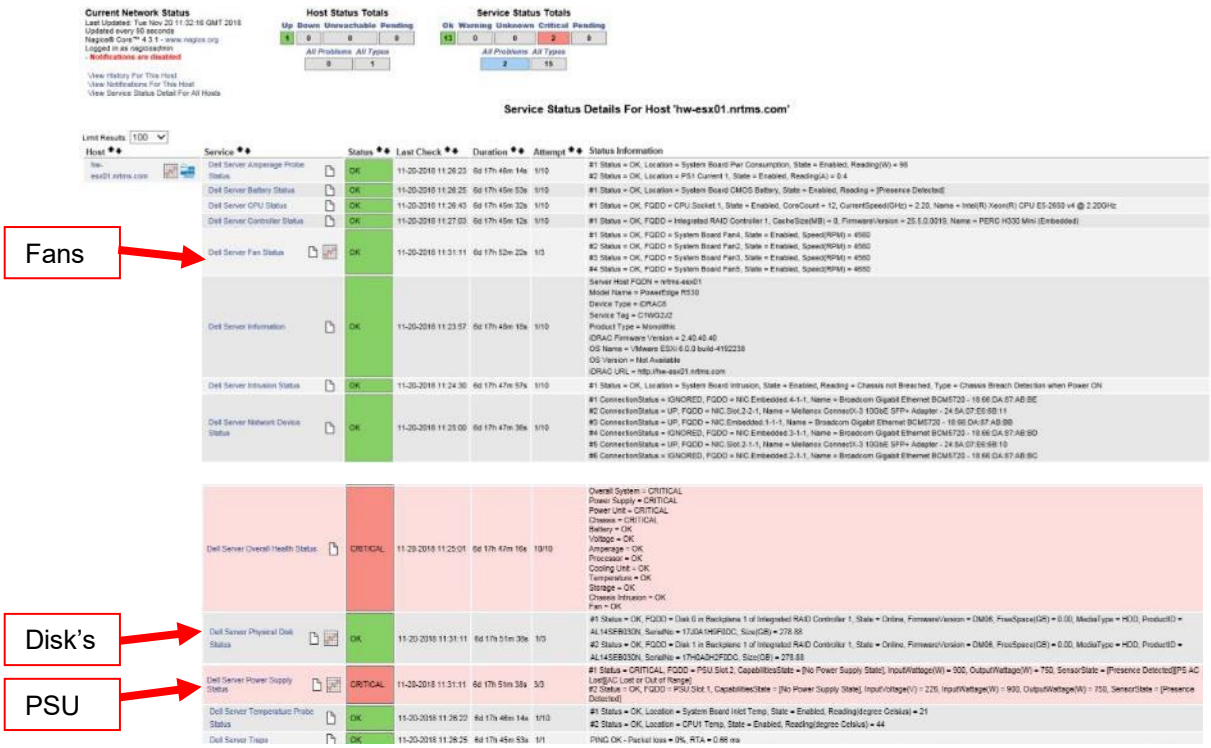


Figure 19 – Server Monitoring

Any issues with the fans, power supply units and disks can be corrected by the Network Rail maintainer.

All other Server issues should be raised with the Thales Service Centre providing a full description of the incident that requires further investigation.

8.2 Hardware Indications

The physical servers also present a limited number of status LEDs that give an indication of system health.

A = Steady GREEN indicates a valid power source is connected to the Power Supply Unit and that the Power Supply Unit is operational

B = Flashing GREEN indicates the firmware on the power supply unit is being updated

C = Flashing Green & Turns Off indicates this power supply unit is mismatch with the other one (dual PSUs) in terms of efficiency, feature, health and voltage), hence should be replaced

D = Flashing AMBER indicates a problem with the Power Supply Unit

E = Indicates power is not connected.

Figure 20 - Server – PSU Indications

LED	Status	Colour	Meaning
1	On	Green	Hard-drive activity
2	Off	N/A	Ready for insertion or removal of drive
2	On	Blue	hard drive identifying drive preparing for removal
2	Blinks	Green – Amber - Off	Predictive drive failure
2	Blinks	Amber 4 times per second	Drive failed
2	Blinks	Green slowly	Drive rebuilding
2	Blinks	Green slowly for 3 seconds then Amber for 3 seconds then off for 3 seconds	Re-build of the hard drive is aborted

Table 6 - Server Hard Drive (RAID) Indications

9. Server - PSU

9.1 Physical Faulting Procedure

The following faulting procedure should be followed when attending the Server prior to undertaking any component replacement.

a) Check that no loose connections exist, for example, loose power cables.

b) Check that the power supply handle/LED indications to identify faulty PSU. If both PSU 1 & 2 are showing failure indications, then DO NOT PROCEED FURTHER and refer fault to Thales.

c) Verify that both the power supply units are of the same type and wattage.

d) Verify both power supply units have Extended Power Performance (EPP) label on the back.

e) Disconnect the power cable from the back of the faulty PSU (access from the back of the cubicle) for a few seconds, and then reconnect again.

f) Gently pull out the faulty PSU gently in part (so as to disconnect), and then reseat it back in again.

NOTE: After re-seating the power supply unit, allow several seconds for the system to recognize the power supply unit and determine if it is working properly.

g) Check the LED status indications on the hardware and also the status presented on the monitoring system to determine if the fault has been corrected.

h) If the problem persists undertake the component replacement using SMTH.

10. Server – Fan

10.1 Physical Faulting Procedure

Replace on Failure.

11. Server - Hard Disk

11.1 Physical Faulting Procedure.

Replace on Failure.

12. Access Switch

12.1 Monitoring System

An overview of the status of the Access Switches can be viewed on the Host Groups screen on the monitoring system.

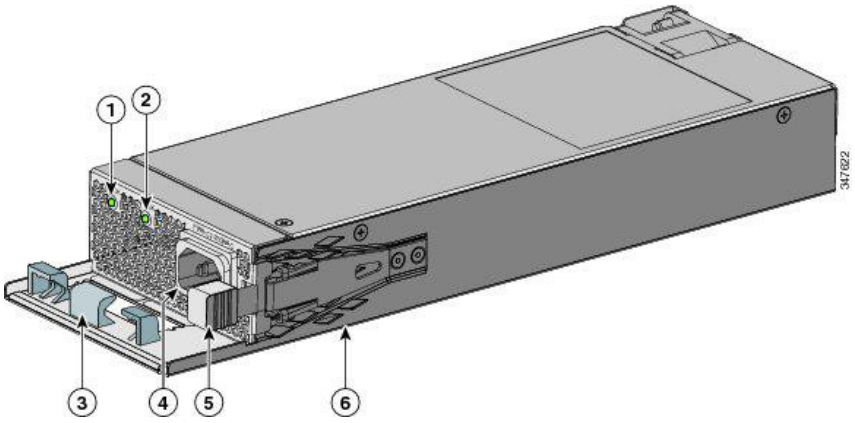
Figure 21 - Location of the Access Switches on the Host Groups screen where the status is summarised

It should be noted that although there are two physical switches they are configured as a resilient pair and as such appear as a single entity on the monitoring system.

Where issues are indicated, the hyperlink name can be clicked to view more details for the switches.

13. Access Switch – PSU

13.1 Hardware Indications



No	Description	No	Description
1	AC OK LED	4	AC power cord connector
2	PS OK LED	5	Release latch
3	AC power cord retainer	6	Power supply

LED Illumination Meanings			
AC OK LED	Description	PS OK LED	Description
Extinguished (off)	No AC input power.	Off	Output is disabled, or input is outside operating range.
Green	AC input power is present.	Green	Power output to switch.
		Red	Output has failed.

Figure 22 - Access Switch – PSU (including indications)

13.2 Monitoring System

The location of the status of the PSU that the Network Rail maintainer has the responsibility to undertake corrective maintenance for, is highlighted.

Four PSUs are displayed, two for Switch 1 and two for Switch 2.

Any issues with the power supply units can be corrected by the Network Rail maintainer.

All other Access Switch issues should be raised with the Thales Service Centre providing a full description of the incident that requires further investigation.

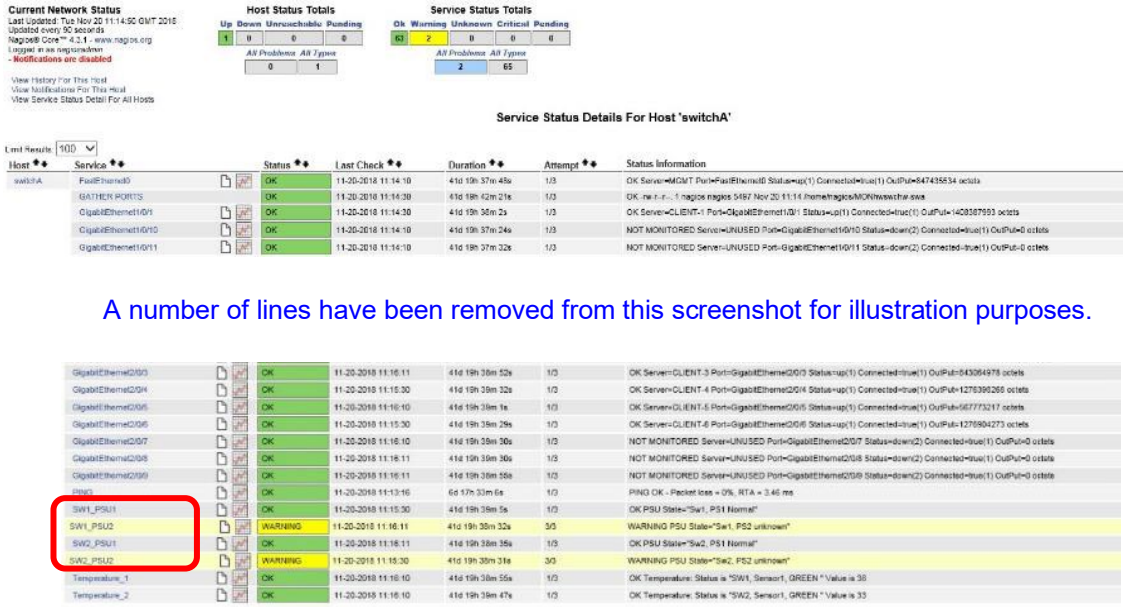


Figure 23 – A detailed view from the monitoring system for the Access Switches.

14. Maintenance Switch

14.1 Monitoring System

An overview of the status of the Maintenance Switch can be viewed on the Host Groups screen on the monitoring system.

Figure 24 identifies the location of the Maintenance Switch on the Host Groups screen where the status is summarised.

Where issues are indicated, the hyperlink name can be clicked to view more details for the switch.

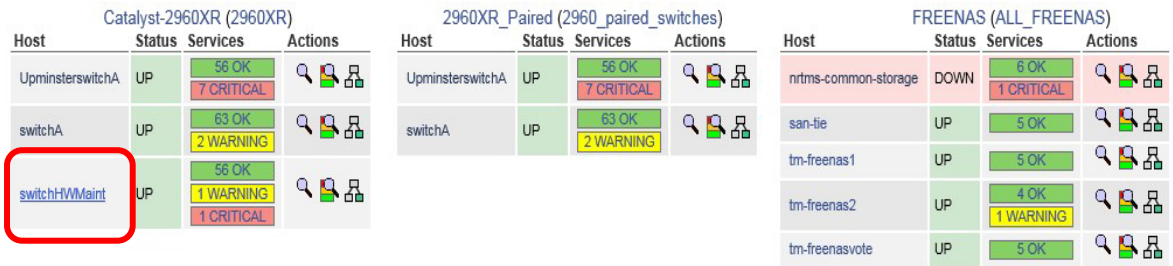


Figure 24 – Location of the Maintenance Switch on the Host Groups screen

15. Maintenance Switch - PSU

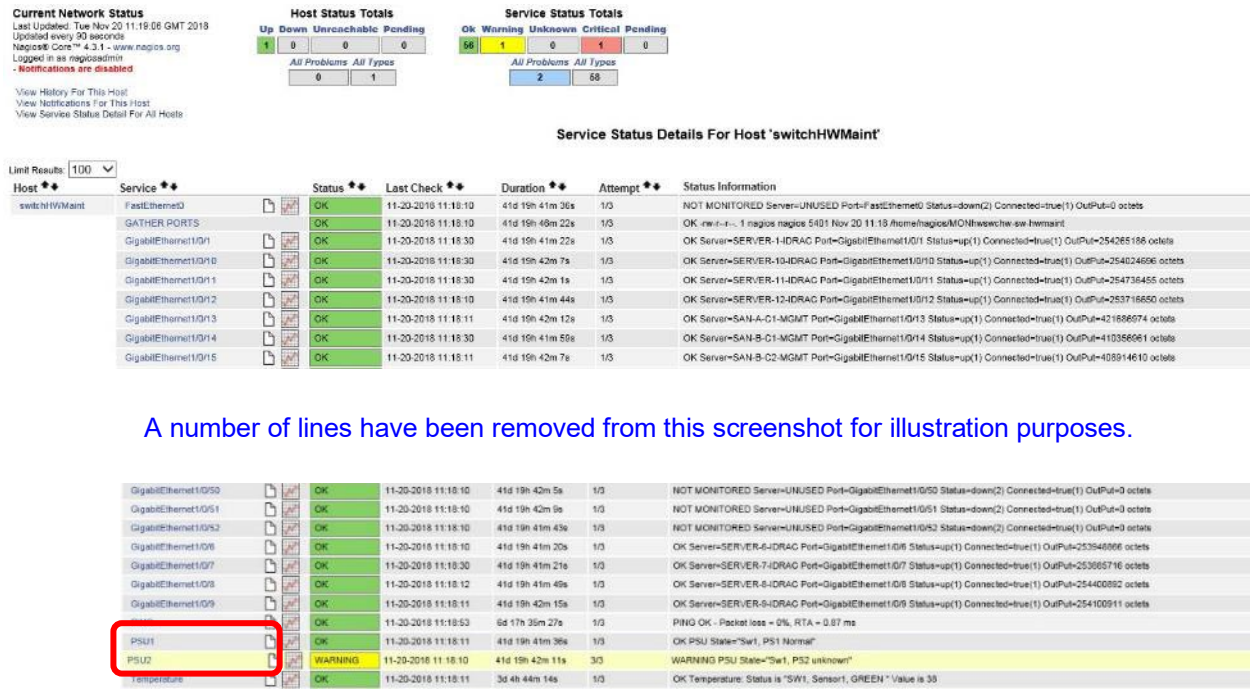
15.1 Monitoring System

Figure 25 shows the position of the PSU's on a detailed view from the monitoring system for the Maintenance Switch.

The location of the status of the PSU that the Network Rail maintainer has the responsibility to undertake corrective maintenance for is highlighted.

Any issues with the power supply units can be corrected by the Network Rail maintainer.

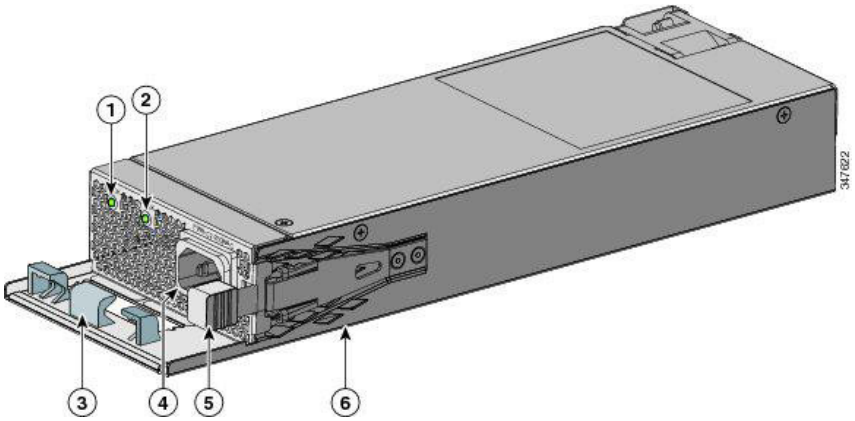
All other Access Switch issues should be raised with the Thales Service desk.



A number of lines have been removed from this screenshot for illustration purposes.

Figure 25 – Maintenance Switch PSU location

15.2 Hardware Indications



No	Description	No	Description
1	AC OK LED	4	AC power cord connector
2	PS OK LED	5	Release latch
3	AC power cord retainer	6	Power supply

LED Illumination Meanings			
AC OK LED	Description	PS OK LED	Description
Extinguished (off)	No AC input power.	Off	Output is disabled, or input is outside operating range.
Green	AC input power is present.	Green	Power output to switch.
		Red	Output has failed.

Figure 26 - Maintenance Switch – PSU (including indications)

16. Maintenance Server

16.1 Monitoring System

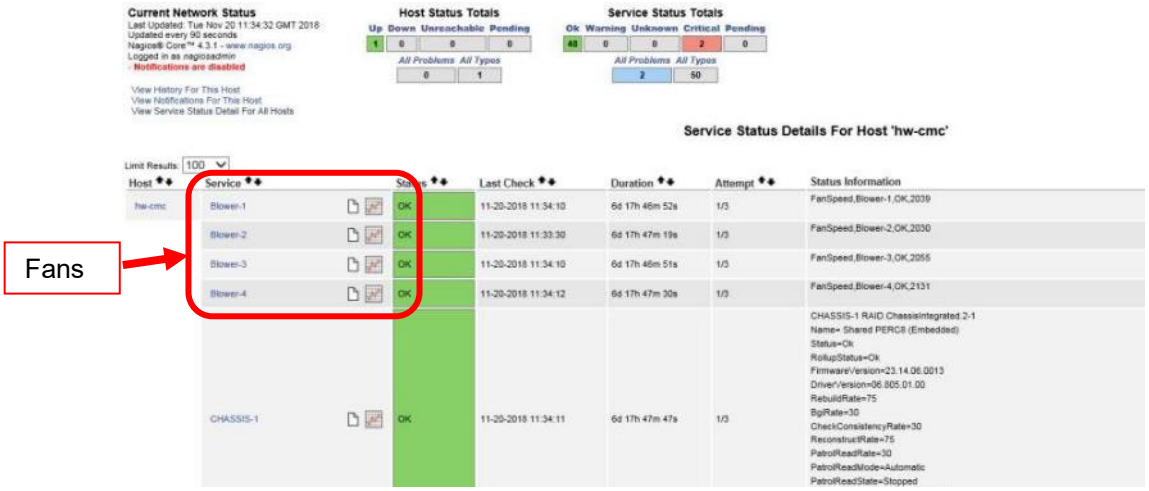
An overview of the status of the Maintenance Server can be viewed on the Host Groups screen on the monitoring system.

Figure 27 identifies the location of the Maintenance Server on the Host Groups screen.

Where issues are indicated, the hyperlink for the individual component name can be clicked to view more details for that particular device.

A number of lines have been removed from this screenshot for illustration purposes.

Figure 27 – Location of the Maintenance Server on the Host Groups screen.



A number of lines have been removed from this screenshot for illustration purposes.

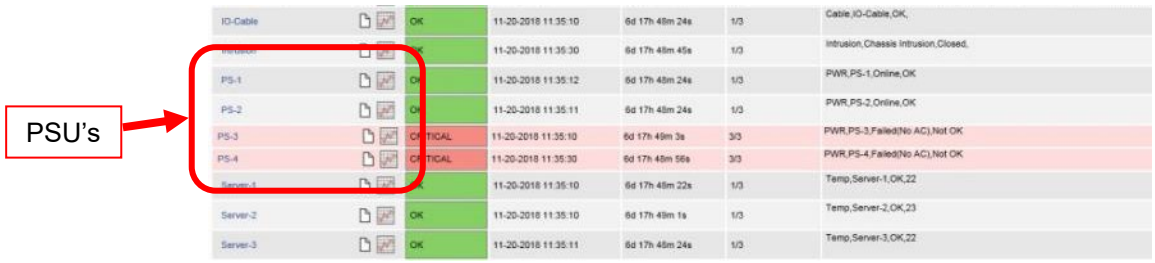


Figure 28 – The Locations of the Maintenance Server PSU's and Fans

The locations of the status information for the components under the responsibility of the Network Rail Maintainer (PSUs, fans) are highlighted.

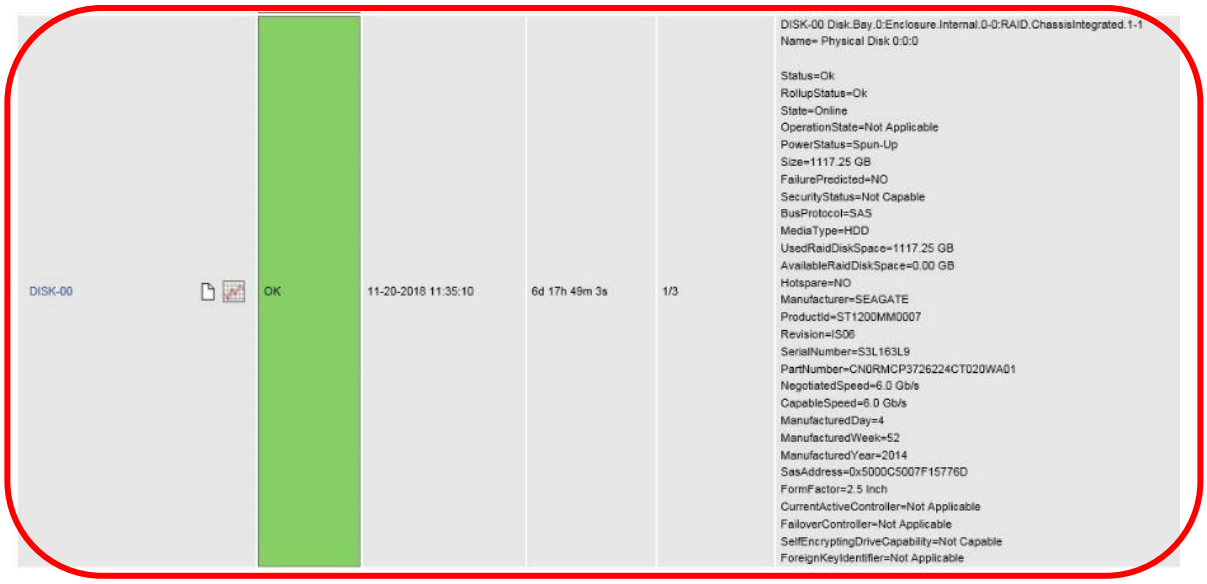


Figure 29 - Maintenance Server Monitoring - Disks

Figure 29 presents the monitoring system view for a single disk. The maintenance server contains 25 disks in total.

Any issues with the fans, power supply units and disks can be corrected by the Network Rail maintainer.

All other Maintenance Server issues should be raised with the Thales Service Centre providing a full description of the incident that requires further investigation.

17. SAN Controller (Shared Area Networks)

17.1 Monitoring System

An overview of the status of the SANs can be viewed on the Host Groups screen on the monitoring system.

Figure 30 identifies the location of the SANs on the Host Groups screen where the status of each is summarised.

Where issues are indicated, the hyperlink for the individual component name can be clicked to view more details for that particular device.

The host groups screen shows the SAN controllers. There are two SANs each with two controllers.

Figure 30 – The Location of the SAN's on the Host Groups Screen

Figure 31 - SAN Controller Monitoring

Figure 31 presents the detailed view from the monitoring system for a SAN controller. The status information fields contain the status and alerts for the components under the responsibility of the Network Rail Maintainer (PSUs, fans, disks).

Any issues with the controllers, power supply units and disks can be corrected by the Network Rail maintainer.

All other Server issues should be raised with the Thales Service Centre providing a full description of the incident that requires further investigation.

17.2 Hardware Indications

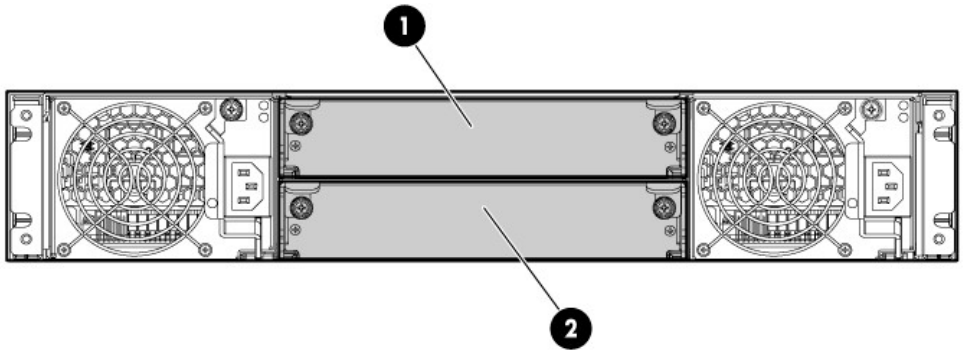


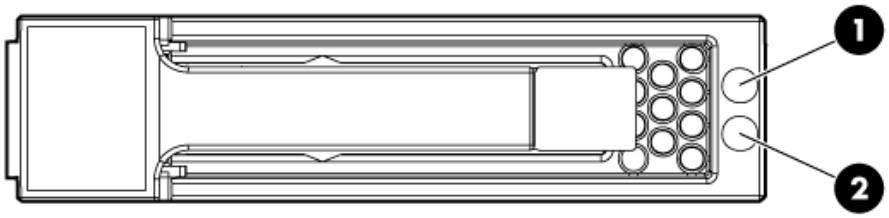
Figure 32 – SAN Controller Module Positioning

Module LED	Description
FRU OK	**Solid Green** = Module is operating normally
	Blinking = System is starting up
	Off = Module is not operating normally
Fault / Service Required	**Solid Amber** = Fault condition
	Blinking Amber = Hardware-controlled power-up or cache flush/restore error
	Off = No fault conditions

Table 7 – SAN Controller Module Indications

18. SAN Disk (Shared Area Networks)

18.1 Hardware Indications



LED Designation	LED Colour	LED Status	Definition
1 (UID /Fault)	Blue	Solid or Blinking	Drive was selected by a management application to locate the drive
	Amber	Solid or Blinking	Failed or failing
2 (Online/Activity)	Green	Solid or Blinking	Online and active
		Off	No diagnostic value

Figure 33 – SAN Disk Hardware Indications

19. Client Workstation

19.1 Monitoring System

The monitoring system does not cover client workstation equipment.

19.2 Hardware Indications

Workstation Monitor

Power Button Indications codes:

- BLUE indicates monitor is ON.
- AMBER indicates monitor is in STANDBY, and
- No INDICATION indicates monitor is OFF.

Workstation Keyboard

The keyboard does not have any LED indications, to identify whether the equipment is operating or at fault, keyboard press should be observed on the Monitor. When failed – no key press can be observed on the monitor.

Workstation Mouse

No LED indication on the mouse, when operating response to key press can be seen on the Monitor. When failed – no key press can be observed on the monitor.

Amulet KVM

DXZ4 zero clients are fitted with front panel LEDs and switches which light in various colours to communicate device status:

Power switch - all models

- Red Unit is in standby, with power applied.
- Amber flash Unit is starting up.

Power switch - DXZ4-M only

- Turquoise flash - SFP modules not recognized.
- Blue flash - SFP fibre modules; no network connection.
- Blue - SFP fibre modules; connected to network.
- Green flash - SFP copper modules; no network connection.
- Green - SFP copper modules; connected to network.
- Alternate green and blue flash - SFP copper module and SFP fibre module; no network connection.
- Alternate green and blue - SFP copper module and SFP fibre module; one module is connected to network. A longer green pulse indicates the SFP copper module is connected to the network. A longer blue pulse indicates the SFP fibre module is connected.

Link LED - all models

- Off - No PCoIP link is established.
- Green flash - PCoIP link is available but not in session.
- Green - PCoIP session is active.

20. Maintenance Terminal

20.1 Monitoring System

If the maintenance terminal has failed it is not possible to view the monitoring system. Faults are identified as the maintainer uses the maintenance terminal.

21. Rack KVM

21.1 Monitoring System

The KVMs are used for server hardware maintenance only and as such it is not monitored or used by the Network Rail Maintainer. Faults are identified by opening the KVM and confirming it is active.

22. Visual Fault Finding

The Nagios Application should be used to investigate all faults. If the Nagios system is not available the following visual checks can to be to ascertain the status of the components which make up the ARAMIS system.

22.1 Workstation

a) Check the monitor is displaying the “On” (blue) LED indication.

b) Verify server connection by checking the ARAMIS Toolbar (bottom right-hand corner) displaying green indication.

c) Check the keyboard is working by observing its operation.

d) Check the mouse is working, by observing its operation.

e) Check the ‘LINK LED’ is displaying steady green indication on the Zero Client – Amulet.

22.2 Equipment Room Cubicles

Client PC - Dell Precision 7910 Rackmount

a) Check the ‘LED Panel’ on each unit is displaying a blue backlight for normal working.

b) Check the occupied ‘Hard Drive Bays’ are displaying steady green indication.

c) Check the back of Client PC; ‘Power Supply Unit 1 & 2’ are displaying steady green LED indications.

d) Check the LED status light is illuminated.

Virtual Server Dell PowerEdge R530 Rackmount

a) Check the ‘LED Panel’ on each unit is displaying a blue backlight for normal working.

b) Check the occupied ‘Hard Drive Bays’ are displaying steady green indication.

c) Check the back of Client PC; ‘Power Supply Unit 1 & 2’ are displaying steady green LED indications.

d) Check the LED status light is illuminated.

Maintenance Server - PowerEdge M620 Blade*

a) Observe the 'Status Indicator' is displaying steady green indication.

b) Check each occupied 'Hard Drive Bay' is displaying steady green indication.

c) Check the LED status light is illuminated.

Server Storage SAN - HP MSA 2040

a) Check the 2040 SAN 'Heartbeat LED' lamp is illuminated.

b) Check the fault light LED is not illuminated on the SAN.

c) Check 'Disk Drive Online / Activity LED' on each hard drive is displaying steady green indication.

d) Check the 'Disk Drive Fault LED' on each hard drive is NOT alight.

e) At the rear of SAN Power Supply check:

f) The input source power voltage LED is illuminated.

g) The 'Voltage/Fan Fault /Service Required' LED not illuminated.

h) At the rear of HP MSA SAN controller check:

- The 'Voltage/Fan Fault /Service Required' LED not illuminated.

Network Core Switch - Cisco Nexus 5672UP

a) Check the 'Chassis Locator LED' is displaying steady blue indication.

b) Check the 'Power Status LED' is displaying steady green indication.

c) Check the rear side 'PSU OK LED' on both supplies is displaying steady green indication.

d) Check the back of the fan unit that 3 x 'Fan Blower LEDs' are displaying steady green indications.

Network Access Switch - Cisco Catalyst 2960XR-24TS-I

a) Check Stack LED is displaying a steady green indication.

b) Check the 'System LED' displaying steady green indication.

c) Check the 'STAT LED' is not illuminated.

d) Check the 'System LED' is displaying a green indication

e) Check the 'IPRS LED' is displaying steady green.

Network Management Switch - Cisco Catalyst 2960XR-48TS-I

a) Check the 'System LED' is displaying steady green indication.

b) Check the 'STAT LED' is not illuminated.

c) Check the power supply 'System LED' is displaying steady green indication.

d) Check the power supply 'IPRS LED' is displaying steady green.

Firewall - CISCO ASA 5545-X with fire power Services

a) Check the 'Power Button' is displaying power symbol in steady green.

b) Check the 'ALARM LED' is not displaying steady amber.

c) Check the PSU 'PS1 & PS0 LED' is displaying steady green.

d) Check the hard disk drive 'HD1 and HD0 LED' are displaying steady green or flashing green.

Server HMI - KVM Rackmount Console Unicorn 17

a) Check each KVM is displaying steady GREEN 'Power Indication'.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part10/FF25		
Faulting Guide: Vehicle Identification Loops (VIS)		
Issue No: 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

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 VIS OTU relay module transmits failure indications to the signal box/control centre, this allows for immediate identification of a failure of a part of the Vehicle Identification System. This in turn prompts the need for reactive maintenance and a visit to the affected location. The protocol for reactive maintenance in the event of VIS system failure is as follows:

For information on Loop Tuning see NR/SMS/PartB/025 (Vehicle Identification Loops (VIS) Loop Tuning Setup).

1. VIS Loop Antenna, Tuning Unit and Tail Cable

1.1 Visual confirmation that the VIS loop antenna and its fixings are free from ballast.

1.2 Visual confirmation that tail cables are correctly located, secured and free from damage.

1.3 Visual confirmation that tuning unit is correctly located, secured and free from damage.

1.4 Visual confirmation there is no physical damage to the VIS loop antenna, its mountings and fixings.

1.5 Visual confirmation that the VIS loop antenna is mounted centrally in the 4ft, rectify as necessary.

If rack output test probe readings in the OTU cubicle are outside of the normal levels detailed in Table 1, use the Orion test meter on the loop antenna to determine if the corresponding field level values are within the parameters specified in the table in the NR VIS maintenance handbook (OP/89296/NR VIS Trackside Sim HB/ Issue 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

2. LED Diagnostics

2.1 Check each module's LEDs in accordance with the Tables 2, 3, 4 and 5. If the LED status indicates a card fault, then the card shall be replaced with a spare, configured with identical switch/link arrangements.

LED Ident	Function	Operation
3.3V	3.3V voltage ok	Illuminates when 3.3V is present
LINK	Ethernet Link	Illuminates when Ethernet status/connection is OK
10	10MB operation	Illuminates for 10MB operation (not applicable)
100	100MB operation	Illuminates for 100MB operation
COL	Collision	Illuminates when a collision id detected
STAT	Ethernet Connection Status	Illuminates when the Ethernet connection is active.
KEY	Key Connected Status	Illuminates when the Memory Key is inserted
RXD	WIZNET receive LED	Illuminates when WIZNET data is received
TXD	WIZNET transmit LED	Illuminates when WIZNET data is transmitted
ST1	Card Status 1	Future Use
ST2	Card Status 2	Future Use
ST3	Card Status 3	Future Use
I/P4	SCADA Input 1	Used for RTC 1 Watchdog, on when OK
I/P3	SCADA Input 2	Used for RTC 2 Watchdog, on when OK
I/P2	SCADA Input 3	Used for RTC 3 Watchdog, on when OK
I/P1	SCADA Input 4	Used for RTC 4 Watchdog, on when OK

Table 2 - Microcontroller Module LED's

PCB Ident	Function	Operation
10V	10V Voltage OK	Illuminates when voltage is within acceptable band
DET	Data Detect LED	Illuminates on when modulation is turned on
CD	Carrier Detect LED	Illuminates on when transponder is turned on
I	Current Status	Illuminates on when current is in range
COM	Comms Status	Flash every 6 seconds to denote Comms status OK

Table 3 - Loop Module LED's

PCB Ident	Function	Operation
+V	Voltage Monitor	Illuminates when voltage is present
24V	24V Monitor	Illuminates when voltage is present
5V	5V Monitor	Illuminates when voltage is present

Table 4 - Power Supply LED's

PCB Ident	Function	Operation
4 WDG to RTC	Watchdog Output 3	Illuminates when OUT watchdog OK
3 WDG to RTC	Watchdog Output 2	Illuminates when OUT watchdog OK
2 WDG to RTC	Watchdog Output 1	Illuminates when OUT watchdog OK
1 LOOP FAULT	Output Relay 13	Illuminates when on Loop fault
12	Output Relay 12	Illuminates when relay is activated
11	Output Relay 11	Illuminates when relay is activated
10	Output Relay 10	Illuminates when relay is activated
9	Output Relay 9	Illuminates when relay is activated
8	Output Relay 8	Illuminates when relay is activated
7	Output Relay 7	Illuminates when relay is activated
6	Output Relay 6	Illuminates when relay is activated
5	Output Relay 5	Illuminates when relay is activated
4	Output Relay 4	Illuminates when relay is activated
3	Output Relay 3	Illuminates when relay is activated
2	Output Relay 2	Illuminates when relay is activated
1	Output Relay 1	Illuminates when relay is activated

Table 5 - Relay Module LED's

2.2 If the Micro module at the Tinsley OTU has to be changed, it is imperative that the Wiznet module settings on the new card are correctly set.

2.3 If a loop module requires replacement, the new module shall be re-phased, See Section 10.5.3 of the NR VIS maintenance handbook (OP/89296 for Tinsley OTU and OP/89322 for Mainline and Parkgate OTUs) for details on configuring the phasing utility.

It is imperative that the new module has the same address switch (SW1) setting as the one being replaced.

3. Full System Reset

3.1 The reset button on the loop module should be depressed for 10 seconds and released.

3.2 The reset button on the microcontroller module should be depressed for 10 seconds and released.

3.3 If the system does not reset correctly (confirmed by LED diagnostics) then the VIS equipment should be powered down and subsequently powered up again.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part10/FF26		
Faulting Guide: KVB Balise		
Issue No. 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	KVB Balise (Contrôle de Vitesse par Balises) Used in Ashford, Kent
Excludes:	All other types of Balise

1. KVB Fault Finding

Tools required:

a) KVB Tester.

b) KVB DCO Configuration Files.

c) Commissioning Record Card.

d) Wiring Diagrams.

e) A Calibrated Meter.

2. Ask the Signaller

a) What type of alarm did the driver report? (“Panne Sol” or “Panne Engin”).

b) Where and when did the incident occur?

c) What was the status of the signal?

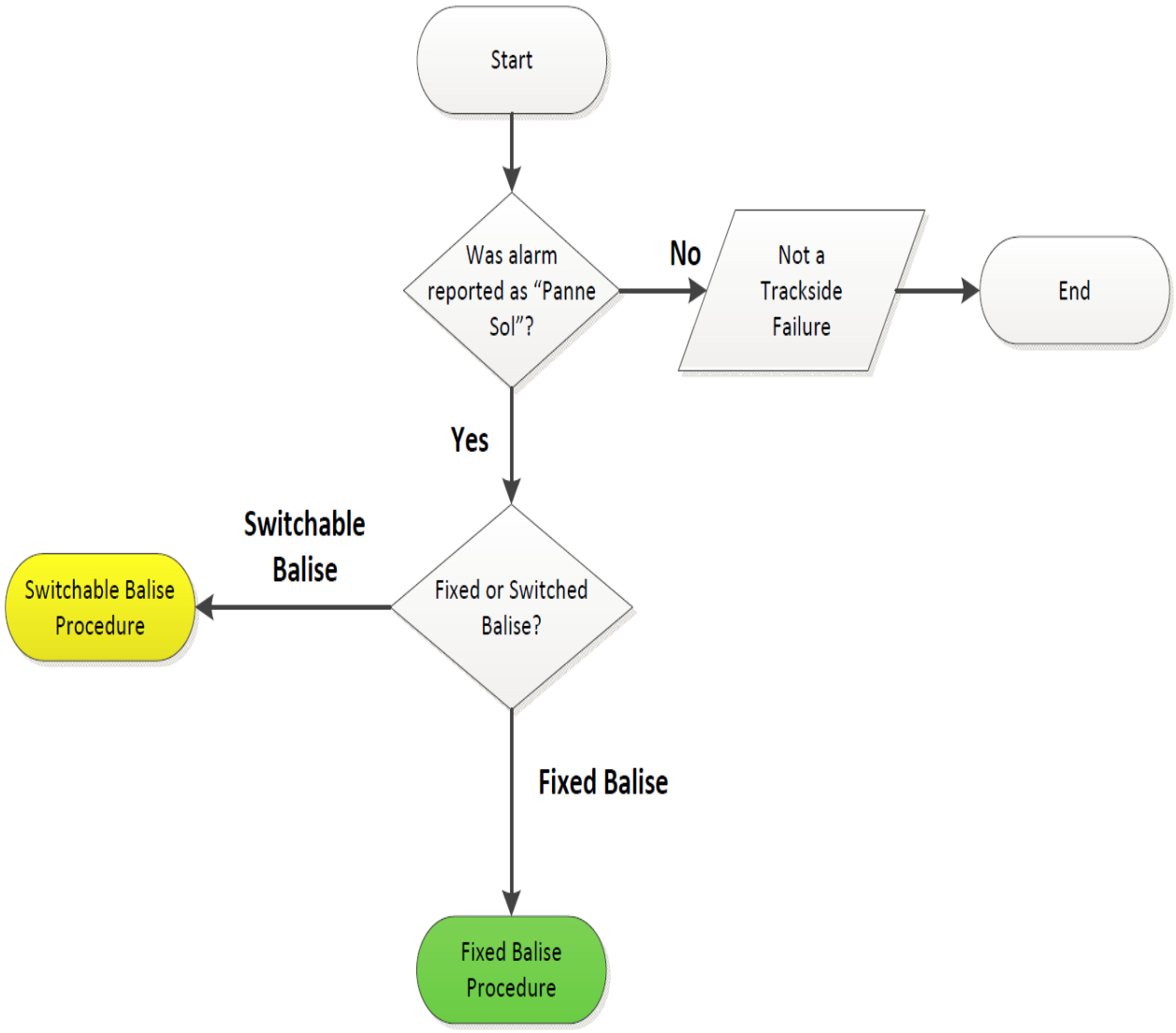
Once these facts have been noted move to the start of the flow chart

3. Faulting flowchart

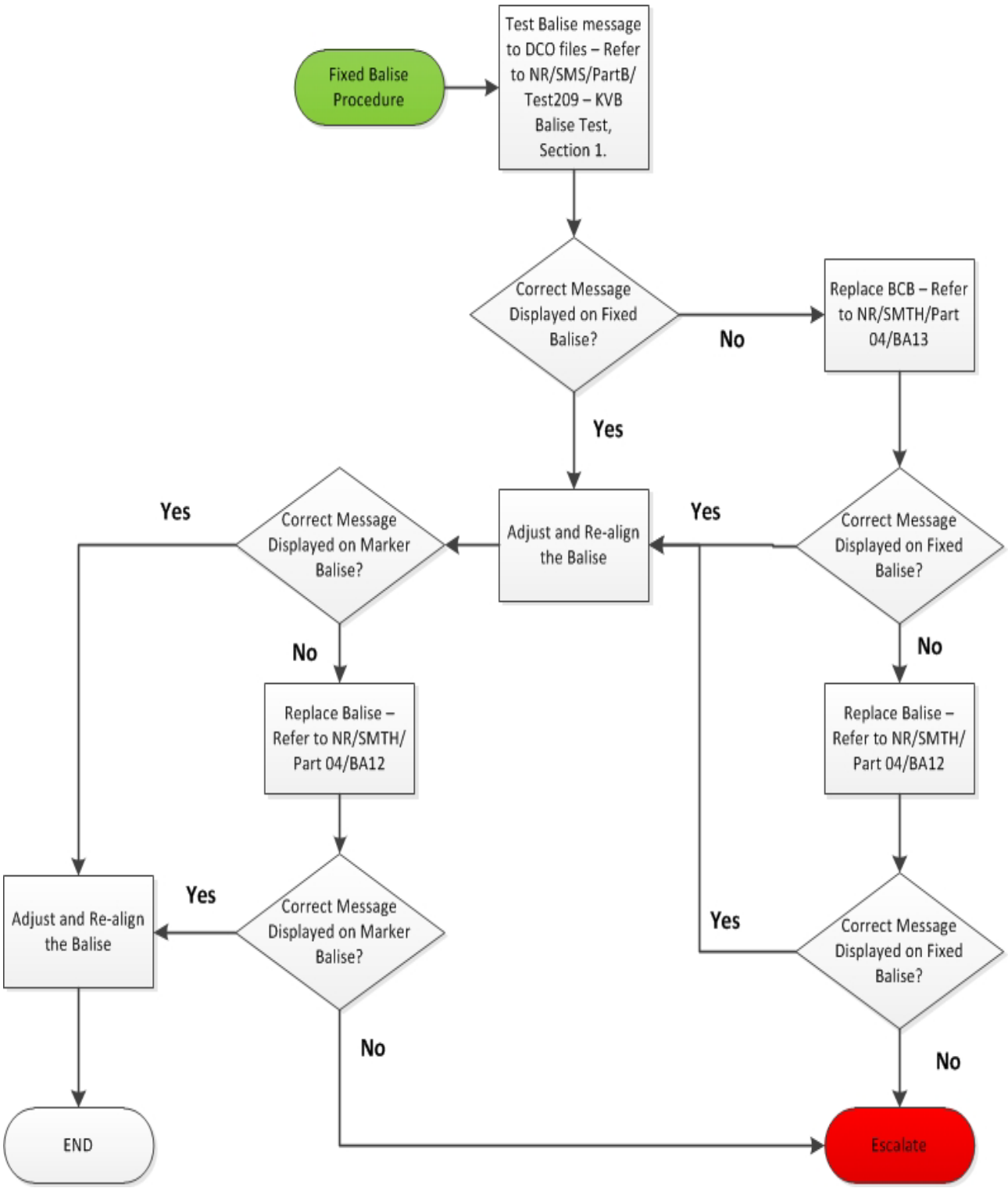
For details of the Test set refer to NR/SMS/Appendix/23 (General information on the KVB Test Set).

See the following pages for fault finding flow charts.

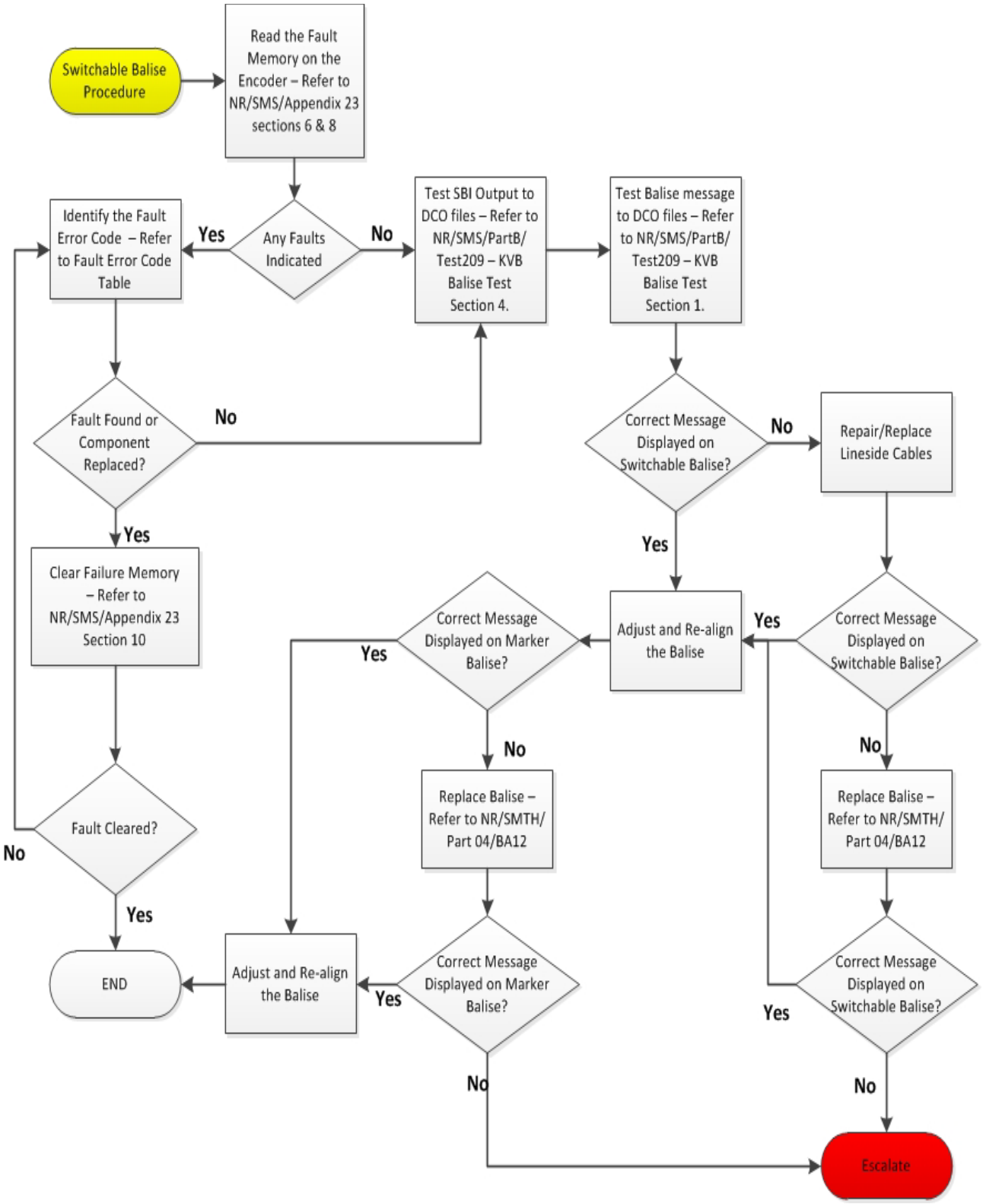
4. Start Point.



5. Fixed Balise Procedure



6. Switchable Balise Procedure



7. Example of a Test Set Failure Screen

8. Explanation of the Test Set Failure Screen

Line 1

Shows the failure number and the total number of failures recorded, in the example this is failure 3 of 3.

Line 2

Shows which type of encoder software is at fault. LA (firmware) or LB (application), in the example it is LA.

Line 3

Shows the software address (if the information is available) where the failure happened.

Line 4

Specifies the time that has elapsed between the failure occurring and it being read by the Test Set, shown in days, hours, minutes and seconds.

So the example failure occurred 1 day 9 hours 29minute and 12 seconds before it was read by the Test Set.

9. Meanings Main Failure Codes

The tables showing the main failure codes and their meanings.

An encoder power supply failure will disturb the earlier failures dating information.

If the Test Set detects a power supply failure (by inconsistencies between the failure order in the memory and dating values): it will not display any time values for the earlier failures. If it does not detect it the time values will be distorted.

LA + Software Fault

Error	Description	Check /Change
100	No error	No Action
101	Non detected breakdown	Change BCC or UCS
107	Lack of BCC	Change BCC or UCS
108	New BCC	Change BCC or UCS
109	BCC reading anomaly	Change BCC or UCS
110	Incorrect checking sum	Change BCC or UCS
111	Incorrect signature	Change BCC or UCS
112	Incorrect N°1 input card signature	Change ECI
113	Incorrect N°2 input card signature	Change ECI
114	Incorrect N°3 input card signature	Change ECI
115	Incorrect N°4 input card signature	Change ECI
116	Incorrect input card signature	Change ECI
117	Incorrect SBI card signature	Change SBI
124	Incorrect output card signatures	Change SBI
125	Incorrect card signatures	Change ECI or SBI
126	N°1 exit message anolmaly	Check Input Status
127	N°2 exit message anolmaly	Check Input Status
128	N°3 exit message anolmaly	Check Input Status
129	N°4 exit message anolmaly	Check Input Status
130	Anomaly messages on several exits	Check Input Status

LB + Firmware Fault

Error	Description	Check /Change
1	No mistake detected	No action
2	Incorrect reading memory checking sum	Change BCC or UCS
3	BCC error	Change BCC or UCS
4	Saved memory error	Change UCS
5	No error in the saved memory	No action

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part10/FF27		
Faulting Guide: Residual Voltage Fault		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

GENERAL

This guide is to be used when a residual voltage has been found, with a residual percentage exceeding 30%. The attached result sheet is be filled out, as a record of the testing and results.

The correct escalation process shall be used, as stated in NR/SMS/PartB/Test/251 (DC Track Circuit Test).

All tests to be recorded on the Residual Voltage Test Record Sheet, see Appendix A, also on any relevant equipment record card.

Pictures can be taken of any issues, and to be forwarded to SM (Level 2) and Fault Control to be attached to the fault report.

This Fault finding guide is to be used in conjunction with, NR/SMS/PartB/Test/251 (DC Track Circuit Test) and NR/SMTH/Part10/FF02 (Faulting Guide: DC Track Circuits).

FAULT FINDING GUIDE

1. Record the drop away, pick up resistances and voltages, of the effected track circuit.
2. Record the coil voltage of the effected TR. Record the Residual voltage and percentage of the effected track circuit.
3. Identify the track circuits that are adjacent and parallel with the effected circuit.
4. Record the track IDs on the diagram. Identify which is the Feed and the Relay end.
5. Draw the IBJ's on the parallel track diagram to identify where they are in relation to the effected track circuits IBJ's.
6. Record the bonding and cables on the diagram.
7. Record the track circuit information on the result sheet. This includes track length, type of track (low, medium, high), type of sleepers, condition of ballast, pads and clips. Any level crossings that cross the track need naming and there location indicating where on the track circuit they are.
8. Test and record the readings of the IBJ's on the effected track circuit.
9. Test and record the earths in the feed and relay locations.
10. Isolate both adjacent track circuits and all parallel track circuit feeds and test/record the effected track circuit residual voltage.

11. Reconnect the track circuits in term, starting with the parallel track circuits, retest/record the effected residual voltage.

12. At the feed end of the effected track circuit switch positive and negative cable cores. This puts the reverse feed onto the track circuit, this should destroy stored residual voltage.

13. After 5 minutes record the coil voltage. Then test the residual voltage of the effected track circuit, using the normal method. Record the residual voltage at 0 and 120 seconds.

14. If the original recorded residual voltage is there straight away it would indicate a stray voltage is been inducted onto the track circuit by an external source. If it creeps up over time it would indicate a battery effect on the track circuit, due to ballast and ground conditions.

15. Record all treadles that are connected to the effected track circuit, include all treadles even if not associated with the effected track circuit (such as entrance/exit treadle for AHB crossings).

16. Record if the treadles have the track feed through it, or a different supply (e.g. 50v for QNR).

17. If the treadles have a different supply, then disconnect the incoming/outgoing links in the treadles feed location. Test and record the effected track circuit residual voltage.

APPENDIX A - Residual Voltage Test Results

1. Track Details

Track ID		To be completed with 150KΩ shunt meter				
Drop Away	Ω	v	Coil Voltage	v	Percentage*	%
Pick Up	Ω	v	Residual Voltage	v		

Table 1 – Track Details

NOTE: **Residual percentage 30 – 70% investigate and inform SM,*
Above 70% investigate and sign out effected TC after informing SM.

2. General Details

Fault No		Track circuit type	
Signal Box		Weather conditions	
Track Circuit ID		Type of sleepers	
Length		Condition of ballast	
Level Crossings		Condition of pads/ clips	
Material of deck		Condition through crossing	
Sleeper ends clear of ballast		Under rail clear of ballast	

Table 2 - General Details

3. Block Joint Testing

	IBJ1	IBJ2	IBJ3	IBJ4
Rail to Rail V1	v	v	v	v
Inner Plate to Rail V2	v	v	v	v
Inner Plate to Rail V3	v	v	v	v
Outer Plate to Rail V4	v	v	v	v
Outer Plate to Rail V5	v	v	v	v

Table 3 – Block Joint Testing Results

4. Earth Testing

Earth Test - Feed Location				
Supply (AC)	Busbar	V1	V2	Vb
	v	v	v	v
	v	v	v	v
Supply (DC)	Busbar	V1 B-E	V2 N-E	
	v	v	v	
	v	v	v	
	v	v	v	
	v	v	v	
Earth Test - Relay Location				
Supply (AC)	Busbar	V1	V2	Vb
	v	v	v	v
	v	v	v	v
Supply (DC)	Busbar	V1 B-E	V2 N-E	
	v	v	v	
	v	v	v	
	v	v	v	
	v	v	v	

Table 4 – Earth Testing Results

5. Track Layout Sketch

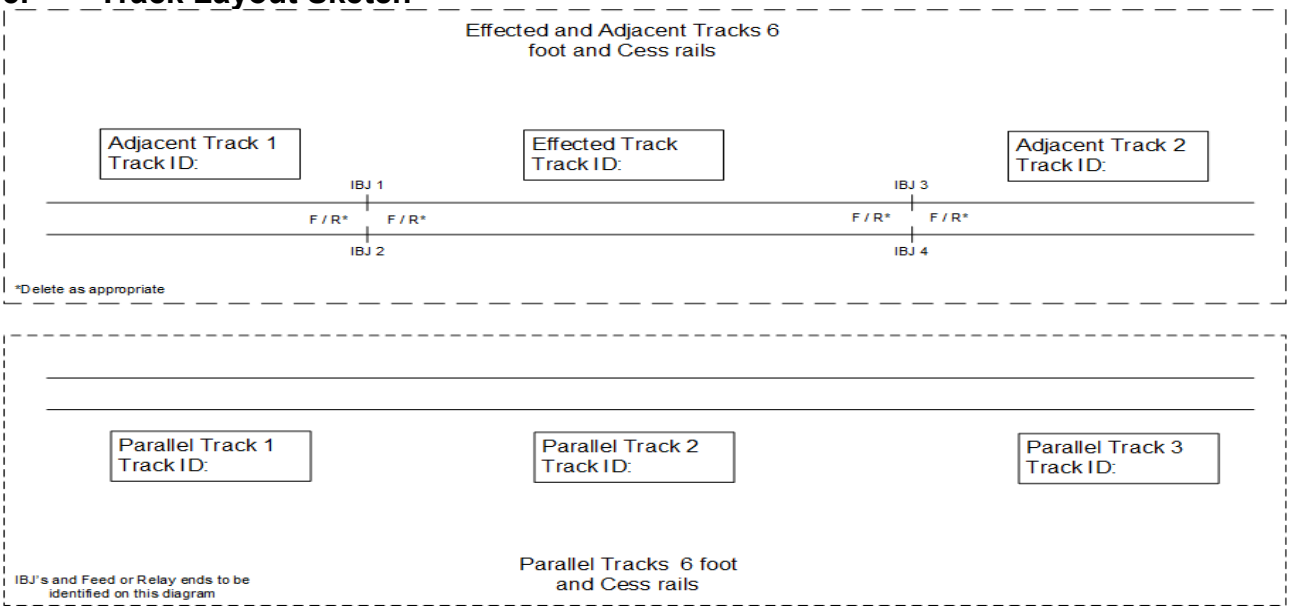


Figure 1 – Track Layout Sketch

5.1 The location of any level crossings should be indicated on the above diagram.

6. Testing

6.1 Temporarily Switch Feed End Polarity and record the results.

Coil voltage power in reverse for 5 mins	v
Residual voltage at 0 secs	v
Residual voltage at 120 secs	v

Table 5 - Feed End Polarity Switch

6.2 Isolate Track feeds and retest Residual Voltage.

Track circuits to be disconnected	Residual Voltage
All Adjacent & Parallel Tracks	v
Adjacent Track 1 & 2	v
Adjacent Track 2	v
Adjacent Track 1	v

Table 6 – Track Isolated Results

6.3 Treadle check, Isolate Track feeds and retest Residual Voltage.

Treadle ID	Treadle Location	Supply (Track/other)	Residual Voltage
			v
			v
			v
			v

Table 7 – Treadle Check Results

7. General Notes

END

INDEX

GENERAL

This Faulting Guide is to be used in conjunction with the applicable Faulting Guide for the HIMatrix application, e.g., manually controlled barrier level crossing.

This Faulting Guide uses questions to diagnose a HIMatrix fault and determine the rectifying action. The user selects the most appropriate answer to each question and the Faulting Guide will then specify the next Faulting Step. Faulting Steps are numerically numbered from 1 to 16.

Faulting Information in support of the Faulting Guide steps can be found at the end of the Faulting Guide in Appendix A in sections 17 to 27.

Before handling any electronic equipment observe electrostatic discharge precautions.

Protection / Possession arrangements shall be made before commencing work on a HIMatrix signalling or level crossing system.

Before powering down a HIMatrix unit or Ethernet switch or disconnecting any plug coupler or signalling equipment, inform the Signaller as to the effect on the operational railway.

DEFINITIONS

Term or Abbreviation	Definition
Centrix	An optional software platform for advanced performance monitoring of HIMatrix systems.
Crosstalk	Two circuit conductors that should be electrically insulated, become electrically connected by a short circuit or earth fault. This includes positive and negative conductors of the same circuit.
F3	A HIMatrix F3 object controller.
F30	A HIMatrix F30 interlocking (programmable logic controller) or object controller.
HIMatrix	Either an F30 or an F3.
I/O	input / output
II	Intelligent Infrastructure.
IP address	Internet protocol address. IP addresses uniquely identify F3s and the F30 to each other. They are downloaded to F3s and the F30 using SILworX.
MCB	Miniature circuit breaker.
PSU	Power supply unit.
User Programme	The signalling “data” that programmes each F30. It is downloaded to an F30 using SILworX. Each HIMatrix F30 has a unique user programme.

Table 1 – Definitions

1. Faulting steps

1.1 Check the data logger (see Step 20) or Centrix or II for critical, high alert and warning alarms.

1.2 If there is more than one critical or high alert or warning alarm, first investigate critical, then high alert and then warning alarms.

1.3 Identify the first alarm to be investigated from Table 2 and then go to the indicated Step. After each alarm has been investigated, return to this Step.

Data Logger Alarm Identity [HIMatrix ID, *** Ethernet Switch ID]**	**Go to Step:**
MODBUS OFFLINE	4
** COMM ERROR	5
** ID OK	6
** OVERLOAD	7.4
** HIGH TEMP	7.2
** MODULE FAULT	7.3
** IP SHORT CCT	11
** IP X-TALK	11
** OP OVERLOAD	11
** OP SHORT CCT	11
** OP FAULT	7.5
S(***)K	8
ELK	9
(PSU)K	10
Other alarm reported	Refer to application specific Guide NR/SMTH/Part10/FF29 (Faulting Guide: HIMatrix Manually Controlled Barrier Level Crossing)
No alarm reported	2

Table 2 - Data logger alarm identity

2. Faults not specifically alarmed by the data logger

2.1 Select the first applicable description of the fault report from Table 3:

Fault report description	Go to Faulting Step:
Unable to download user programme or IP address to a replaced HIMatrix.	16
HIMatrix is not responding to a contactor or contact being closed.	14
HIMatrix is not responding to a contactor or contact being opened (possible wrong-side failure).	15
An object is not being switched on when expected.	12
An object is not being switched off when expected (possible wrong-side failure).	13
HIMatrix status LEDs indicate a fault.	3
Other fault	Refer to application specific Guide NR/SMTH/Part10/FF29 (Faulting Guide: HIMatrix Manually Controlled Barrier Level Crossing)

Table 3 - Fault report description.

3. HIMatrix status LED faults and errors

3.1 Check the HIMatrix status LEDs (Step 17) and carry out the rectification tasks for any fault or error found.

4. Data logger or serial link fault

4.1 Check that the F30 has not failed (Step 17) before moving on to Step 4.2.

If the F30 has failed, go to Step 7.

4.2 Check the data logger status LED. If the data logger is not powered on, test its power supply (see Step 21). If the power supply has failed, test whether the MCB or PSU has failed and rectify power supply fault.

4.3 Check the data logger and Centrix or II for changing function values in response to changes to the signalling system, e.g., track circuit occupancy.

a) If the data logger function values do not change, check the serial cable for correct connection to the F30 and check the data logger for signs of damage. Replace the serial cable if damaged.

b) Power the data logger off and on using its supply fuse/MCB. If the fault persists, replace the data logger.

c) If the values of data logger functions change and there is no update to Centrix / II then follow the data logger manual to check the data logger connection with Centrix or II.

5. HIMatrix Ethernet communication fault

5.1 Check the data logger for COMM ERROR alarms and note which F3 is affected. If the fault occurred after replacing the affected HIMatrix, complete Step 6.2 before moving to Step 5.2.

5.2 Check if an Ethernet switch has failed (Step 8) before moving to Faulting Step 5.3.

5.3 Check the HIMatrix and Ethernet switch port LEDs (see Step 19) for data transmission. Check the affected Ethernet cables for correct connection between Ethernet switch and connected devices shown in the location case diagrams.

5.4 Check if the F30 or F3 has failed (Step 7) before moving to Step 5.5.

5.5 Check Ethernet cables for signs of damage. Replace Ethernet cables either if damaged or if no fault found with the F30, F3(s) and Ethernet switch(es).

6. HIMatrix identity fault

6.1 Check the data logger for ID OK and VER OK alarms for all HIMatrix and note which HIMatrix are affected.

6.2 Did the fault occur after replacing a HIMatrix? If yes, then:

a) Check the HIMatrix I/O plug couplers (Step 23) are inserted into the correct I/O ports.

b) Check the HIMatrix I/O plug couplers are firmly inserted.

c) If the F30 has been replaced, carry out NR/SMTH/Part04/IS17 (Download Data to a HIMatrix Programmable Logic Controller (PLC) F30 and F3) to download a new user programme to the F30.

d) If the F3 has been replaced, carry out NR/SMTH/Part04/IS17 (Download Data to a HIMatrix Programmable Logic Controller (PLC) F30 and F3) to download a new IP Address and Rack ID to the F3.

e) Check the HIMatrix status LEDs (Step 17). If the Prog, Force, Fault, OSL and BL LEDs are simultaneously blinking then another HIMatrix on the Ethernet network has a duplicate IP address – re-check the data logger for other HIMatrix identity faults and rectify.

6.3 Did the fault occur during operational service? If yes, then:

a) Check the data logger for an IP X-TALK alarm for the failed HIMatrix. If an HIMatrix IP X-TALK fault is alarmed, then move to Step 15.

b) Check that the HIMatrix input LEDs (Step 18) correspond with the location case diagrams identity wiring. If any identity input status LEDs are not on/off as per the identity wiring (Step 27) carry out Steps 14 and 15.

7. HIMatrix hardware fault

7.1 Check the HIMatrix status LEDs (Step 17). If the 24V DC LED is off or the Error LED is blinking, test the HIMatrix power supply (Step 21).

a) If the power supply has failed, investigate, and rectify.

b) If the HIMatrix power supply is normal and the 24V DC LED is off, power off and on the HIMatrix using its supply fuse/MCB. If the 24V DC LED is still off, replace the HIMatrix.

c) If the Error LED continues blinking, replace the HIMatrix.

7.2 Check the data logger for HIGH TEMP alarms and note which HIMatrix is affected. If a HIGH TEMP is alarmed:

a) Check the data logger for the location case temperature. If it exceeds 60°c, then increase the apparatus housing ventilation.

b) Check the front and top of the affected HIMatrix by hand but without directly touching the HIMatrix. If it feels uncomfortably warm and the apparatus housing temperature is acceptable, then check the HIMatrix vents are clear and remove any obstructions.

c) If the HIMatrix temperature remains high or the fault is not resolved, replace the HIMatrix.

7.3 Check the data logger for MODULE FAULT alarms and note which HIMatrix is affected. If a MODULE FAULT is alarmed, power off and on, the affected HIMatrix using its supply fuse/MCB. If the fault persists, replace the HIMatrix.

7.4 Check the data logger for OP OVERLOAD and OVERLOAD alarms and note which HIMatrix is affected. If an OP OVERLOAD or OVERLOAD is alarmed, go to Step 11.

7.5 Check the data logger for OP FAULT alarms and note which HIMatrix is affected. If an OP FAULT is alarmed, power off and on, the affected HIMatrix using its supply fuse/MCB. If the fault persists, replace the HIMatrix.

8. Ethernet switch fault

One or more Ethernet switches are provided to connect HIMatrix units. A fault of an Ethernet switch will be reported by the data logger to Centrix / II.

8.1 Check the Ethernet switch status LED. If no status LED is on, test the power supply (see Step 21) to the Ethernet switch.

8.2 If the status LED is on and the Ethernet switch is healthy, move to Step 14 and check the HIMatrix detection input of the Ethernet switch.

8.3 Power off and on the failed Ethernet switch using its supply fuse/MCB. If the fault persists, replace the Ethernet switch.

9. Earth fault

Insulation monitoring is provided for all HIMatrix busbars. An insulation resistance less than the threshold level stated in the location case diagrams will be alarmed by the data logger to Centrix / II.

9.1 Check the ELK status LED. If no LED is on, test the power supply (Step 21) to the ELK.

9.2 If a fault LED is on, investigate the monitored busbar for an earth fault.

9.3 If the ELK status LED is on and the ELK is healthy, move to Step 14 and check the HIMatrix detection input of the ELK.

9.4 Power off and on the failed ELK using its supply fuse/MCB. If the fault persists, replace the ELK using SMTH.

10. PSU fault

Redundant 24Vdc PSUs are provided to supply HIMatrix. A first fault of a PSU will be reported by the data logger to Centrix / II.

10.1 Check the PSU status LED. If no LED is on, test the power supply (Step 21) to the PSU.

10.2 If the PSU status LED is on and the PSU is healthy, move to Step 14 and check the HIMatrix detection input of the PSU.

10.3 Power off and on the failed PSU using its supply fuse/MCB. If the fault persists, replace the PSU.

11. HIMatrix unknown I/O fault

An unknown I/O fault is one where a generic I/O fault is reported for a HIMatrix. The Run LED will be illuminated steady and the Fault LED of the affected HIMatrix will be blinking. This Faulting Guide step will not identify all I/O faults. Specific I/O faults are expected to be faulted from an observed failed object, e.g., a failed lamp.

11.1 Check the data logger for OP OVERLOAD, OVERLOAD, OP FAULT, OP SHORT CCT, IP SHORT CCT and IP X-TALK alarms and note which HIMatrix is affected.

a) If there is an OP OVERLOAD, OVERLOAD or OP FAULT alarm go to Faulting Step 11.2.

b) It there is an IP SHORT CCT or IP X-TALK alarm move to Step 11.3.

11.2 Check the HIMatrix output circuit wiring sheets for external relay contacts or contactors in the circuit and check that these are all closed.

Check output status LEDs (Step 18) against the corresponding controlled objects.

a) If an output status LED is on and the object is de-energised, record the affected output and move to Step 12.

b) If an output status LED is off and the object is energised, record the affected output and move to Step 13.

11.3 Check the input circuit relay contact or contactor is closed.

Check input status LEDs (Step 18) against the corresponding relay contact or contactors.

a) If an input status LED is off and the contact/contactor is closed, record the affected input and move to Step 14.

b) If an input status LED is on and the contact/contactor is open, record the affected input and move to Step 15.

12. HIMatrix output circuit off fault

An output circuit off fault is one where a connected object is expected to be energised and is not. This occurs when either a component of the circuit has become high resistance, or a conductor is broken, or there is a short circuit, or the HIMatrix has failed.

If an output is provided with line monitoring (Step 26), an open circuit fault will be detected and the HIMatrix Fault LED blinking even if the connected object is not switched on.

12.1 Check the output circuit wiring sheets for external relay contacts or contactors and check that these are all closed.

Check the data logger for OP OVERLOAD or OP SHORT CCT alarms. If there is an OP OVERLOAD or OP SHORT CCT alarm move to Step 13.

12.2 Check the output status LED (Step 18):

a) If the output status LED is off, there is no output open circuit fault.

b) If the output status LED is on there is an open circuit fault – move to Step 12.3.

12.3 Use a multimeter set to range 24Vdc to test the voltage across the object. If 24Vdc (nominal) is measured, then investigate the object fault and rectify or replace.

12.4 Check the HIMatrix has not failed – move to Step 7 then Step 12.5.

12.5 Use a multimeter set to range 24Vdc to test the output voltage of the HIMatrix.

a) If it is less than 20Vdc or more than 28Vdc replace the HIMatrix.

b) Continue to test the remainder of the circuit to find any breaks or high resistance.

13. HIMatrix output crosstalk circuit fault

Crosstalk occurs due to low resistance (a short circuit) between the conductors of different circuits or the positive and negative legs of the same circuit. There are two types of output crosstalk faults:

- *Wrong-side. A controlled object is falsely energised by the crosstalk voltage. The controlled object HIMatrix output status LED is off.*
- *Right-side. The controlled object HIMatrix output status LED is on and voltage is applied to the circuit, but a short circuit prevents the energisation of the object.*

If an output is provided with line monitoring (see Step 26), a crosstalk circuit fault will be detected and the HIMatrix Fault LED blinking even if the connected object is not switched on.

13.1 Check the object should be de-energised by HIMatrix.

Check the output status LED (Step 18):

a) If the output status LED is off and the object is energised, then there is a wrong-side crosstalk circuit fault.

This might be wrong-side failure depending on the criticality of the object. **If it is a wrong-side failure, immediately contact the Signaller and stop all trains.** Then move to Step 13.2.

b) If the output status LED is on and the object is de-energised, then there is a right-side crosstalk circuit fault. Move to Step 13.2.

13.2 Test for the crosstalk source by planning the disconnection of plug couplers from the affected HIMatrix except the plug coupler for the affected input. Isolate other potential voltage sources of the crosstalk. Test conductor insulation resistance to identify short circuits (Step 22).

14. HIMatrix input open circuit fault

An input open circuit fault is one where an input should be on, but the HIMatrix input status LED is off. This occurs when either a component of the circuit has become high resistance, or a conductor is broken.

14.1 Check the input circuit relay contact or contactor is closed.

Check the input status LED (Step 18):

a) If the input status LED is on and there is no IP X-TALK alarm, there is no open circuit fault.

b) If the input is provided with anti-valence proving (Step 25), check the other input status LED if off. If the other input status LED is on, move to Step 15.

c) If the input status LED is on and there is an IP X-TALK or IP SHORT CCT alarm, there is a crosstalk fault. Move to Step 15.

d) If the input status LED is off and there is no IP X-TALK or IP SHORT CCT alarm, move to Step 14.2.

14.2 Check the HIMatrix has not failed – move to Step 7 then Step 14.3.

14.3 Use a multimeter set to range 24Vdc to test the source voltage of the HIMatrix input.

a) If it is less than 20Vdc or more than 28Vdc replace the HIMatrix.

b) Continue to test the remainder of the circuit to find any breaks. If no breaks are found, move to Step 14.4.

14.4 Remember that F3 line control circuits (Step 24) require two separate inputs and both shall be tested for high resistance.

Disconnect the plug coupler of the input and the plug coupler of its voltage source. Use a multimeter set to resistance range 1kΩ to test the input circuit between the pins of the plug coupler. If the loop resistance exceeds 100Ω, the circuit is high resistance. Locate the high resistance circuit component and replace.

15. HIMatrix input crosstalk circuit fault

Crosstalk occurs due to low resistance (short circuit) between the conductors of different circuits or positive and negative legs of the same circuit. There are two types of input crosstalk faults:

- *Unprotected wrong side. An input without either line control (Step 24) or anti-valence proving (Step 25) should be off, a crosstalk voltage is present, and the HIMatrix input status LED is on.*
- *Protected wrong side. An input provided with line control (Step 24) or anti-valence proving (Step 25) should be off, a crosstalk voltage is present, and the HIMatrix input status LED is on but the HIMatrix unit ignores the input due to crosstalk being detected or anti-valence proving.*

15.1 Before commencing Faulting Step 15.1, check the input circuit relay contact or contactor is open.

Check the input status LED (Step 18) and check the data logger for the input name and state:

a) If the input status LED is on and there is no IP X-TALK or the input is not provided with anti-valence control, then there is an unprotected wrong-side crosstalk circuit fault.

This might be a wrong-side failure depending on the safety criticality of the input. **If it is a wrong-side failure, immediately contact the Signaller and stop all trains.** Then move to Step 15.2.

b) If the input status LED is on and there is an IP X-TALK alarm (line control) or the data logger reports the input as off (= DN, anti-valence proving),then there is a protected wrong-side crosstalk circuit fault. Move to Step 15.2.

15.2 Test for the crosstalk source by planning the disconnection plug couplers from the affected HIMatrix (except the plug coupler for the affected input) and isolating other potential voltage sources of the crosstalk. Test conductor insulation resistance to identify short circuits (Step 22).

16. Unable to download user programme or IP address

Downloading a user programme or IP address to HIMatrix requires specific tools and information covered by SMTH. This Faulting Step covers only hardware problems that might be encountered.

16.1 Check the laptop Ethernet cable for damage and replace.

16.2 Check if the HIMatrix has failed – move to Step 7.

APPENDIX A - Faulting Information

17. Check HIMatrix Status LEDs

All HIMatrix units have the same status LEDs. A full description of the function of each of these LEDs can be found in the location case diagrams alongside the HIMatrix analysis sheets. Table 4 highlights the principal error LEDs.

17.1 Check the HIMatrix status LEDs against the fault LED states listed in Table 4.

LED(s)	Illumination	Issue or Fault(s)
24V DC	Off	Power fault – go to Step 7.1.
Run	Blinking green	i. A new user programme is being loaded – no fault. ii. Temperature warning – go to Step 7.2.
Error	Steady red	Missing software licence or in test mode – not a maintenance fault.
	Blinking red	i. Power fault or hardware fault – go to Step 7. ii. Fault while downloading user programme - re-attempt download.
Prog	Steady yellow	A new user programme is being loaded – no fault.
	Blinking yellow	Reload is being performed – no fault.
Force	Steady yellow	Forcing is prepared – not a maintenance fault.
	Blinking yellow	Forcing is active – not a maintenance fault.
Fault	Blinking yellow	i. With Run LED steady green: HIMatrix I/O Fault – go to Step 11. ii. With Run LED blinking: fault while downloading user programme - re-attempt download.
OSL	Blinking yellow	Operating system loader active – no fault.
BL	Blinking yellow	i. Binary loader defective – not a maintenance fault. ii. Hardware fault – go to Step 7. iii. (F30 only) Communication fault with one or more F3s.
Prog & Force & Fault & OSL & BL	Blinking yellow	A duplicate IP address has been detected – go to Step 6.

Table 4 – HIMatrix status LED fault states

18. Check HIMatrix I/O LEDs

All HIMatrix I/O have yellow status LEDs reporting whether the I/O is on. The I/O LEDs are positioned directly above / below the I/O as illustrated in Figure 1.

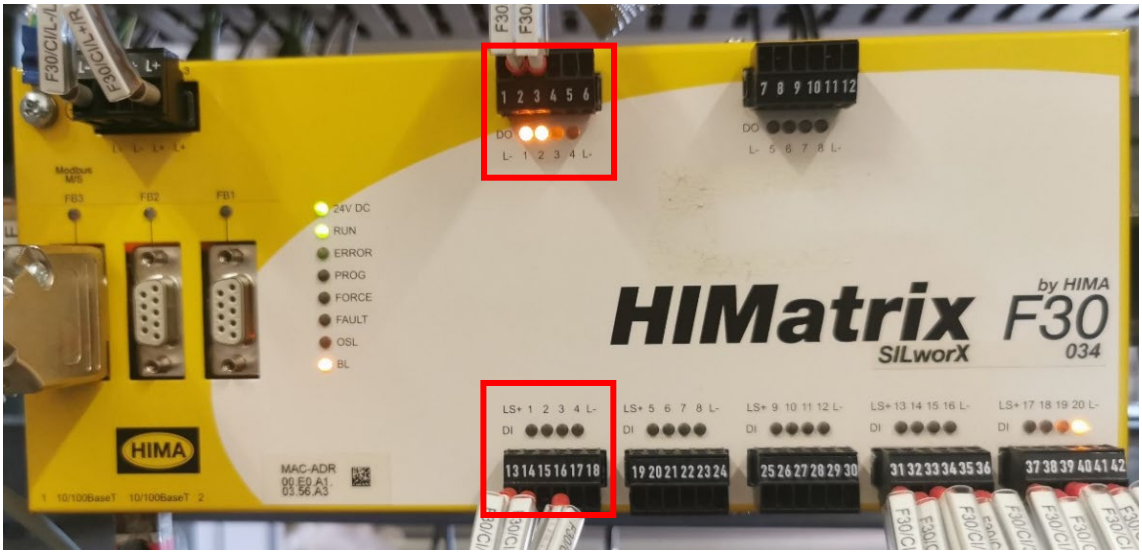


Figure 1 – HIMatrix Status LEDs

F30 outputs are all single pole.

F3 outputs are double pole but can also be configured as single pole with either the positive or negative leg of the circuit switched. The location case diagram HIMatrix analysis and wiring sheets depict whether an output is configured as double pole or single pole.

18.1 Check an output is on. Status LEDs are provided for each output pole. If the corresponding status LED is on, the output pole is switched on.

18.2 Check an input is on. Status LEDs are provided for each input. If the corresponding status LED is on, voltage is detected, and the input is on. For inputs with line control (Step 24), the input status LED will be on, but it is only recognised as on if no crosstalk is detected. If crosstalk is detected, the input will not be recognised as on and the HIMatrix Fault LED will blink (Step 17).

19. Check Ethernet port LEDs

Every HIMatrix Ethernet port has two LEDs as illustrated in Figure 2.

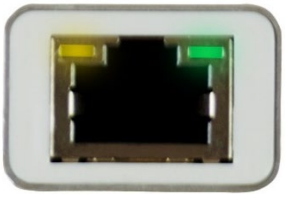


Figure 2 – Port with two LEDs

19.1 Check the Ethernet port LEDs to determine the status of the Ethernet port. The following LED states indicate faults:

a) Yellow LED on – connection available but no transmission or receiving communication. Indicates an F30 or F3 fault.

b) Yellow LED off – no connection available. Indicates an Ethernet cable or Ethernet switch fault.

c) Green LED off – only transmission or communication but not both. Indicates an F30 or F3 fault.

19.2 Ethernet switch port LEDs indicate:

a) Data “in” from the F30 “to” the switch.

b) Data “out” from the switch “to” the F3.

Figure 3 shows the unlit status LED for a failed connection between the switch and the F3 identified as “M01”.

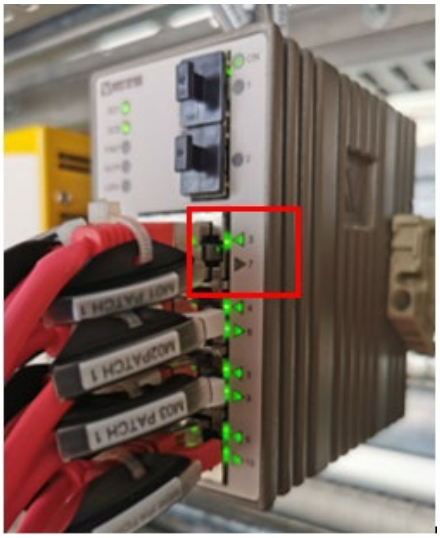


Figure 3 – Unlit Status LED

20. Check the data logger

The data logger has a touch screen display that is used to view logged functions. Logged functions are listed in the location case diagrams. Refer to the location case diagrams for whether there is an alarm for a logged function. If there is an alarm, the location case diagrams will also specify what function state corresponds to an alarm: on = UP or off = DN.

21. Test the power supply

All the PSU, HIMatrix and Ethernet components have status LEDs.

21.1 Check that one or more status LEDs, except a fault LED, are on. If so, then the component power supply is normal.

21.2 Check if a fault LED is on. If a fault LED is on, then test the supplying busbar voltage.

22. Test HIMatrix conductor insulation

22.1 Power off all equipment sharing the HIMatrix 24Vdc busbar supplying the affected HIMatrix. Disconnect all plug couplers from all HIMatrix sharing the same busbar.

22.2 Confirm all HIMatrix power ports and I/O are disconnected or isolated from every circuit conductor under test.

22.3 Remove flyback diodes from circuits being insulation resistance tested.

22.4 Using an insulation test meter, measure the resistance between the affected circuit and other circuits that are potential sources of the crosstalk voltage. If the resistance between any pair of circuits is less than 150kΩ locate the low insulation resistance and rectify.

22.5 Confirm flyback diodes are reinserted with the correct polarity bias when insulation resistance testing is complete.

The correct flyback diode polarity bias is shown in the location case diagrams.

23. Check HIMatrix I/O wiring

Each HIMatrix has wiring looms terminated in plug couplers that are inserted into the front plug coupler sockets.

23.1 Check the labelling on the wiring loom matches the identity of the HIMatrix in the location case diagrams and the I/O numbering on the front of the HIMatrix (Figure 4).

DIGITAL OUTPUT (DO) TERMINALS

ID	DES	FUNCTION	SHT	SAFE STATE	LINE MONITORING	COUPLER ID	PIN ID	W
9	1-	(YO) (BOOM) EN	W06	ON	NOT USED	M03-09-16	01	1
10	1+	(YO) (BOOM) E	W06				02	1
11	2-	(YO) ZRN	W06	OFF	NOT USED		03	1
12	2+	(YO) ZR	W06				04	1
13	3-	(YO) RE(L) N	W10	ON	INDUCTIVE		05	1
14	3+	(YO) RE(L)	W10				06	1
15	4-	(YO) RE(R) N	W10	ON	INDUCTIVE		07	1
16	4+	(YO) RE(R)	W10				08	1
17	5-	(YO) HEN	W10	OFF	INDUCTIVE	M03-17-24	01	1
18	5+	(YO) HE	W10				02	1
19	6-	SPARE	-	-	-		03	-
20	6+	SPARE	-				04	-
21	7-	(YO) (VALVE) N	W06	OFF	NOT USED		05	1
22	7+	(YO) (VALVE)	W06				06	1
23	8-	SPARE	-	-	-		07	-
24	8+	SPARE	-				08	-

Figure 4 – Wiring Loom and Location Case Diagram

24. Check if a HIMatrix circuit is provided with line control

Line control is present on a circuit if:

a) The circuit is an input and

b) The “BIT CHK” column in location case diagram HIMatrix analysis sheets (Figure 5) have an entry next to the input of “T1” or “T2” for F3s and “T1” or “T2” or “T3” etc. for F30s.

DIGITAL INPUT (DI) TERMINALS

ID	DES	FUNCTION	BIT CHK	SHT	COUPLER ID	PIN ID	W
13	LS+	DI3 B	X	P01	I/L-13-18	01	1
14	1	(TECH RESET)	=T1	T07		02	1
15	2	SPARE	-	-		03	-
16	3	(PO)	-	P01		04	1
17	4	SPARE	-	-		05	-

Figure 5 – HIMatrix Analysis Sheets

Line control inputs to F3s are always in pairs using the T1 and T2 power supply sources on the F3 and both inputs must be on for the HIMatrix system to detect the state of the object.

25. Check if a HIMatrix circuit is provided with anti-valence proving

Some critical interface relays may be input to HIMatrix using both a front contact and a back contact of the relay. This pair of inputs is cross proved by HIMatrix. This is called anti-valence proving. Anti-valence proving is present on a pair of circuits if:

a) The circuits are inputs.

b) The “BIT CHK” column in location diagram HIMatrix analysis sheets have an entry next to the inputs of <>#, where # is the number of the other cross proved input circuit. See Figure 6.

DIGITAL INPUT (DI) TERMINALS

ID	DES	FUNCTION	BIT CHK	SHT	COUPLER ID	PIN ID	W
33	LS+	DI1-2 B		R01	M07-	01	1
34	LS+	DI3-4 B		R01	33-42	02	1
35	1	8812 TP	<>2	R01		03	1
36	2	8812 TPZ	<>1	R01		04	1
37	3	9013 TP	<>4	R01		05	1
38	4	9013 TPZ	<>3	R01		06	1
39	L-	NOT USED		-		07	
40	L-	NOT USED		-		08	
41	PA	NOT USED		-		09	
42	PA	NOT USED		-		10	

Figure 6 - HIMatrix Analysis Sheets

Anti-valence inputs status LEDs must not be both simultaneously on or off (except briefly as the relay picks or drops) – this indicates a circuit fault.

26. Check if a HIMatrix circuit is provided with line monitoring

Line monitoring is present on a circuit if the circuit is connected to an F3 and the location case diagrams HIMatrix analysis LINE MONITORING column has an entry of “INDUCTIVE” or “CAPACITIVE”. See Figure 7.

DIGITAL OUTPUT (DO) TERMINALS

ID	DES	FUNCTION	SHT	SAFE STATE	LINE MONITORING	COUPLER ID	PIN ID	W
9	1-	(YN)(BOOM)EN	W04	ON	NOT USED	M01-	01	1
10	1+	(YN)(BOOM)E	W04			09-16	02	1
11	2-	(YN)ZRN	W04	OFF	NOT USED		03	1
12	2+	(YN)ZR	W04				04	1
13	3-	(YN)RE(L)N	W08	ON	INDUCTIVE		05	1
14	3+	(YN)RE(L)	W08				06	1
15	4-	(YN)RE(R)N	W08	ON	INDUCTIVE		07	1
16	4+	(YN)RE(R)	W08				08	1

Figure 7 - HIMatrix Analysis Sheets

27. Check HIMatrix identity wiring I/O

Identity wiring for F30s and F3s is shown in the HIMatrix location case diagrams “Module ID / Data Version” sheets. For each HIMatrix, one or more straps shall connect either an LS+ or T1/T2 supply to inputs.

27.1 For every HIMatrix identity input connected by a strap to one of these supplies, check:

a) The corresponding input status LEDs are on.

b) All other input status LEDs are off.

c) Check the data logger has no IP X-TALK alarm.

In the example below (Figure 8), the LEDs for inputs 13, 15 and 16 should be on.

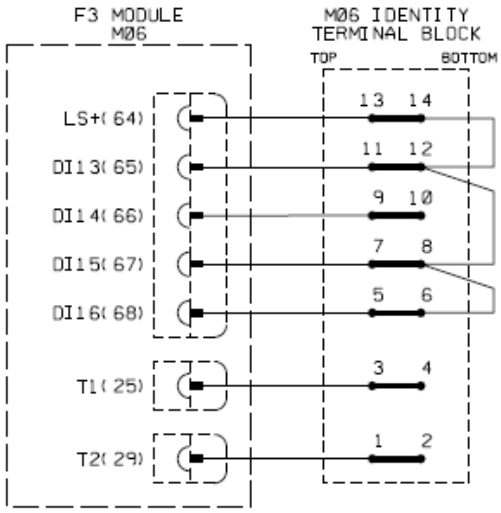


Figure 8 - Example

END

INTRODUCTION

This Faulting Guide is for a HIMatrix manually controlled barrier Level Crossing (LC). It should be used in conjunction with NR/SMTH/Part10/FF28, which provides guidance for general faulting of HIMatrix.

The HIMatrix manually controlled barrier Level Crossing uses standard Level Crossing lineside equipment. Faulting of standard Level Crossing lineside equipment is not covered by this Faulting Guide.

GENERAL

Before handling any electronic equipment observe electrostatic discharge precautions.

Protection / Possession arrangement shall be taken before commencing work on a HIMatrix Level Crossing system.

Before powering down a HIMatrix unit or Ethernet switch or disconnecting any plug coupler or Level Crossing equipment, inform the Signaller as to the effect on the operational railway.

DEFINITIONS

Term or Abbreviation	Definition
Crosstalk	Two circuit conductors that should be electrically insulated become electrically connected by a short circuit or earth fault. This includes positive and negative conductors of the same circuit.
HIMatrix	Either an F30 or an F3.
LC	Level Crossing.
LCU	Local Control Unit.
RTL	Road Traffic Light.

Table 1 – Definitions

1. Has a fault been reported in response to a Signaller's LC alarm? If yes:

1.1 Refer to the Fault Alarms and Indications Control Table in the location case diagrams to determine the possible failures to investigate.

2. Has a fault been reported in response to a data logger alarm? If yes:

2.1 Refer to the Fault Alarms and Indications Control Table in the location case diagrams to determine the possible failures to investigate.

3. Does the fault report have only an incomplete or unclear description of the failure? If yes:

3.1 Operate the LC and observe which LC equipment does not operate in accordance with the Level Crossing Control Table.

4. Is there a failure of LC lineside equipment to operate? If yes:

4.1 If a HIMatrix has been replaced or powered off, confirm the LCU switch was in the Hand / Lower position when the LC was set to work. If the LCU switch was not, return the LC to local control by switching the LCU to Hand / Lower and then switch it to Normal / Stop.

4.2 Do some, but not all, of the LC equipment not operate as expected? If so, identify the affected LC equipment output circuit and controlling HIMatrix and investigate:

a) Carry out NR/SMTH/Part10/FF28 – Step 3 - HIMatrix status LED faults and errors.

b) Carry out NR/SMTH/Part10/FF28 - Step 8 - Ethernet switch fault.

c) Carry out NR/SMTH/Part10/FF28 - Step 12 - HIMatrix output circuit off fault (if it is not switching on).

d) Carry out NR/SMTH/Part10/FF28 - Step 13 - HIMatrix output crosstalk circuit fault (if it is not switching off).

4.3 Does the LC not operate in response to a specific button or switch? If so, identify the affected LC input circuit and controlling HIMatrix and investigate:

a) Carry out NR/SMTH/Part10/FF28 - Step 3 - HIMatrix status LED faults and errors.

b) Carry out NR/SMTH/Part10/FF28 - Step 8 - Ethernet switch fault.

c) Carry out NR/SMTH/Part10/FF28 - Step 14 - HIMatrix input open circuit fault.

4.4 If no fault is found with the operating switch or button, refer to the Level Crossing Control Table and check all other button, switch, and interface relay (including track circuits) input status LEDs are on or off as required. Take account of line control and anti-valence proving, when inspecting input status LEDs.

a) Carry out NR/SMTH/Part10/FF28 - Step 24 - Check if a HIMatrix circuit is provided with line control.

b) Carry out NR/SMTH/Part10/FF28 - Step 25 - Check if a HIMatrix circuit is provided with anti-valence proving.

Identify the relevant button, switch and interface relay input circuits and controlling HIMatrix and investigate:

c) Carry out NR/SMTH/Part10/FF28 - Step 3 - HIMatrix status LED faults and errors.

d) Carry out NR/SMTH/Part10/FF28 - Step 8 - Ethernet switch fault.

e) Carry out NR/SMTH/Part10/FF28 - Step 12 - HIMatrix output circuit off fault (if it is not switching on).

f) Carry out NR/SMTH/Part10/FF28 – Step 13 - HIMatrix output crosstalk circuit fault (if it is not switching off).

5. Has a fault been reported in response to a signal failing to clear? If yes:

5.1 Refer to the location case diagrams Signal Control Table and the signal circuits to determine which interface relays are needed for the signal to clear. Identify which relays are not in the required up or down state and investigate:

a) Carry out NR/SMTH/Part10/FF28 - Step 3 - HIMatrix status LED faults and errors.

b) Carry out NR/SMTH/Part10/FF28 - Step 8 - Ethernet switch fault.

c) Carry out NR/SMTH/Part10/FF28 - Step 12 - HIMatrix output circuit off fault (if the relay is not up when expected).

d) Carry out NR/SMTH/Part10/FF28 - Step 13 - HIMatrix output crosstalk circuit fault (if the relay is not down when expected).

6. Has a fault with the red road traffic light(s) fault been reported but no fault found? If yes:

6.1 Check the Technician Reset button has been pressed. Press again and check it is detected by the HIMatrix unit.

6.2 Check the failed RTL LED module shunt resistor is installed as per the location case diagrams. If it is missing, replace it.

7. Has a fault been rectified but the Signaller's Failed/Local indication and alarm remain operated? If yes:

7.1 Check that the LC barriers have been fully raised or fully lowered to reset the fault indication.

7.2 Check the Technician Reset button has been pressed. Press again and check it is detected by the HIMatrix unit.

END